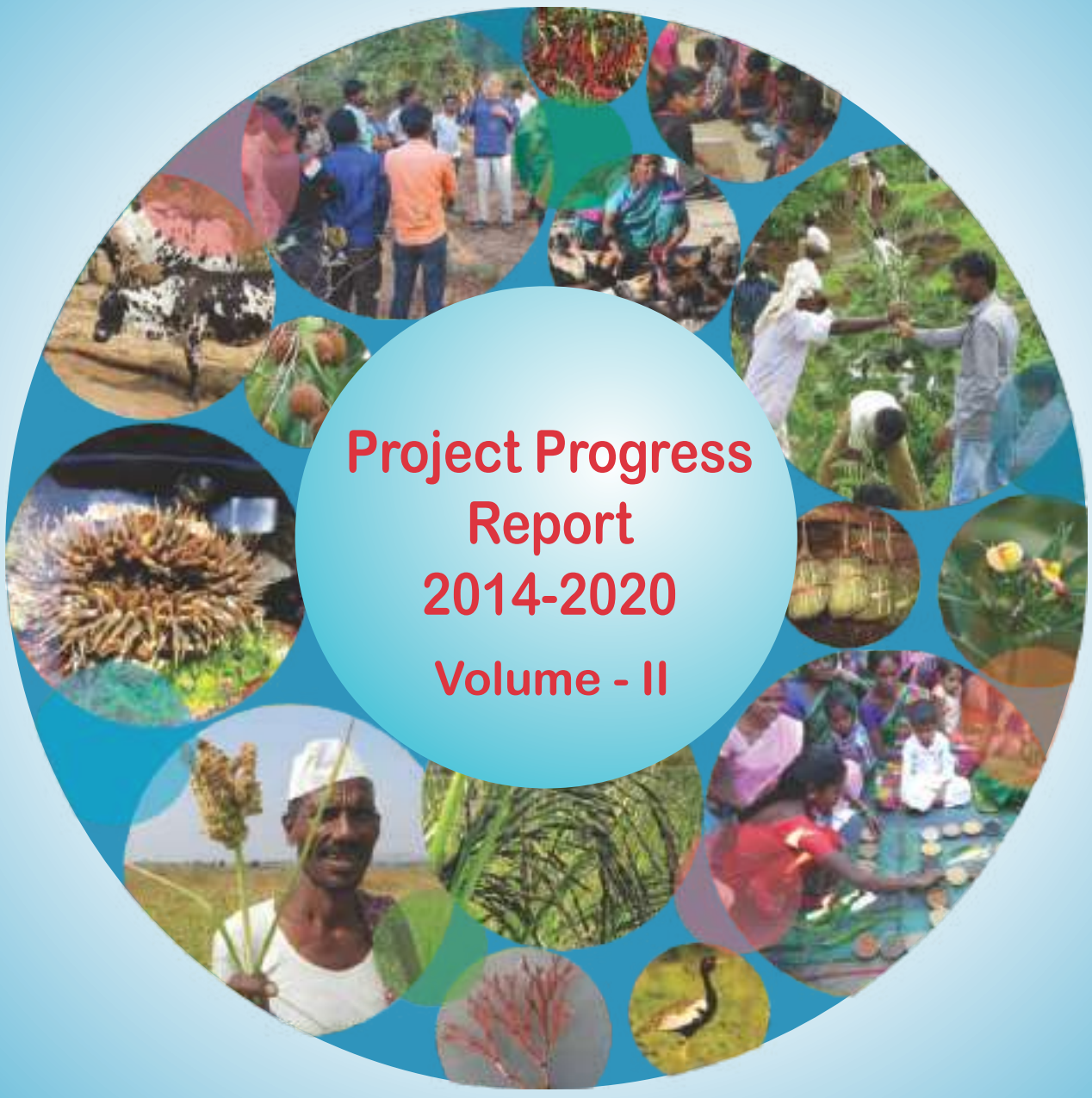
Maharashtra Genebank Programme

A multi-institutional project funded by

Rajiv Gandhi Science & Technology Commission, Govt. of Maharashtra



Project Progress Report 2014-2020

Volume - II

Coordinated by
Indian Institute of Science Education and Research Pune

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Preface

It is my pleasure to present the consolidated report of the project Maharashtra Gene Bank Programme funded by Rajiv Gandhi Science and Technology Commission, Govt. of Maharashtra.

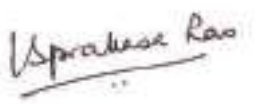
My association with the project started only from May 2019, after the erstwhile Project Coordinator, Prof. Milind Watve, decided to resign from IISER Pune and RGSTC requested IISER Pune to continue the project with an alternative arrangement to take the project to a logical conclusion. I am thankful to Director, IISER Pune and RGSTC for reposing confidence in me and assigning this responsibility. I am thankful to the Principle Investigators of the collaborating institutes / organisations for accepting this arrangement and cooperating with me. By this time, the first 5-year tenure of the project was completed and extension of one year was already sanctioned by RGSTC and was in progress. My job was made easier because the reporting formats were put in place by the previous coordinator and reports up to October 2018 were already available. Shri Girish Sohani and Smt. Rajashree Joshi from BAIF provided their wise counsel to me, and also agreed to anchor some of the activities during the extension period, to make me comfortable in handling this mega project.

The major thrust during 2019-20 was on building up a searchable database using the data generated during the previous five years by all the collaborating institutes. This involved several levels of consultation and discussion at multiple levels to generate formats for the data that are compatible for a database structure. Dr. Madhav Gadgil, Dr. Vijay Edlabadkar, along with Dr. Madhura Niphadkar, Dr. Prashant Hedao, Shri Ravikant Patil and Shri Yogesh Karyakarte (BAIF) ensured that the basic database is ready in a record time. More improvements in database are being made in the coming months.

It was envisaged that from April 2020 we will conduct a series of workshops at IISER Pune for finalizing the report. However, the unanticipated lockdown conditions due to the outbreak of COVID 19 pandemic, have thwarted all our efforts in that direction. Even after one year, the situation is no way near normal and physical meetings are not yet feasible. The report has been compiled with the limitation imposed through virtual meetings. I thank all the PIs for bearing with my frequent phone calls and video calls for clarifications regarding the contents of the report.

I would also like to place on record the valuable contribution of the coordination team and other project staff at IISER Pune, viz. Dr. Alok Bang, Dr. Ulfat Baig, Dr. Neelesh Dahanukar, Dr. Harshada Dube, Ms. Ojas S.V., and Ms. Anagha Pund for their help in compiling the reports. I would also like to thank the Grants office led by Dr. Vandana Gambhir, the finance team headed by CA Ms. Vasundhara Laad and Registrar, Col. G. Raja Sekhar (Retd.) for their cooperation in managing this project with diverse organisations. My particular thanks are due to Ms. Savita Mapari and Ms. Trupti Bhingarkar for their valuable administrative support during the entire project tenure.

The members of the Monitoring Committee and the Mid-term Review Committee had contributed immensely in shaping the progress of the project through their suggestions. I sincerely thank them. And fianlly, I would like to place on record the continuous advice and encouragement provided by Dr. Madhav Gadgil, Chairman EC, MGB project and Dr. Anil Kakodkar, Chairman RGSTC; Dr. A.B. Sapre and Shri A.S. Manekar, past and present Member Secretaries of RGSTC and other officials of RGSTC.



(V.S. Rao)
MGB Coordinator

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Volume -II

Conservation of Grassland and Savanna Diversity

Report

5.1

Conservation of Grassland and Savanna Diversity

Samvedana
Karanja Lad, Dist. Washim

Background

Savanna grasslands are one of the most neglected ecosystems in India. Conservation efforts by government as well as other organizations have no specific program for the conservation of grasslands in India. Historically, Vidarbha region of Maharashtra is known for grasslands and local livestock breeds (Satya Laxman, Ecology colonialism and cattle OUP 2007). Local grass species are in decline because of encroachment and use of weedicides. (http://terragreen.teriin.org/terragreen/TGApr17/TG_CoverStory/files/downloads/TG_April_2017_Cover_Story1.pdf). Endangered species like Great Indian bustard and Lesser florican use grasslands as their habitat, so they too are facing population decline. Traditional pastoral and non-pastoral nomads, agrarian communities are also dependent on grasslands for their livestock which they use for livelihood.

Samvedana is working with local communities and natural resources on which they are dependent. These communities have important traditional knowledge about these vanishing grassland ecosystems. They can play an important role in the conservation, which in a way will also benefit them in the strengthening of their livelihoods.

There are significant results on the ecosystems and livelihoods after the MGBP initiative which can be replicated in other parts of the state.

Journey with MGBP

Key issues addressed

- *In-situ* conservation of grassland biodiversity
- Community based studies of Lesser florican
- Fodder development
- In-situ conservation of local grass species in Western Vidarbha
- Livelihood strengthening of dependent communities
- Environmental education
- Documentation of traditional knowledge
- Convergence with Government schemes
- Local and state level advocacy for grassland policy
- Publication of awareness in media
- Youth empowerment
- Soil and water conservation
- Forest regeneration
- Capacity building of local youths

Objectives

- In situ conservation of grassland biodiversity with special reference to lesser florican (*Sypheotides indica*) and legumes of genus *Alysicarpus*, Kunda grass (*Ischaemum pilosum*) Pavnya grass (*Sehima nervosum*), Jondhali (*Sorghum contraversum*) and other indigenous grass species. Lesser florican is categorized as 'Endangered' and in the red list published by IUCN. Additionally MoEF has prepared a 'Recovery plan' for Bustard species. The native grass species are important for the livelihood of local communities and also preferred by other grassland dependent species like Black buck and Chinkara
- Livelihood strengthening of communities dependent on grassland/scrubland areas through eco-restoration activities
- Capacity building of communities dependent on these ecosystems, including nomadic and pastoral tribes and other communities engaged in animal husbandry. This was done through various trainings and workshops. Process of preparing People's Biodiversity Registers (PBR) will also build capacities of local communities for sustainable use of natural resources
- Documentation of traditional knowledge through People's Biodiversity Registers. Advocacy efforts for creation of an inclusive grassland/scrubland policy

Objectives fulfilled

- In-situ conservation of grasslands is done on 600 hectares of land
- Livelihood strengthening through eco-restoration activities are done in five villages and still going on
- Capacity building of communities done through data collection and PBR and implementation of Biodiversity act and still going on
- Documentation of traditional knowledge is initiated and still going on

Sampling methods

Data sampling methods were decided in workshop organized at IISER. We are using the same formats for data collection. We have developed sampling methods and research design for studies like grass germination.

Florican territory studies in collaboration with IISER.

Data collection on following aspects is being done from 2016

Fodder

Frequency: annual

Number of villages: 10

Samples: 10 units per village

Method: Communication with local knowledgeable individuals

1. List of grass species

2. Agriculture residues used as fodder

3. Seasonal, village wise crop wise data of above

Land use pattern

Frequency: annual

Number of villages: 10

Samples: 10 units per village

Method: Communication with local knowledgeable individuals. Additionally, information was collected by secondary data

1. Land holding and status of irrigation

Crop pattern

Method: Communication with local knowledgeable individuals. Additionally information was collected by secondary data

Fodder plots

Frequency: thrice a year

Number of villages: 10

Samples: community conserved grassland sites in four villages

Method: plots of one x one meter are selected in each site. GPS location is taken. All grass species in the plot are collected and wet and dry weight is taken for each species. The number of plots are dependent on the size of the community conserved area.

1. Wet and dry fodder availability from improved varieties

Livestock

1. Number of livestock, categories, breeds, primary and secondary usage

2. Frequency: annual

3. Number of villages: 10

4. Samples: 20 units per village

5. Method: Communication with local knowledgeable individuals. Additionally information was collected by secondary data

Grassing

1. Mapping of grassing lands in each village, land tenure and number of livestock grassing on these land

2. Frequency: Monthly

3. Number of villages: 10

4. Samples: depending on the grassing sites in each village

5. Method: Communication with local knowledgeable individuals. Area is mapped with the GPS coordinates of north-south-east-west. Number and type of animals using the area for grassing is recorded in communication with local herders.

Grass diversity

1. Species occurrence in community conserved areas, local and scientific names, species-wise wet and dry weight

2. Frequency: Twice a year

3. Number of villages: 9

4. Samples: depends on the grassing sites in each village

5. Method: Communication with local knowledgeable individuals. List of grass species on each site with its abundance is documented.

Lesser florican Teretory mapping

Lesser florican uses mosaic lands as a habitat. (https://www.researchgate.net/publication/ 279835327 _Lesser_Florican_Sypheotides_indica_in_Warora_Chandrapur_Maharashtra_India_Conservation_requirements). It prefers habitat comprising agriculture, savannah grasslands and small water bodies. There are rapid changes in the land use in project area. It is important to document and map the present land types used by florican for display, foraging and nesting. This will help to understand the local habitat preferences of florican and its adaptation.

Lesser florican habitat development through seed money intervention

We have taken a 25 acres of land on lease for 6 months to develop florican habitats. The sites are selected on the basis of previous sighting of florican and availability of land. The major intervention is to plant traditional crop varieties and to spare land so that the grass will grow and thus requirement of a mosaic habitat requirement is fulfilled. The grazing is totally banned on these lands. We have very encouraging outcome and a male florican sighted displaying on one of the plots. One female and one male sighted foraging on the other plot too. However, we could not locate nest on the selected plots.

Major work done under MGBP

- *In-situ* grassland conservation in 600 hectares of forest and private land area
- Documentation of florican sightings and nest protection-total four nests protected and eight chicks survived
- First ever territory documentation of florican habitat in central India (report attached)
- 10 schools involved in the environmental education activities and students become aware about the local biodiversity issues
- Livestock based livelihood strengthening in four villages
- PBR preparation in 10 Villages
- Establishment of SHGs and their capacity building for local resource based livelihood activities

Database

Data collected during the project duration has been converted into a format amenable for database structure. A summary of the data available in RDBMS is given below. Detailed data is available at http://mgb.iiserpune.ac.in

Form	Number of Records
1. Vill-biodiversity	25
2. Special_utility	7
3. Tapu_Information	4
4. Qualitative abundance of Species on Tapus	25
5. Tapu_Transect for PCQM	21

Quantitative impact of the work

Sr. no	Parameters	Before 2014	After
1	Area under community managed grassland	100 hectares	600 hectares
2	Number of Sightings of Lesser florican	2	27
3	Number of nests reported	1	3
4	Number of BMCs formed	1	11
5	Number of SHGs	3	17
6	Number of small enterprise	0	6
7	Number of schools involved in environmental education about local issues	0	10

Community participation in MGBP process

We started the community based grassland conservation in 2008. It was initiated by Phasepardhi tribes for optional livelihood. Most of the youths from Wadala village don't want to be in hunting for livelihood. Samvedana and village community started finding new livelihood options. It was understood that there are some options which were already initiated by community and can be strengthened. Livestock keeping, nomadic trade and agriculture are these options. Youths prioritize the livestock keeping as best and low cost livelihood option. Fodder availability was the important issue so they started conservation of grass species through three bans i.e. no grassing, no cutting and no forest fire.

Under MGP, the Wadala model was introduced to the villages which are having large number of livestock and surrounded by forest land. Villagers visited Wadala and thus participation of other village community also ensured.

Community's role in designing or reshaping the work

Community played the role in designing and reshaping the work often. Like in Wadala village, community observed that if grassing ban is imposed in their protected area the propagation of grass is declining. If grassing is totally banned, as per community observation, there is less grass germination. Hence, there is a need to introduce grassing in specific season. Wadala youths selected the area where they open the area for grazing after seed dispersal ends.

Lesser florican monitoring and conservation is almost fully managed and governed by knowledgeable individuals from Phasepardhi tribe. They select and monitor the possible sites, decide the monitoring techniques, prioritize the site for possible breeding site, and they decide nest monitoring and protection methodologies. Their role is formally recognized in Bustard recovery plan for Maharashtra prepared by MoEF, BNHS and WII.

Management of common resources by communities

In Wadala, community is managing common resourses through their "Tanda Panchayat" (please see the poster). This is the newly created community based system to manage multiple issues. BMC is also in place and involved in decision making. They have following rules:

- No grassing in community based conservation areas
- No cutting of firewood
- No forest fire or any act to promote fire
- No hunting at all
- Grass cutting starts in November
- A bamboo stump must be used so that grass seeds fall on ground
- All families involved in protection will get fodder
- Those who are not able to involve in protection because of their nomadic livelihood, can help in grass cutting and get 50% of grass in return of their labor
- Spatial protection means no branch cutting before seeds disperse, to the wild fruits, medicinal and firewood plant

Villages who have newly initiated their conservation follow the following three bans

- No grassing in community based conservation areas
- No cutting of firewood
- No forest fire or any act that promotes fire

Social conflicts around conservation– conflicts with neighboring villagers

There is history of conflicts with neighboring villages. The reason for conflicts is "Who will use the additional resources available after conservation?" these conflicts are at two levels, one is within village community and one with neighboring villages.

Village community uses their Tanda Panchayat system to resolve the matters and took the decision that those who are not participating in conservation because of their nomadic livelihood and other issues like small family size, such families must donate their labor for grass cutting and get 50% share. This model is running well and now there is almost no conflict within.

Conflicts with neighboring villages are much more complicated. The reason is again about resources use. Initially communities tried to solve the matters mutually but it is not possible because of multiple reasons like caste issues, no system of Tanda Panchayat etc. When neighboring village tried to use the resource forcefully there were some incidents of physical fights between individuals. The matter goes to police station and forest department. Both the departments appreciate the efforts of village that initiated conservation and took action against the intruders. Government departments and conservation community often advice the intruders to start conservation to minimize the conflicts about resource use.

Conservation and weaving of social fabric

There are some major changes in social fabric. One is within community and other is about the relationships between communities and government departments. Wadala village community reformed their social system of "Jatipanchayat" and created a new system of "Tandapanchayat". Tandapanchayat is more democratic and inclusive. Creation of BMC and its implementation is also a new development within other village's decision making. Youths are more active in all these processes as they are looking for their future and optional livelihoods.

Changes were observed in Phasepardhi community's identity and stigma. Phasepardhi community is known as hunters in Vidarbha. Because of the conservation initiatives, their identity is changing as conservators and contributors. Their traditional knowledge is also recognized at local and national levels. Forest department's perspective towards them is also changed and they are subject to inclusion into conservation efforts.

Other mainstream communities are also changing and initiating conservation efforts for livelihood strengthening. The change of identity is also observed within Phasepardhi community and they have added feel of dignity.

Local and global factors influencing conservation related behaviour of communities

As mentioned earlier, there are changes. The recognition, felicitations, awards they received bring these changes. Even other local communities too changed their perception towards these youths. Youths are adopting the use of modern technologies like GPS, Mobile phones and scientific methods of documentation, monitoring and management. (Please see presentation in India science academy event confluence)

Benefits they have received

Resource: Because of conservation efforts their livelihoods are strengthening and they can take active part in conservation.

Knowledge: Community having space to use their traditional knowledge for conservation and social issues. They are also exposed to modern knowledge, technologies and methods to adopt. This adoption is not only helping them to improve their management practices but also creating changes in their mindset.

Exposure: Because of MGB, many communities and individuals (Village youths, school students) are exposed to all new worlds of knowledge building and its use to change their surrounding situations.

Economic benefits: Communities and youths are active on multiple levels. They are not only getting economic benefits through conservation but also interacting with government departments to avail development schemes.

Long term/short term/rights based benefits and their continuation beyond MGB project

Resource conservation, adoption of modern knowledge, networking with government line departments, convergence development schemes will benefit in long term. (See attached paper on economic and biodiversity benefits)

Seed money for self-help groups, individual entrepreneurs, availing of government schemes will benefit in short term

Implementation through Biodiversity act (BMC), NREGS and Forest Rights Act are in process that will benefit in rights based benefits

Biodiversity management committees have been setup and methods of conservation and management are in place. Forest department is ready for the grassland development agenda. Samvedana is also in process of expansion of activity so all this will ensure that the communities will get benefited even after MGBP.

Relevance of history in conservation practices

There is very well documented history of grassland destruction and land use change in the region during colonial times. (Ecology colonialism and cattle Dr. Satya Laxman, Oxford University Press.) Dr. Satya in his book elaborates how British arrived in Berar in 1953 with the idea of growing cotton. This was because the industries in Manchester were having deficit of raw material. The uncultivated land which was about 25% of total land in Berar in 1953, declined to 2%. The book gave detailed account of how this cotton promotion destroyed the local livelihood and resource use patterns and impacted Berar. He concluded that the huge landscape change brought three famines in late 19th century.

Species of fodder value, biomass growth and yield

अ.क्र	मराठी नाव	स्थानिक नाव	शास्त्रीय नाव	गुण वैशिष्टये
1	कुंदा	कुंदो	*Ischaemum pilosum*	Used for nesting by Lesser florican. Root juice used as source of water during hunting
2	पवन्या	पोण्या	*Sehima nervosum*	Most preferred fodder by livestock. Increased milk production is observed
3	मारवेल	मारवल	*Dichanthium Annulatum*	Fodder
4	सुरलाई	सुरली	*Chrysopogon fulvus*	Fodder
5	जोंधळी	रोहिस	*Sorghum*	Used for roofing and flowers used as flavor enhancer in liquor
6	तिखाडी	तिखाड्यु	*Cymbopogon*	Fodder
7	बोंडी	भोंड	*Andropogon pumilus*	Preferred fodder
8	कुसळी	कुसल	*Heteropogon contortus*	Fodder

Fauna associated with grasslands

Sr. no	English name	Local name	Scientific name
1	Black buck	Kalvit	*Antilope cervicapra*
2	Chinkara	Chinkara	*Gazella bennettii*
3	Bluebull	Nilgai	*Boselaphus tragocamelus*
4	Black napped hare	Jangli sasa	*Lepus nigricollis*

Sr. no	English name	Local name	Scientific name
5	Indian wild cat	Ran manjar	*Felis silvestris ornate (?)*
6	India fox	Khokad	*Vulpes bengalensis*
7	Indian jackal	Kolha	*Canis aureus indicus*
8	Indian Wolf	Landga	*Canis lupus pallipes*
9	Indian grey mongoose	Mongoos	*Herpestes edwardsii*

List of Publications and presentations at conferences etc

No	Title	Conference/ publication	Published / accepted/ in process
1	Sighting of endangered lesser florican in Akola district of Maharashtra	Mistnet BNHS	Published (attached)
2	'Phase Pardhis' of Central India in Search of Sustainable Livelihoods through Natural Resources Conservation'	International conference in Vienna Presented by Dr. Sanjay Savale	Presented
3	Hunters turn protectors, Down to Earth, Saturday 15 March 2014 http://www.downtoearth.org.in/coverage/hunters-turn-protectors-43638	Down To Earth	Published
4	तणमोरांचा प्राणहर्ता रक्षणकर्ता होतो तेव्हा... http://www.thinkmaharashtra.com/node/2648	Think Maharashtra website	Published
5	तणमोर, फासेपारधी आणि संवेदना–१ https://www.youtube.com/watch?v=A3L7J14v5Rc	Think Maharashtra You Tube Channel	Published
6	तणमोर, फासेपारधी आणि संवेदना–२ https://www.youtube.com/watch?v=txEz2psFtNg	Think Maharashtra You Tube Channel	Published
7	तणमोर आणि पारधी समाजातील पुनरुत्थान–भाग १ http://moklik.blogspot.com/2017/09/blog-post_13.html	Sunil Tambe blog / Sakal Agrowon	Published
8	तणमोर आणि पारधी समाजातील पुनरुत्थान–भाग २ http://moklik.blogspot.com/2017/10/blog-post.html	Sunil Tambe blog / Sakal Agrowon	Published
9	Collaboration of Science and community for the conservation of savannah grasslands and endangered Lesser florican http://confluence.ias.ac.in/collaboration-of-science-and-community-for-the-conservation-of-savannah-grasslands-and-endangered-lesser-florican/	Indian Academy of Science Confluence website	Published
10	P. Thamizoli and Balakrishna Pisupati, 2015, Sustainable Development – Stories from those Making it Possible. Fledge, India http://fledgein.org/wp-content/uploads/2017/11/Sustainable Development Stories from Those Making it Possible. pdf	Published by FLEDGE Chennai E.Mail: info@fledge.in	Published
11	कापुसकोंड्याची गोष्ट–नंदा खरे Translation of Dr. Laxman Satya's book Ecology colonialism and cattle (OUP)	Manovikas Prakashan Pune/ Samvedana	Published
12	Phasepardhis and the lesser florican https://news.mongabay.com/2019/04/phasephardhis-and-the-lesser-florican-commentary/	https://news.mongabay.com/	Published
13	Head: Tribal Knowledge Helps create a Livestock Boom in Washim Neema Pathak Broome and Shrishtee Bajpai http://www.rainfedindia.org/wp content/uploads/2019/02/Livestock.pdf	Revitalizing rainfed area network	Published
14	'PHASEPARDHI'S AND THE LESSER FLORICAN Neema Pathak Broome and Shrishtee Bajpai	Vikalpsangam. org	Published

Networking with other MGBP groups

Thematic and regional meetings were planned to fulfill the objective of networking and helping each other within MGBP. Initially it happened well but after some time for several reasons it was not much functional. Still there was frequent interaction within group during thematic meetings organized by IISER. Exchange during meetings, exchange of reports and common interaction for theme presentation gives a great space for sharing, experiences, good practices and knowledge. Sharing among team members too impacted positively in our work. (Will document the actual case and put it here).

Meeting/workshops at IISER i.e. data collection workshop and workshop on paper writing was really helpful and fruitful too. Helpful in term of improved dada collection.

Meeting/workshops/interactions with CEE for environmental education are useful for capacity building of staff and writing on various issues.

There are other collaborations and networking happening with state forest department. Samvedana is in process to help forest department in developing a proposal for fodder development in five districts in Vidarbha. This proposal could be funded by National livestock mission which has similar objective as MGB. We are in communication with theme members to participate in the process.

Outreach

We are now partner in Revitalising Rainfed Agriculture (**RRA**) **Network** and pushing the agenda of grassland conservation for fodder development and livestock based livelihood strengthening.

Knowledge Outcomes

Interesting / unknown/ unrealized facts during the work

Though we initiated the grassland conservation activity at community level, three individuals came forward for the activity on their agricultural land. Mr. Bhimrao Suradkar has done grassland conservation on his 5 acres of land to produce fodder for his buffalos. Mr. Akshay has done grassland conservation on his three acres of agricultural land. Now he has taken initiative for the conservation on about 30 acres of social forestry land.

Sightings of florican are reported from Yeotmal, Amravati and Nagpur districts in the last 3 years. We have planned to monitor these sites with the help of Phasepardhi tribe there.

Territory mapping of florican habitat is done with GPS with the objective to understand the mosaic pattern of habitat and land use commotions.

Experiments of new grass germination methods are going on. Cow, buffalo and wild animals like Nilgai and Blackbucks droppings are collected and sown on soil trays to test the fertility. Soil samples from community conserved area are collected and sown in trays to test the fertility.

Stories emerged

List given in the publication table

Realizations about human nature/ human-nature relationship

We will write a story on Community perspective towards nature that is 'holistic' and how this perspective is built and how it impacted the conservation efforts

Observations about ecology- regeneration/ depletion/ conservation

Florican territory study will give us additional information of ecology and conservation

Newunderstandings/philosophy/realizations emerged

Ideas about the development process of western Vidarbha needs to be based on grassland development, livestock development and water conservation. All these can be achieved through grassland regeneration on forest land. We are very much close to making it people's and forest department's agenda. Dr. Satya's book (Ecology colonialism and cattles) is about colonial history of Berar which comes in our project area. The book elaborates the history of ecology of the area of pre-colonial times and changes during British rule. It showcased how local communities designed the livelihood patterns and resource use according to ecological setup i.e. rainfall, soil and temperature. It is clear that during this period there are issues and problems, but history tells us that the area was not under famines before and there was stable economy. There is need to understand, learn and plan the development process on the traditional practices of resource use, cropping pattern and so on.

Species Lists/Inventory See Annexure

Impact on ecology

The impact on ecology can be considered as positive. Soil and moisture is improved at grassland conservation sites, resulting in more natural germination of local plants. This has become useful for local ecosystems. Local grass species provide food to many birds and insects. It is observed that there is an overall increase in biodiversity. Habitat for lesser florican is conserved at conservation sites. There are sightings nearby these sites.

On policy level interventions: Maharashtra government has set up a study group with the mandate of suggesting draft grassland and fodder policy for the state. This is one of the significant developments as an

outcome of collaborative efforts of grassland theme of MGB and Maha-RRAN (Revitalizing Rainfed Agriculture Network). Though core activities of MGB are finished by September 2020, there is a need for information dissemination and exploring opportunities for grassland biodiversity conservation and livelihood development through recent policy changes.

Failure stories

The work regarding PBR is held up at Maharashtra State Biodiversity Board. There are some issues regarding the formation of BMC and number of BMC members. Data is generated but PBR is not submitted to MSBB.

There is negative response for the grassland conservation from the village very near to cities. The causes are communities are not much dependent on natural resources. Especially youths in the villages near to cities are looking towards cities to fulfill their aspirations. Though we have Panjabrao Deshmukh Agriculture University in Akola, youths from village Masa is more dependent on industries in Akola. There is no hope from agriculture to fulfill the economic and social aspirations of youths. This leads to less response towards actions based on biodiversity regeneration.

Way forward

In-situ conservation, livelihood development and youth empowerment are the backbone of our work. All these parts will continue in future. In-situ conservation of grasslands will continue as this is taken up by communities and needs no money. State forest department is also intended to work on grassland conservation as they have mandate to work for florican conservation.

Livelihood development is linked with grassland conservation it reduce dependency on fodder from market. People tends to buy more and more livestock because of this.

Support structure

At community levels there are Biodiversity management Committees, Gramsabhas and youth groups are working and building their capacities through these structures. These will continue as they are linked with community livelihoods activities.

At Organizational level we are planning on the proposals for grassland conservation with State forest department. There is a proposal in pipeline for community empowerment and women farmers in the area.

National livestock mission has mandate of development of fodder in forest land. Maharashtra forest department has not worked on this aspect till date. Samvedana as a member of Revitalization of Rainfed Area Network (RRAN) took this up and started communication with forest department (APCCF wildlife). Forest department has organized a workshop of all district officers at Amravati to start working on this. All district officers are now sending proposals for their respective district and forest department will write a project for five districts of western Vidarbha. Samvedana will play a role in building community partnership and florican conservation.

List of staff involved in the project with their posts and one liner introduction

No	Name	Position	Introduction
1	Kaustubh Pandharipande	PI	Working on community based grassland conservation and youth empowerment from last 15 years
2	Himmat Pawar	Resource person	Expert in Lesser florican; belongs to Phasepardhi tribe
3	Kuldip Rathod	Cluster coordinator	Community leader and expert in youth empowerment
4	Aniruddha Bade	Project fellow	An engineer having interest in conservation
5	Prafulla Kalokar	Project fellow	M.A in Economics, doing PhD. in Economics and he belongs to pastoral community
5	Sewa Pawar	Jaivavividhata Mitra	Community leader and knowledgeable individual
6	Sahebrao Rathod	Paryavaran Shikshan Mitra/Jaivavividhata Mitra	Community leader and knowledgeable individual
7	BhimraoSuradkar	Jaivavividhata Mitra	Community leader and knowledgeable individual
Individuals worked under program and resigned			
1	Ms. Pooja Surkar	Project fellow	Msc in environmental sciences and a good birdwatcher
2	Ms. Priti Ukey	Project fellow	She has done her MA from TISS. Interested to work on the field based project

Annexure 1

RESEARCH AND CONSERVATION

Sighting of endangered Lesser Florican *Sypheotides indicus* in Akola district, Maharashtra

Kaustubh A. Pandharipande[1], Himmat Kanjra Pawar, and Anil Pimplapure

On August 24, 2015 I woke up to a phone call. On the other end was my Phasepardhi friend Himmat Pawar, who told me about what he had just seen – the courtship display of a male Lesser Florican (LF) *Syphotides indicus*. Earlier that day, Himmat's son Alasingh Pawar had also encountered a male LF in full breeding display in a soybean field. It was a welcome call and opportunity to document the courtship display.

Our organisation, Samvedana is implementing *in-situ* conservation project on "Community-based grassland biodiversity conservation" in selected villages of Akola and Washim districts in the western Vidarbha region of Maharashtra. The traditional hunting tribe known as Phasepardhi is playing a very important role in this project. Their traditional knowledge and skills in the conservation of grassland biodiversity and LF is an asset for this project.

On receiving Himmat's call, we hastened to Akola with great anticipation. We reached the site near the village Sisa Masa at about 4.00 p.m. The area is dominated by agriculture with mainly soybean, sorghum, cotton, black gram, green gram and sesame fields. After about 10 to 15 minutes, Alasingh was excited to hear the typical "frog like" call produced by male LF. Our persistence was rewarded within a few minutes by the sight of a beautiful jumping jack. The bird was foraging in the fallow land dominated by Gokhru *Xanthium strumarium*, *Cleome chelidonii* and

few grass clumps said to be *Sehima species*.

We hid ourselves in an Acacia bush. Kaustubh, our teammate, clicked some beautiful photographs of the bird. We observed and photographed this solitary bird for half an hour and captured some record shots from a distance of about 300 to 400 metres. Even though the bird was aware of our presence, it made seven courtship display jumps within a span of ten minutes. After some time, we sighted one more male LF with full breeding plumage flying towards the opposite direction.

Again on September 7, 2015, our team members visited the same site and located and documented three more male LF in the same area. On November 14, Himmat Pawar reported the sighting of two juvenile LF around an area near Sisa Masa, which is about 700 metres from the display site. This reporting confirmed the existence of female birds, pair formation and successful breeding around Sisa Masa village.

These records are significant documentations of LF breeding activity in Maharashtra. Samvedana with the help of Phasepardhi tribe is making efforts to record more breeding sites in this area.

LF has been reported from Vidarbha on a few occasions including near Sisa Masa village. On November 17, 1998 an injured LF was found by Himmat Pawar at this site (Rithe, 2003). Another bird was photographed by Prashant Gahale near Borgaon Manju dam, which is approximately 25km east of Akola city (Kasambe and Gahale 2010).

References

Kasambe, R. and Gahale, P. (2010): Status survey and sighting records of Lesser Florican in Maharashtra. *Mistnet* 11 (2): 7-9.

Rithe, K. (2003): The survey of IBA sites in Vidarbha region, Maharashtra. Nature Conservation Society, Amravati. Final Report. Submitted to BCN-BNHS. Pp 32.

Acknowledgments

Alasingh Himmat Pawar, Yogesh Himmat Pawar, Bahar S. Baviskar.

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District Washim, Maharashtra, 444105.
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Annexure 2

Mapping and Study of Monsoon Territory of Lesser Florican

Team

Team Member	:	Mr. Aniruddha A. Bade
Team Co – Leader	:	Mr. Himmant Pawar, Mr. Yogesh H. Pawar
Guided By	:	Mr. Kaustubh Pandhripande, Dr. Anil Pimpalapure

Objectives

Lesser Florican (Sypheotides indicus) is flagship species of Grass land.

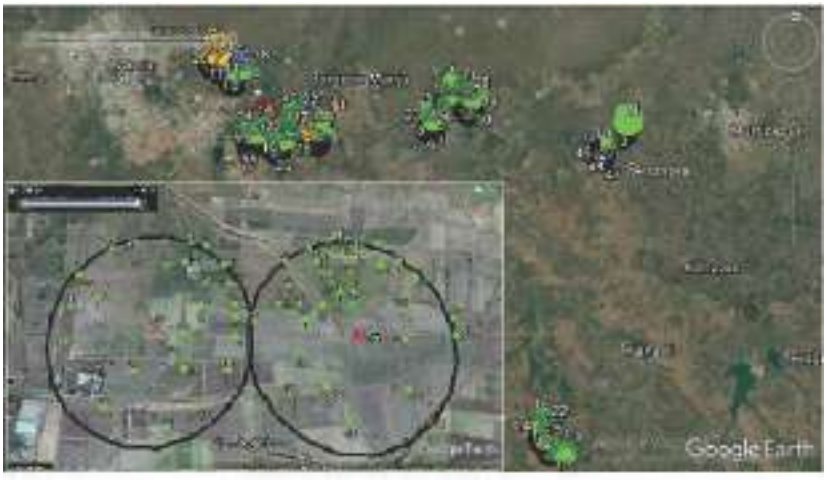
As per previous research, it is found that lesser florican's population goes down due to insufficient rainfall, change in crop pattern and uncontrolled grazing and hunting etc. Result is that bird comes under the schedule one species by Wildlife Protection Act 1972 and status as an Endangered by IUCN.

Project area and duration: The duration of project was from 15 June 2017 and completion date was 15 September 2017. The study area was Sesa – Masa Village (N 20 Degree 41'.393' E 077 Degree 06'.538') and surrounding area of Akola District and Wadala village (N20 Degree 29.913' E 077 Degree 14.345') in Washim District Maharastra. These locations were selected due to previous record of lesser florican.

(Beautiful Grass land Patch)

To conserve this endangered species, its habitat conservation is more important. So the main objective of the project was to know how many and what type of grasses, herbs, shrubs are present in the territory as well as what was the crop pattern, water resources, land use pattern, list of insecticides, pesticide used by farmers, other fauna, specially the birds and butterflies species in predominant habitat of this bird.

Work Area Map



(Our study area near Akola and Washim District, Maharashtra. Study conducted in total 27 locations with 662 GPS Co-ordinates Mapped)

Methodology

As per the previous record of sighting, we differentiate the location into three parts.

1) Courtship Display Site (DS) (2) Nesting Site (NS) (3) Foraging Site (FS)

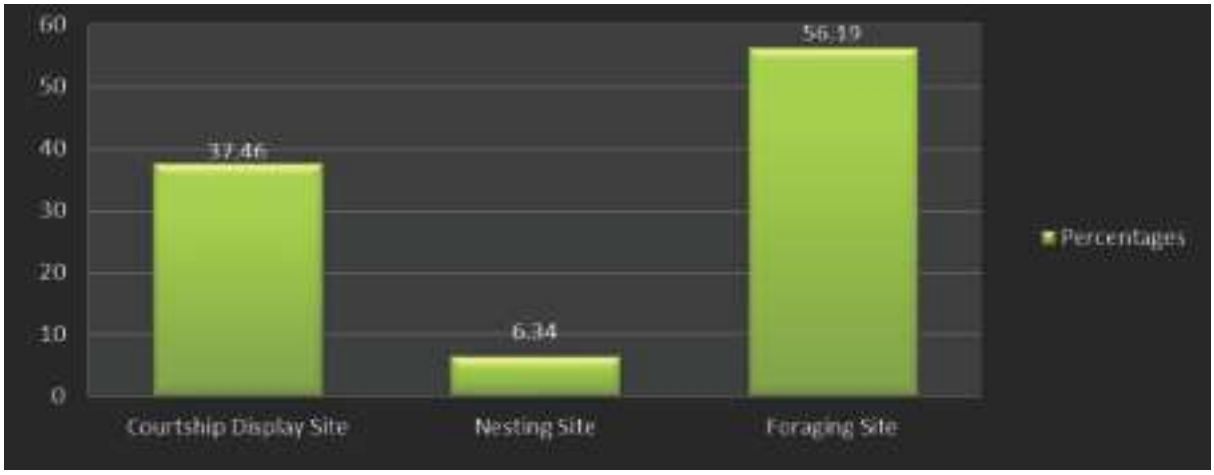
1) Courtship Display: In breeding season, male Lesser Florican displays himself by jumping aerially to attract the female. In one day, male Lesser Florican jumps around 500 to 600 times. This particular phenomenon is called as Courtship Display.

2) Nesting Site: Is site which selected by female Florican for laying eggs. The eggs are covered with thick grasses and bushes.

3) Foraging Site: The Area which is used for foraging by Lesser Florican.

In recent study, the breeding Males Florican territory varies in between 200 M to 500 M and does not occupy more than two hectares of land as a dominant area. So we created a circle as a study area of 700 m. in radius. We used GPS essential App for mapping, tracking, dropping a way points and note down all information. Most of the time myself and Himmant Pawar or Yogesh Pawar (Phasepardhi) covered all the area on foot. On an average 40 small areas come inside radius of 700 M study area in which most of the area is covered with agriculture land, some area of grass land, forest patches, fallow lands, etc.

Total Location (In Numbers)	Courtship Display Site	Nesting Site	Foraging Site
27	08	02	17
Total GPS Co – ordinates			
662	248	42	372
Percentages	37.46	6.34	56.19



Courtship Display Site

Total GPS Co – ordinates	Land Ownership	
	Private	Government
248	172	76
Percentages	69.35 %	30.64 %

	Forest land				Grass Land (Private / Gov. Ownership)					Agriculture Land / Private or Government	
Total Way point mark	Thorny	Scrub	Shrub	Forest in Private Land	Savana	Mixed	Protected	Fellow Land / Free Grazing Land.	Baren Land	Irrigated	Rainfed
248	**09**						**81**			**158**	
	05	02	02	00	00	00	00	81	00	44	114
Percentages	2.01%	0.80%	0.80%	00%	00%	00%	00%	33.62%	00%	17.74%	45.96%

Water Resources						
Total	Lake	Stream	Canal	Nala	Borewell	Well
248	01	00	01	05	13	24
Percentages	0.40%	00%	0.40%	2.01%	5.24%	9.69%

Nesting Site

Total GPS Coordinate	Land Ownership	
	Private	Government
42	41	01
Percentages	97.61%	2.38%

Forest Land					Grass Land (Private /Gov. Ownership)					Agriculture Land	
Total Rain Fed Area (In Nos)	Thorny	Scrub	Shrub	Forest in Private Land	Savana	Mixed	Protected	Fellow Land/Free Grazing.	Baren Land	Irrigated	Rain Fed
42	**01**				**18**					**23**	
	00	01	00	00	00	00	00	18	00	08	15
Percentages	00%	2.38%	00%	00%	00%	00%	00%	42.85%	00%	19.04%	33.71%

Water Resources.						
Total	Lake	Stream	Canal	Nala	Bore well	Well
42	00	00	00	00	03	05
Percentages	00%	00%	00%	00%	7.14%	11.90%

Foraging Site

Total GPS Co-ordinates	Land Ownership	
	Private	Government
372	334	38
Percentages	89.78%	10.21%

Forest Land					Grass Land (Private /Gov. Ownership)					Agriculture Land	
Total Rain Fed Area (In Nos)	Thorny	Scrub	Shrub	Forest in Private Land	Savana	Mixed	Protected	Fellow Land/Free Grazing.	Baren Land	Irrigated	Rain Fed
372	**21**				**68**					**283**	
	06	00	15	00	00	00	00	68	00	90	193
Percentages	1.61%	00%	4.03%	00%	00%	00%	00%	18.27%	00%	24.19%	51.88%

Water Resources.						
Total	Lake	Stream	Canal	Nala	Bore well	Well
372	00	00	00	03	20	67
Percentages	00%	00%	00%	0.80%	5.37%	18.01%

Crop Pattern

While studying the crop pattern on 27 locations, variety of crop pattern are seen. Total 86 types of crops are taken by the farmers. The highest 32.32% is Soyabean crop, next is that of Soyabean + Tur is 13.89% , Udid is 8.76% and 4.98% Cotton crop.

Crop Details

Sr No	Crop Name	Quantity In Nos.	Percentages
1	Soyabean	214	32.32
2	Raan Soyabean	2	0.30
3	Tur	12	1.8
4	Udid	58	8.76
5	Brinjal	3	0.45
6	Cluster Bean (Gavar Sheng)	2	0.30
7	Ladies Finger	3	0.45
8	Turmeric	1	0.15
9	Dill (Shepu)	2	0.30
10	Kavala	1	0.15
11	Spinach	10	1.51
12	Coriander	5	0.75
13	Cauliflower	9	1.35
14	Pigweed (Ghol)	1	0.15
15	Black Eyed Pea	2	0.30
16	Onion	5	0.75
17	Sesame (Til)	1	0.15
18	Amala	2	0.30
19	Cucumber	5	0.75
20	Ground nut (Bhoimung)	1	0.15
21	Ridge Gourd Luffa (Dodke)	1	0.15
22	Banana	1	0.15
23	Green Gram (Mung Dal)	11	1.66
24	Millet (Bajara)	1	0.15
25	Sorghum (Jowar)	19	2.87
26	Cotton	33	4.98
27	Pomagranate	3	0.45
28	Anjan	1	0.15
29	Papaya	1	0.15
30	Lemon Tree	6	0.90
31	Banana + Soyabean	1	0.15
32	Soyabean + Black Gram + Sesame	3	0.45
33	Soyabean+Tur	93	13.89
34	Soyabean + Cotton	7	1.05
35	Soyabean + Green Gram	7	1.05
36	Soyabean + Black Gram	16	2.41
37	Soyabean +Tur + Sesame + Green Gram + Black Gram	1	0.15

Sr No	Crop Name	Quantity In Nos.	Percentages
38	Soyabean + Sesame	4	0.60
39	Soybean+ Green Gram +Jowar+ Black Gram	1	0.15
40	Soybean+ Green Gram +Jowar+Tur	1	0.15
41	Soyabean + Jowar	2	0.30
42	Soyabean + Green Gram + Black Gram	4	0.60
43	Soyabean + Green Gram + Tur	3	0.45
44	Soyabean + Black Gram + Tur	1	0.15
45	Soyabean + Tur + Cucumber	1	0.15
46	Soyabean + Bajra + Green Gram	1	0.15
47	Tur + Black Gram	9	1.35
48	Tur + Green Gram	4	0.60
49	Green Gram + Black Gram	7	1.05
50	Tur + Green Gram + Black Gram	5	0.75
51	Cotton+Tur	10	1.51
52	Cotton + Green Gram	2	0.30
53	Cotton + Green Gram + Tur	3	0.45
54	Jowar+ Black Gram+ Sesame	1	0.15
55	Cotton + Soyabean	2	0.30
56	Jowar + Green Gram	1	0.15
57	Jowar + Tur Dal	9	1.35
58	Jowar+Tur+Nilgiri Trees	1	0.15
59	Jowar + Lemon Tree	2	0.30
60	Jowar+Tur+Soyabean	2	0.30
61	Jowar+ Black gram +Tur	1	0.15
62	Jowar + Black Gram	2	0.30
63	Cotton+Jowar	1	0.15
64	Cotton + Jowar+ Sesame + Tur	1	0.15
65	Tur + Jowar + lubiya + Black Gram	1	0.15
66	Cotton+Tur+Jowar	1	0.15
67	Green Gram + Cotton + black Gram + Tur	3	0.45
68	Cotton + Tur+ Sesame +Green Gram	2	0.30
69	Cotton + Tur+ Sesame	1	0.15
70	Lemon Tree + Black Gram	1	0.15
71	Lemon Tree + Black Gram + Green Gram	1	0.15
72	Lemon Tree+ Soyabean+ Tur	1	0.15
73	Cotton + Tur + Black Gram	5	0.75
74	Soyabean + Cotton + Tur	2	0.30
75	Green Gram + Soyabean + Cotton	1	0.15
76	Cotton + Tur +Sesame + Soyabean	2	0.30
77	Cotton + Tur+ Sesame +Lemon tree	1	0.15
78	Cotton + Tur	1	0.15

Sr No	Crop Name	Quantity In Nos.	Percentages
79	Tur + Black Gram + Sesame	4	0.60
80	Green Gram + Sesame + Black Gram	1	0.15
81	Tur+ Black Gram + Lubiya	1	0.15
82	Black Gram + Sesame	2	0.30
83	Green Gram + Sesame	2	0.30
84	Cotton + Bajra	1	0.15
85	Charoli + Sugar Apple	1	0.15
86	Field Bean+ Lemon Tree	2	0.30

Grass Details

Sr No	Local Name of Grass	Scientific Name	Occurrence in no. of coordinates	Percentages
1	Kena		227	34.29
2	Hara		124	18.73
3	Marval		291	43.95
4	Shipi		183	27.64
5	Kunda	Ischaemum	109	16.46
6	Pawanya	Sehima	195	29.45
7	Kandi Gavat		3	0.45
8	Bajara Gavat	Setaria	11	1.66
9	Budhali		2	0.30
10	Panhal	Dactylotenium	2	0.30
11	Chopda Gavat	Chrysopogon	44	6.64
12	Surlai	Sehima	5	0.75
13	Lona	Dinebra	157	23.71
14	Chikati		53	8.00
15	Rohis		1	0.15
16	Jondhali	Sorghum	21	3.17
17	Gadda Gavat	Chloric	6	0.90
18	Gonda Gavat		6	0.90
19	Bondi Gavat		28	4.22
20	Pathri Bondi		2	0.30
21	Choti Kusali	Dichanthium	5	0.75
22	Mothi Kusali	Dichanthium	1	0.15
23	Barik Kusali	Aristida	19	2.97
24	Mothi Kusali	Heteropogon	1	0.15
25	Jadi Kusali		1	0.15
26	Chot Gavat		1	0.15
27	Mothi Lenda		1	0.15
28	Kateri Gavat		62	9.36
29	Patalki	Apluda	38	5.74

Sr No	Local Name of Grass	Scientific Name	Occurrence in no. of coordinates	Percentages
30	Katel	Arthraxan	82	12.38
31	Tikadi	Cymbopogon	34	5.13
32	Lal Bondi		4	0.60
33	Fulki		22	3.32
34	Lalkadi		183	27.64
35	Lalkusali	Themeda	16	2.41
36	Kadau Grass		1	0.15
37	Kali Kusali	Heteropogon	6	0.90
38	Barik Lendi	Echinochloa	4	0.60
39	Padhari Kusali	Heteropogon	4	0.60
40	Pandhara Lenda		3	0.45
41	Kaus	Saccharum	12	1.81
42	Layali		127	19.18
43	Rui	Digitaria		
44	Choti Bondi	Dinebra		
45	Don Fati	Dactylotenium		
46	Char Fati	Dactylotenium		
47	Mothi Katel	Thelepogon		
48	Madhali Bondi	Iseilema		
49	Panhal			
50	Bhurashi	Melanocenchrus		
51	Barik Bondi	Poeaceae		
52	Katel Lendi	Mnesithea		
53	Motha Lona	Dichanthium		
54	Tikadi Kusali	Heteropogon		
55	Mothi Katel	Thelepogon		
56	Padhal	Eleusine		
57	Chopda Gavat	Aristida		

(All above grass species with their local name are identified by Mr. Himmant Pawar and scientific name identified by Dr. Ashok N. Deore.)

Analysis (Monsoon Territory)

Land Ownership Details

Sr No	Name of Site	Total	Private land	Government land
1)	Courtship Display	248	172	76
2)	Nesting	42	41	01
3)	Foraging	372	334	38
	Total	**662**	**547**	**115**
	Percentages		**82.62%**	**17.37%**

From above study of land ownership, which is a Lesser Florican's breeding territory, it was concluded that 83% land are belonging to private owners and remaining 17% land is under Government ownership.

Land Use Pattern

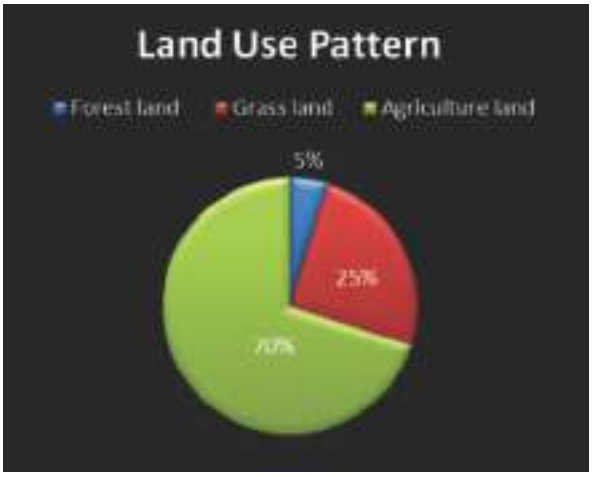
Sr No	Name of Site	Total	Forest	Grass land (Private / Gov. Ownership)	Agriculture land
1)	Courtship Display	248	09	81	158
2)	Nesting	42	01	18	23
3)	Foraging	372	21	68	283
	Total	**662**	**31**	**167**	**464**
	Percentages		**4.68%**	**25.22%**	**70.09%**

In this Land Use Pattern Study, 70% of land is covered with Agriculture, 25% of land is covered with Grassland (Private / Government Ownership) and remaining 5% of land belongs to a Forest.

This above pie diagram shows that, Lesser Florican breeding ground is now replaced by Agriculture land. For survival of this endangered species what types of crop the farmers are interested to take is very important.

As per above crop pattern, The highest 32.32% is Soyabean Crop, Below that Soyabean + Tur 13.89%, Black Gram (Udad Dal) is 8.76%, while 4.98% is under to Cotton Crop.

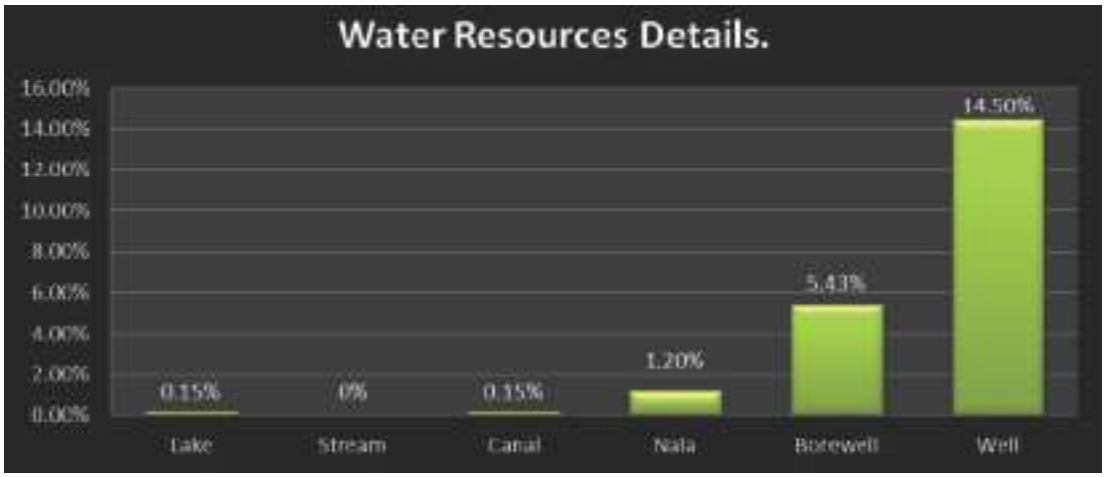
As the crop pattern changes different types of insecticides, pesticides use also changed which directly affect the food chain. This harmful insecticide, pesticide killed different types of insects, grasshoppers, rodents, reptiles, etc which is important diet for lesser floricans.



In Future, if such trend of crop pattern continues the survival of florican is difficult.

Water Resources

Sr No	Site Name	Total	Lake	Stream	Canal	Nala	Borewell	Well
1)	Courtship Display Site	248	01	00	01	05	13	24
2)	Nesting Site	42	00	00	00	00	03	05
3)	Foraging Site	372	00	00	00	03	20	67
	Total	**662**	**01**	**00**	**01**	**08**	**36**	**96**
	Percentages		**0.15 %**	**00 %**	**0.15 %**	**1.20 %**	**5.43 %**	**14.50 %**



In above study of water resources, the highest 14.50% belongs to well, 5.43% is bore well and 1.20% belongs to Nala, 0.15 % belongs to Canal & Lake. Only 21.43% is available water source, rest of the 78.57% water source is coming from seasonal monsoon.

Threats for Lesser Florican

1) Uncontrolled use of insecticide, pesticide which killed small insects, grasshoppers, rodents, reptiles etc which is main source of food for lesser florican.

2) Crop Pattern changes over the period of time.

3) Increase in exotic shrubs, plants etc.

4) Instead of sowing traditional crop like Millets, green gram, Jowar, farmers are more interested to sow soybean, Pomagranates, cotton etc.

5) Uncontrolled Grazing.

6) Mining.

7) Encroachment of habitat.

(Use of Insecticide)

(Uncontrolled Grazing)

Future Conservation Strategy

1) Awareness campaign will arrange among the farmers group to teach them about importance of Organic Farming,

2) Encourage farmers to farming the traditional crops like Millets, green gram, Jwari instead of Soyabean, Cotton or different fruits.

3) To stop uncontrolled grazing, Protection will provided for grassland patches with the involvement of local people.

4) Systematically creating a plan for use of grass for grazing.

5) Create more grassland patches and create awareness about Grass land Eco system in local communities.

6) To create alternate resources for hunters, so hunting completely ended. (Controlled tourism involving local community)

7) Maintaining data of plant and shrub species in Grass Land.

8) Maintaining Database of Lesser Florican by conducting a census with scientifically proven techniques.

9) Creating a group of Local Stake Holders, Forest Department, and Agriculture Department in Awareness campaign.

10) Arranging On - field training (Ex :- GPS Training, Tourism, Birds , Grass Identification scientific way of preparing checklist of flora and fauna, formation of florican's cell etc) program for local farmers as well as new generation of people from Phase - Pardhi tribes.

11) Try to Gain status of grassland Community reserve.

12) To form strategies to protect nesting sites.

Conclusion

Lesser Florican (Sypheotides indicus) is on the verge of extinction. There are only areas where this bird is trying to survive. It is high time we conserve not only this bird species but also conserve the habitat.

To create a win – win situation between bird, grassland eco system and human being, long-term conservation plan has to be implemented. The conservation plan has to be driven by Forest Department, Education System, researcher, agriculture department, local stake holders and the most important the *Policy Maker*.

A collaborative effort between all above agencies will prevent the extinction of this the jumping beauty.

Annexure Check list of Birds

Sr No	Name Of Birds	Scientific Name
1)	Jungle Babbler	Turdoides striata
2)	Indian Roller	Coracias benghalensis
3)	Black Drongo	Dicrurus macrocercus
4)	Indian Silver Bill	Euodice malabarica
5)	House Crow	Corvus splendens
6)	Plain Prinia	Prinia inornata
7)	Black Shouldred Kite	Elanus axillaris
8)	Grey Francolin	Francolinus pondicerianus
9)	Ashy Crown Sparrow Lark	Eremopterix griseus
10)	White Throated Kingfisher	Halcyon smyrnesis
11)	Red Wattled lapwing.	Vanellus indicus
12)	Common Myna	Acridotheres tristis
13)	Spotted Dove	Spilopelia chinensis
14)	Ashy Prinia	Prinia socialis
15)	Yellow Eye Babbler	Chrysomma sinense.
16)	Baya weaver	Ploceus philippinus.
17)	Red vented Bulbul	Pycnonotus cafer
18)	Pied Cuckoo	Clamator jacobinus
19)	Indian Nightjar	Caprimulgus asiaticus
20)	Magpie Robin	Copsychus saularis
21)	Bayback Shrike	Lanius vittatus
22)	Wooly Necked Stork	Ciconia episcopus
23)	Rain Quail	Coturnix coromandelica
24)	Common Hawk Cuckoo	Hierococcyx varius
25)	Common Iora	Aegithina tiphia
26)	Green Beeater	Merops orientalis
27)	Water Brested Water hen	Amaurornis phoenicurus
28)	Oriental White Eye	Zosterops palpebrosus
29)	Rose Ringed Parakeet	Psittacula krameri
30)	Scaly - breasted Munia	Lonchura punctulata
31)	Brahmany sterling	Sturnia pagodarum
32)	Plum headed Parakeet	Psittacula cyanocephala
33)	Yellow Footed Green Pigeon	Treron phoenicoptera
34)	House Sparrow	Passer domesticus
35)	Indian Peafowl	Pavo cristatus

Checklist of Butterflies

Sr No	Checklist of Butterflies	Scientific Name
1)	Common Emigrant	Catopsilia Pomona
2)	Small Grass Yellow.	Eurema brigitta
3)	Common Leapord.	Phalanta phalantha
4)	Common lime.	Papilio demoleus
5)	Plain Tiger.	Danaus chrysippus
6)	Blue Pansy	Junonia orithya
7)	Common Gull	Cepora Nerissa
8)	Plain Cupid.	Chilades pandava
9)	Yellow Tip	Ixias pyrene
10)	Orange Tip	Anthocharis cardamines
11)	Indian Tortoise Shell	Aglais caschmirensis
12)	Common Rose	Pachliopta aristolochiae
13)	Common Jezebel	Delias eucharis
14)	Striped Tiger	Danaus genutia
15)	Common Pierrot	Castalius rosimon

Name of Trees

Sr. No.	Name of Trees	Scientific Name
1)	Amla Tree	Phyllanthus emblica
2)	Nim	Azadirachta indica
3)	Kokan	
4)	Indian Jujube (Bor)	Ziziphus mauritiana
5)	Babhali	Vachellia nilotica.
6)	Zinz	
7)	Ramkati	
8)	Hivar	
9)	Gogal	
10)	Kamati	
11)	Moh	Madhuca longifolia
12)	Mango	Mangifera indica
13)	Palas	Butea monosperma
14)	Behda	Terminalia bellirica
15)	Sambal	
16)	Aptya	Bauhinia racemosa
17)	Nilgiri	Eucalyptus
18)	Teak	Tectona grandis
19)	Bhokar	Cordia dichotoma

Sr. No.	Name of Trees	Scientific Name
20)	Bhingari	
21)	Kunjara	
22)	Shindi	
23)	Unlhali	
24)	Chilati	
25)	Babchi	
26)	Hingantbhet	Balanites roxburghii
27)	Taykayi	
28)	Ghoshya	
29)	Umbar	Ficus racemosa
30)	Rui	Calotropis gigantea
31)	Godan	
32)	Mungna	
33)	Wad	Ficus benghalensis
34)	Chandrazoti	
35)	Paisa	
36)	Jambhul	Syzygium cumini
37)	Khair	Senegalia catechu

Photos of insecticides and pesticides used by farmers

During Field Work, a small interview of farmers was taken on the use of insecticides and pesticides used by them. Many of them are using these chemicals without following the instructions.

Sr. No.	Photos	Name	Quantity and Use.
1)		Prime Gold	Insecticide, 1Litre / Rs 950/-
2)		Cosmic	Insecticide, 1 Litre.
3)		Boom Flower.	Fertilizer for flowering plants. 1litre / Rs 720/-
4)		Proclaim	Insecticide, 250 g / Rs 2075/-
5)		Du Pont Coragen	Insect Control, 30 ml / Rs 526/-
6)		Promin - F	Fertilizer, 1litre / Rs 400/-
7)		Cypro	Insecticide, 1litre / Rs 650/-
8)		Propik	Fungicide 250 ml/ Rs 235/-
9)		Surya	Tonic, 50 ml.

Some Photos during Field Work

Grass Hopper

Long Horned Grass Hopper.

Jungle Cat Scat

Common Rose Butterfly Caterpillar

Common lime Butterfly Caterpillar

Russell's viper Snake.

Annexure 3

कुरण क्षेत्र अभ्यास प्रकल्प अहवाल

'महाराष्ट्र जनुक कोष' कार्यक्रमांतर्गत 'संवेदना समाज विकास संस्थे'तर्फे पश्चिम विदर्भातील गवताळ कुरणांचा अभ्यास करण्याचा प्रकल्प हाती घेण्यात आला आहे. या प्रकल्पामध्ये आत्तापर्यंत करण्यात आलेल्या कामाचा लेखाजोखा पुढीलप्रमाणे:

प्रकल्पाची उद्दिष्टे

१. अकोला, वाशीम, यवतमाळ, अमरावती, वर्धा या पाच जिल्ह्यांतील गावनिहाय कुरण क्षेत्रांची (Fodder Reserves) यादी मिळवणे.

२. जिल्हानिहाय महत्वाच्या पाच कुरण क्षेत्रांना भेटी देऊन तिथली जीपीएस लोकेशन्स घेणे.

३. स्थानिक लोकसमुदायाशी चर्चा करून कुरण क्षेत्रांचा इतिहास, सद्यस्थितीतील वापर, पशुधन, इ. बाबत माहिती मिळवणे.

४. वडाळा येथील कुरण क्षेत्र व्यवस्थापनाचे प्रारूप अन्य ठिकाणी राबविण्याबाबत शक्यता वर्तवणे.

प्रकल्पाचा कालावधी

दि. ११ मार्च २०२० ते दि. ३१ मार्च २०२०

प्रत्यक्ष झालेले काम

प्रकल्प करारामध्ये ठरवून दिल्याप्रमाणे दि. ११ मार्च २०२० रोजी प्रकल्पाच्या कामास सुरुवात झाली. दि. १९ मार्च २०२० पर्यंत यवतमाळ आणि वर्धा या दोन जिल्ह्यांमधील महत्त्वाच्या कुरण क्षेत्रांना भेटी देण्यात आल्या. जिल्हा कार्यालयातून कुरण क्षेत्रांची बीटनिहाय आणि तालुकानिहाय यादी मिळवली. प्रादेशिक वन अधिकाऱ्यांचे (Regional Forest Officer - RFO) संपर्क क्रमांक मिळवले आणि संबंधित प्रादेशिक कार्यालयांना भेटी देऊन त्या विभागात येणाऱ्या कुरण क्षेत्रांची यादी मिळवली. दोन्ही याद्या तपासल्यानंतर असे लक्षात येत आहे की, वनखात्याच्या वर्किंग प्लॅनमध्ये असलेली कुरण क्षेत्रांची यादी आणि प्रादेशिक कर्यालयांकडून प्राप्त झालेली यादी यामध्ये तफावत आहे. यवतमाळ जिल्हा कार्यालयातून मिळालेल्या यादीत दारव्हा या तालुक्यात १९५, २०४, २०५, ४३२, ... हे कंपार्टमेंट नंबर कुरण क्षेत्र म्हणून दिसत आहेत, जे दारव्हा प्रादेशिक कार्यालयातून मिळालेल्या यादीत नाहीत. जिल्हा कार्यालयातून मिळालेली कुरण क्षेत्रांची यादी खूप मोठी आहे. मात्र तालुक्याच्या प्रादेशिक कार्यालयांमध्ये उपलब्ध असलेली यादी वेगळी आहे.

यवतमाळ जिल्हा कार्यालयातून मिळालेली यादी दारव्हा प्रादेशिक वनकार्यालयातून मिळालेली यादी

भेट दिलेल्या कुरण क्षेत्रांची स्थाने व तपशील

क्र.	गावाचे नाव	तालुका	जिल्हा	कंपार्टमेंट नंबर	क्षेत्र (हेक्टर)	Latitude	Longitude
1.	खोपडी	दारव्हा	यवतमाळ	67	123.02	20:16:7.02681N	77:44:48.21567E
2.	खोपडी	दारव्हा	यवतमाळ	126	Not yet known	20:16:14.19123	77:43:27.50492E
3.	डोलारी	दारव्हा	यवतमाळ	127	152.10	20:15:48.21794N	77:43:24.06437E
4.	तेंडोळी	आर्णी	यवतमाळ	266	189.74	20:5:55.56102N	78:1:16.5221E
5.	बोरगाव	आर्वी	यवतमाळ	263	350.83	20:4:52.22657N	78:1:44.19738E
6.	दानापूर	आर्वी	वर्धा	170(B)	250	20:57:7.83879N	78:23:47.9058E
7.	दानापूर	आर्वी	वर्धा	170()	100	20:57:38.67524N	78:23:55.37086E
8.	सालदरा	आर्वी	वर्धा	166LR	76	20:51:48.21091N	78:24:23.20696E

स्थानिक लोकांशी चर्चा करताना निदर्शनास आलेल्या बाबी

१. गाई–म्हशींच्या गावरान जातींचे प्रमाण कमी होऊन संकरित गाई–म्हशींचे प्रमाण वाढले आहे. गावरान गाई–म्हशींच्या तुलनेत संकरित गुरांचे दूध उत्पादन जास्त. मात्र गावरान गाई–म्हशींच्या दुधाला बाजारात जास्त भाव आहे.

२. प्रत्येक गावातल्या जनावरांचे फिरण्याचे क्षेत्र साधारणपणे पाच ते सहा किलोमीटर आहे. पावसाळ्यात रानात व उन्हाळ्यात शेतात गुरे चरतात.

३. गुरांची संख्या कमी झाली आहे. पूर्वी प्रत्येक गावात पाच ते सहा हजार, काही गावांमध्ये दहा हजार इतक्या संख्येने गुरं असायची. आता ही संख्या जेमतेम हजार–दीड हजारवर आली आहे. चाऱ्याची कमी उपलब्धता हे कारण.

४. चाऱ्याची उपलब्धता पूर्वीच्या तुलनेत कमी झाली आहे हा सर्व गावांमधला मुख्य प्रश्न. त्याची लोकांनी सांगितलेली कारणे पुढीलप्रमाणे:

- पावसाचे प्रमाण कमी झाले.
- वृक्षलागवडीसाठी, रोपवाटिकेसाठी वा संशोधनासाठी चराऊ कुरणांचा वापर
- तरोटा, गाजरगवत, कामूणा अशा आक्रमक वनस्पती वाढल्यामुळे स्थानिक चाऱ्याची उपलब्धता कमी.
- शेतात तणनाशकाचा वाढता वापर
- शेतीमध्ये जमीन पडीक ठेवण्याची परंपरा बंद झाल्यामुळे चाऱ्याचे प्रमाण घटले.
- पूर्वी शेतावरील छोट्या छोट्या बांधांवर गवत उपलब्ध व्हायचे. ट्रॅक्टरच्या वापरामुळे हे बांध उध्वस्त झाले.
- जर्सी, गीर अशा संकरित वाणांच्या गुरांना देशी गुरांच्या तुलनेत जास्त चारा लागतो.
- जंगलात नीलगाईंची संख्या वाढल्यामुळे चारा कमी झाला.
- गवत पूर्ण वाढून त्याचे बी पडण्याअगोदर गुरांकडून खाल्ले गेल्यामुळे चाऱ्याची उगवणक्षमता कमी.

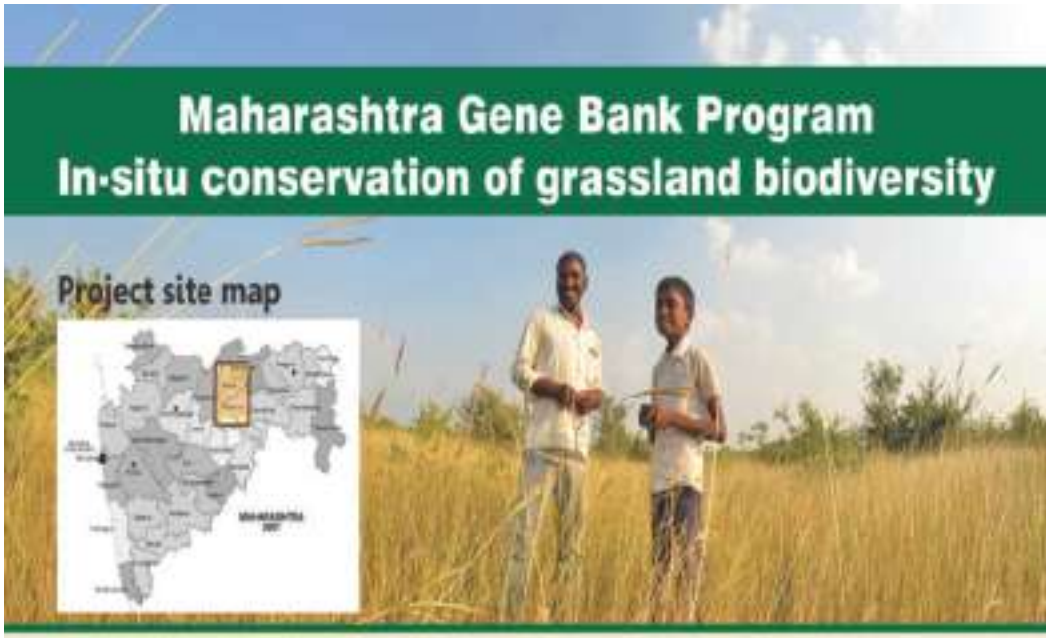
५. स्थानिक लोकांकडून कळलेल्या गवत प्रजातींची नावे: पवन्या, मारवेल, घोण्याड, मालकं–पुलकं, शाळा, पवन्या, गुंडेल, सुगरण, काळमोळ, कंबरमोडी, हेला, कुसळी, काट्याकुरुम, इ.

६. तेंडोळी, सालदरा येथील कुरण क्षेत्र म्हणून यादीत नमूद केलेल्या जागी भेट दिली असता तिथे गवताळ कुरणाच्या ऐवजी जंगल वाढल्याचे आढळून आले.

७. चराऊ क्षेत्राचे कुठलेली व्यवस्थापन स्थानिक लोकांकडून अथवा वनखात्याकडून केले गेल्याचे उदाहरण आढळले नाही.

Annexure 4

Maharashtra Gene Bank Program
In-situ conservation of grassland biodiversity



Objectives and developments

In situ conservation of grassland biodiversity with special reference to lesser florican (Sypheotides indica) and legumes of genus Alysicarpus, Kunda grass (Ischaemum pilosum) Pavnya grass (Sehima nervosum), Jondhali (Sorghum controversum) and other indigenous grass species.

In-situ conservation of grasslands is done on 600 hectors of land, forest department planning to cover 5000 hectors of land in 5 districts under savannah grassland

38 grass species documented and conserved on forest, common, privet lands

Data collection on fodder availability from conservation vs non conservation sites, agriculture, carrying capacity and livestock status is going on

Land use mapping done on 27 sites of lesser florican habitat

Livelihood strengthening of communities dependent on grassland / scrubland areas through eco restoration activities.

Year	Area Hectare	Grass production (kg) estimation	Production valuation rupees
2014	50	50,000.00	50,000.00
2015	110	1,10,000.00	110,000.00
2016	270	270,000.00	270,000.00
2017	430	430,000.00	430,000.00
2018	600	600,000.00	600,000.00
Total		**14,60,000.00**	**14,60,000.00**

Wadala is a first village where people purchased livestock by selling fodder

Plantation of 40,000 foliage plants improve the foliage availability in 10 villagers

Seed money support to CBO needs revisit and review

Capacity building of communities dependent on these ecosystems

Biodiversity management committees, self help groups, youth groups formed in each village as CBOs

Informal study groups formed to start open discussion

Training on MNREGA, FRA and livestock improve the understanding of the issue

Dr. Laxman satya's book on ecological history of the project area is translated in Marathi and published

Exposure visits to the community based conservation sites motivates individuals and help to initiate the same in project area

Documentation of traditional knowledge.

Advocacy efforts for creation of an inclusive grassland/scrubland policy

Biodiversity management committees established and documentation done through People's biodiversity register proposes is going on

MoEF prepared recovery plan for conservation of lesser florican in India. Samvedana's work is recognized, incorporated and suggested in State plan.

State level workshop on inclusive grassland policy is proposed in 2018-19

Advocacy efforts for grassland conservation on forest land in Maharashtra through National livestock mission is going on in collaboration with Revitalization of Rainfed Area Network Maharashtra

CEE Activities

10 schools around 2000 students participating in school level activities, workshops and exposure visits

Local and state level conservation issues and community perspectives are exposed to the students

Rajiv Gandhi Science and Technology Commission

IISER PUNE | SAMVEDANA

Annexure 5


Beginnings of transformation
Phasepardhis and the lesser florican
SAMVEDANA

Annexure 6

संवेदना समाज विकास संस्थाए -- संवर्धनासाठी निवडलेल्या गवताची यादी

अ.क्र	मराठी नाव	स्थानिक नाव	शास्त्रीय नाव	गुण वैशिष्टये
1	कुंदा	कुंदो	Ischaemum pilosum	दुर्मिळ पक्ष्यांना घरटे करण्यासाठी व लपण्यासाठी महत्वाच, सोबतच पारधी समाज पहिले शिकारी जात होता तेव्हा जंगलात पाण्याची तहान भागवण्यासाठी या गवताच्या मुळाच्या देठांचा रस पित होते
2	पवन्या	पोण्या	Sehima nervosum	गाई गुरहाच आवडत गवत, हे गवत गाईला खाऊ घातल्यावर दुधात वाढ होते. चागंल दुध देतात गाई.
3	मारवेल	मारवल	Dichanthium annulatum	चारासाठी उपयोग
4	सुरलाई	सुरली	Chrysopogon fulvus	चारासाठी उपयोग
5	जोंधळी	रोहिस	Sorghum	घरावर छपरी करण्यासाठी, तसेच पुर्वी या गवताच्या फुलांची दारु काढायचे.
6	तिखाडी	तिखाड्यु	Cymbopogon	चारासाठी उपयोग
7	बोंडी	भोंड	Andropogon pumilus	चारासाठी मोठ्या प्रमाणात उपयोग.
8	कुसळी	कुसल	Heteropogon contortus	चारासाठी उपयोग

Annexure 7

महाराष्ट्र शासन
GOVERNMENT OF MAHARASHTRA
पशुसंवर्धन आयुक्तालय, महाराष्ट्र राज्य,
COMMISSIONERATE OF ANIMAL HUSBANDRY
स्पायसर कॉलेज समोर, औंध, पुणे- ४११ ००७
Maharashtra State, Opp. Spicer Memorial College,
Aundh, Pune – 411 007

Fax No. 020 - [illegible]
E-mail – [illegible]

ISO : 9001 : 2015 Certified

Telephone No. [illegible]

जा.क्र. वैवि/अ-६(२०)/ २०८४-८५ /२०२०, पसं-१४, पुणे-६७, दि.२२/१०/२०२०

प्रति,

मा. प्रधान सचिव, (पदुम)
महाराष्ट्र शासन,
कृषि, पशुसंवर्धन, दुग्धव्यवसाय विकास
व मत्स्यव्यवसाय विभाग,
मंत्रालय, मुंबई-३२.

विषय:- राज्यातील गवताळ भाग आणि चारा धोरण यासाठी अभ्यास गट गठित करणेबाबत..

संदर्भ :- मा. मंत्री, पशुसंवर्धन व दुग्धव्यवसाय विकास, क्रीडा व युवक कल्याण यांच्या अध्यक्षतेखाली दि.९/१०/२०२० रोजी संपन्न झालेले ऑनलाईन चर्चा सत्र

महोदय,

उपरोक्त विषयाच्या व संदर्भिय चर्चा सत्राच्या अनुषंगाने सादर करण्यात येते की, संवेदना समाज विकास संस्था, कारंजा जिल्हा वाशिम व महाराष्ट्र कोरडवाहू शेती पुर्नजिवन कार्यक्रम, नागपूर (महाराष्ट्र आरआरएन नेटवर्क) या संस्थांनी आयोजित केलेल्या महाराष्ट्रा गवताळ भाग आणि चारा धोरण या विषयाच्या ऑनलाईन चर्चासत्रामध्ये चर्चेअंती समारोपाच्या वेळी मा. मंत्री महोदयांनी याबाबत अभ्यास गट स्थापनेचे निदेश दिले आहेत.

मा. मंत्री महोदयांनी दिलेल्या निदेशास अनुसरून, राज्यातील गवताळ भाग व चारा धोरण याबाबत शासनास अभ्यास करून अहवाल सादर करण्याच्या अनुषंगाने सदरचा प्रस्ताव सादर करण्यात येत आहे.

कृषि विभागाने संकेतस्थळावर प्रसिध्द केलेल्या जमिन उपयोगाच्या वर्गीकरणानुसार राज्यात १२.१९ लक्ष हेक्टर चराऊ कुरण अथवा गायरान क्षेत्र आहे. तसेच इंडीया स्टेट ऑफ फॉरेस्ट रिपोर्ट २०१९ च्या अहवालानुसार राज्यात २१४८४.६८ चौ. कि. मी. विरळ स्वरूपाचे वनक्षेत्र उपलब्ध आहे. सदर क्षेत्रामधील उत्पादकता अतिशय कमी प्रमाणात असून, या क्षेत्राचा विकास करून यामध्ये स्थानिक सुधारीत प्रजाती जसे मारवेल, पवना, डोंगरी, मोशी व जेथे बारमाही सिंचन सुविधा उपलब्ध होवू शकेल तेथे संकरित हत्ती गवत व शेवगा, शेवरी, हादगा, सुबाभुळ, दशरथ या सारख्या गवत वनस्पतींची लागवड करण्याची आवश्यकता आहे. यामुळे वन विभागातील तृणभक्षी प्राण्यांना चारा उपलब्ध होईल. त्याचबरोबर कोरडवाहू क्षेत्रातील

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पशुपालकांना त्यांच्या पशुधनासाठी वर्षभर हिरवा चारा उपलब्ध होईल. जेणेकरून त्यांना बारमाही स्वरूपाचे रोजगार उपलब्ध होवून, शाश्वत उत्पन्नाची निश्चिती होईल. तथापि, यासाठी सर्वंकष अभ्यास करून शासकीय धोरण निश्चित करण्याची गरज आहे. करिता, शासनास महाराष्ट्र राज्यातील गवताळ भाग व चारा धोरण याबाबतचा अभ्यास करण्यासाठी खालील प्रकारचा अभ्यास गट गठित करण्याची विनंती करण्यात येत आहे.

अ.क्र.	नांव	पदनाम व संस्था	
१	श्री प्रविण श्रीवास्तव	प्रधान मुख्य वनसंरक्षक (उत्पादन व व्यवस्थापन) वन विभाग, नागपूर	सदस्य
२	श्री माणिक गुट्टे	सहसचिव (पदुम), कृषि, पशुसंवर्धन, दुग्ध व्यवसाय विकास व मत्स्यव्यवसाय विभाग, मंत्रालय, मुंबई	सदस्य
३	डॉ. धनंजय परकाळे	अतिरिक्त आयुक्त पशुसंवर्धन, महाराष्ट्र राज्य, पुणे	सदस्य
४	डॉ. मंदार दातार	सायंटिस्ट डी, आघारकर संशोधन संस्था, पुणे	सदस्य
५	श्री. कौस्तुभ पांढरीपांडे	डायरेक्टर फाऊंडेशन फॉर इकॉलॉजिकल डेव्हलपमेंट	सदस्य
६	श्री सजल कुलकर्णी	समन्वयक महाराष्ट्र रिव्हयटलायझिंग रेनफेड एरिया नेटवर्क, सेंटर फॉर पिएल्स कलेक्टिव नागपूर	सदस्य
७	श्री गणेश देशपांडे	उपसंचालक (वैरण विकास) पशुसंवर्धन आयुक्तालय, पुणे	सदस्य सचिव

वरील नमूद अभ्यास गटात महसूल विभागाच्या प्रतिनिधीचा समावेश असणे आवश्यक आहे. तथापि या अभ्यास गटामध्ये महसूल विभागाच्या प्रतिनिधीचा समावेश शासनस्तरावरून करण्यात यावा अशी शासनास विनंती करण्यात येत आहे.

उपरोक्त प्रमाणे गठित करण्यात येत असलेल्या अभ्यास गटास आवश्यकतेनुसार या विषयातील कोणत्याही तज्ञ व्यक्तिस बैठक व चर्चेसाठी निमंत्रित करण्याची परवानगी असेल आणि सदरचा अभ्यासगट शासन निर्णय निर्गमित झाल्यापासून तीन महिन्याच्या कालावधीत शासनास अहवाल सादर करेल. करिता महाराष्ट्र गवताळ भाग व चारा धोरण याचा अभ्यास करून शासनास अहवाल सादर करण्यासाठी वरीलप्रमाणे अभ्यास गट गठित करून याबाबतचा शासन निर्णय निर्गमित करण्यात यावा ही विनंती.

22/10

(सचिन्द्र प्रताप सिंह भा.प्र.से.)
आयुक्त पशुसंवर्धन,
महाराष्ट्र राज्य, पुणे-१७

प्रत- माहितीस्तव सादर.

खाजगी सचिव, मा. मंत्री, पशुसंवर्धन व दुग्धव्यवसाय विकास, क्रीडा व युवक कल्याण, महाराष्ट्र शासन, मंत्रालय, मुंबई-३२.

महाराष्ट्र पर्यायी वनीकरण निधी व्यवस्थापन व नियोजन प्राधिकरण (महा - कॅम्पा)
वनभवन,रामगिरीरोड,सिव्हीललाईन,नागपूर४४०००१
ई-मेल:campams2010@gmail.com / apccfcampa@mahaforest.gov.in
Website: www.mahaforest.gov.in/campa
दूरध्वनी क्रमांक ०७१२-२५५६९२०

क्रमांक : कक्ष-कॅम्पा/प्र.क्र.४७/२०२०-२१/५००
नागपूर, दिनांक : ०२ फेब्रुवारी, २०२१

प्रति,
संवेदना समाज विकास संस्था
व फाऊंडेशन फॉर इकॉनॉमिक
अँड इकॉलॉजीकल डेव्हलपमेंट,
नागपूर

विषय : महाराष्ट्र वनविभागामार्फत गवत कुरण विकास कामाच्या अंमलबजावणीमुळे, गवताळ भागांचे संवर्धन, जैवविविधतेचे संवर्धन तसेच पशुधनाच्या चाऱ्याच्या सोयीबाबत.

संदर्भ : प्रधान मुख्य वनसंरक्षक (वनबल प्रमुख) महाराष्ट्र राज्य, नागपूर यांना उद्देशून लिहिलेले दिनांक ३०/१२/२०२० रोजी प्राप्त आपलेकडील पत्र.

संदर्भिय पत्रान्वये कळविल्यानुसार विषयांकित प्रकरणी महाराष्ट्र वनविभागामार्फत गवत कुरण विकास कामाच्या अंमलबजावणीमुळे, गवताळ भागांचे संवर्धन, जैवविविधतेचे संवर्धन तसेच पशुधनाच्या चाऱ्याची सोय निश्चितच होईल.

सदर कार्यक्रम राबविण्यासाठी लोकसहभागाची फोड आवश्यक असल्याचे मत आपण व्यक्त केलेले आहे. तसेच विषयांकित प्रकरणी राबवावयाच्या कार्यक्रमाची उद्दिष्टये खालीलप्रमाणे नमुद केलेली आहेत.

१. कार्यक्रम प्रस्तावित असलेल्या परिसरातील गावात लोकसहभाग मिळवणे.
२. स्थानिक लोकांचे ज्ञान गवताळ भागांच्या संवर्धन, संरक्षण आणि व्यवस्थापनाच्या बाबतीत वृध्दीगत करणे.
३. उपक्रमासाठी आवश्यक व्यवस्था म्हणून सहभागी व्यवस्थापन समित्यांची व जैवविविधता व्यवस्थापन समित्यांची क्षमतावृध्दी करणे.
४. गवताळ भाग संरक्षण व चारा व्यवस्थापन नियोजन आराखडे बनविणे व राबवून घेणे.

कुरण विकास कार्यक्रम वरिल उद्दिष्ट विचारात घेऊन निवड केलेल्या क्षेत्रात नजीकच्या गांवांसोबत राबविण्यात येईल असे मत प्रदर्शीत केलेले आहे. सदर उपक्रम स्तुत्य आहे. त्यावर या प्राधिकरणाची औपचारीक सहमती असून पत्रात नमुद केल्याप्रमाणे तयार केलेल्या व्यवस्थापन नियोजन आराखडयांच्या प्रती या प्राधिकरणास सादर कराव्े.

(एम. जी. डेंगडी)
विभागीय वन अधिकारी
(महा कॅम्पा)

Village name	Taluka	District	Village code	Total Geographical Area (in Hectares)	Total Households	Total Population of Village	Total Male Population of Village	Total Female Population of Village	Total Scheduled Castes Population of Village	Total Scheduled Castes Male Population of Village	Total Scheduled Castes Female Population of Village	Total Scheduled Tribes Population of Village	Total Scheduled Tribes Male Population of Village	Total Scheduled Tribes Female Population of Village	Forest Area (in Hectares)	Area under Non-Agricultural Uses (in Hectares)	Barren & Un-cultivable Land Area (in Hectares)	Permanent Pastures and Other Grazing Land Area (in Hectares)	Land Under Miscellaneous Tree Crops etc. Area (in Hectares)	Culturable Waste Land Area (in Hectares)	Fallows Land other than Current Fallows Area (in Hectares)	Current Fallows Area (in Hectares)	Net Area Sown (in Hectares)	Total Unirrigated Land Area (in Hectares)	Area Irrigated by Source (in Hectares)
Wadala	Barshitakli	Akola	530492	416	60	250	133	117	0	0	0	250	133	117	122	0	12.18	1.52	0	6	0	0	274.3	2	272.3
Mahagon	Barshitakli	Akola	530495	488	224	977	508	469	436	227	209	0	0	0	0	13.59	10.22	7.26	0	6.28	0	0	450.65	40	410.65
Pimpalgaon	Barshitakli	Akola	530578	895	350	1580	863	717	403	229	174	2	1	1	244.36	4.15	24.72	0	0	0	0	0	621.77	162	459.77
Parabhavani	Barshitakli	Akola	530571	1004.87	213	852	438	414	209	107	102	62	24	38	341.17	4.51	13.79	12.71	0	29	0	0	603.69	89	514.69
Chichkhed	Barshitakli	Akola	530521	398.52	66	266	145	121	80	48	32	2	1	1	94.41	5.28	8.53	5.54	0	0	0	0	284.76	40	244.76
Kanshiwani	Barshitakli	Akola	530096	917.98	1024	4532	2314	2218	886	444	442	248	134	114	0	5.4	17.05	16.2	6.1	0	25.47	9.76	838	17.5	820.5
Masa	Akola	Akola	530120	588	153	690	358	332	95	50	45	43	22	21	0	0	0	50	0	0	0	38	500	200	300
Dongargaon	Akola	Akola	530116	273	456	1960	1001	959	835	436	399	50	26	24	0	33	0	20	0	0	0	9	211	61	150
Wizora	Barshitakli	Akola	530466	703	429	1943	991	952	818	410	408	20	11	9	50	24	24	24	43	22	10	0	506	19	487
Yelwan	Akola	Akola	530124	1932.22	206	885	449	436	316	157	159	187	99	88	459.32	0.02	5.94	24.09	0	15.1	22.59	0	1405.16	180	1225.16
				7616.59	3181	**13935**	7200	6735	**4078**	2108	1970	**864**	451	413	**1311.26**	89.95	116.43	**161.32**	49.1	78.38	58.06	56.76	**5695.33**	**810.5**	**4884.8**

Annexure 8

उपवनसंरक्षक, अकोला वन विभाग, अकोला यांचे कार्यालय

विषय-जिल्हास्तरीय जैविकविविधता व्यवस्थापन समिती स्थापन करणे
क्रमांक:-कक्ष-३/योजना/ १०३६/२०१३-१४
अकोला, दिनांक २८/५/१४

संदर्भ :- १) म.शा. नि. क्र. Wlp/२००९/प्र. क्र. १५एफ-१ महसूल व वनविभाग, मंत्रालय, मुंबई ४०००३२ दि. २१/३/२००९
२) मुवसं (प्रा.) पत्र क्रमांक-५/योजना/१४२२/२०१३-१४/यवतमाळ दिनांक २५/६/२०१३
३) जिल्हाधिकारी, अकोला यांनी दि. २२/५/२०१४ रोजीची मान्य केलेली टिपणी

प्रति,

१) मा. श्री. अरुण शिंदे, जिल्हाधिकारी, अकोला	अध्यक्ष (पदसिध्द)
२). मुख्य कार्यपालन अधिकारी जि.प. अकोला	सदस्य (पदसिध्द)
३) जिल्हा शल्य चिकित्सक, अकोला	सदस्य (पदसिध्द)
४) अध्यक्ष, कृषी व पशुसंवर्धन समिती, जिल्हा परिषद अकोला	सदस्य (पदसिध्द)
५) जैविक विविधता स्थानिक जिल्हा स्तरावर कार्य करणाऱ्या स्वयंसेवी संस्थेचा प्रतिनिधी (श्री. कौस्तुभ पांढरीपांडे)	सदस्य
६) सुक्ष्मजीव शास्त्रज्ञ (स्थानिक जिल्हा स्तरावर) (डॉ. राजा.शिवाजी महाविद्यालय)	सदस्य
७) जिल्हा आयुर्वेद परिषदेचा प्रतिनिधी (श्री. विजय माळोकार)	सदस्य
८) जिल्हा केमिस्ट व ड्रगिस्ट असोसिएशनचा प्रतिनिधी (श्री. उमेश कोठारी.)	सदस्य
९) स्थानिक पक्षीतज्ञ (श्री. दिपक जोशी.)	सदस्य
१०) जिल्हा ड्रु एडव्हायजरी बोर्ड प्रतिनिधी	सदस्य
११) उपवनसंरक्षक वन्यजीव विभाग, अकोला	सदस्य
१२) सहाय्यक आयुक्त, मत्स्य व्यवसाय अधिकारी, अकोला	सदस्य (पदसिध्द)
१३) जिल्हा जलसंपदा विभागाचा प्रतिनिधी	सदस्य (पदसिध्द)
१४) उपसंचालक सामाजिक वनीकरण विभाग, अकोला	सदस्य (पदसिध्द)
१५) जिल्हा अधिक्षक कृषी अधिकारी, अकोला	सदस्य (पदसिध्द)

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महोदय/महोदया

विषयांकित प्रकरणी उपरोक्त संदर्भांचे अनुषंगाने आपली जिल्हास्तरीय जैविक विविधता समितीत सदस्य म्हणुन नेमणुक करण्यात येत आहे. जैविकविविधता समितीची शासन निर्णय या सोबत सहपत्रित केलेला आहे. तरी दि. ०५/६/२०१४ रोजी दुपारी ०४.०० वाजता जिल्हाधिकारी अकोला यांच्या सभागृहात आयोजित समितीच्या सभेस उपस्थित रहावे हि विनंती.

सहपत्र:- शासन निर्णय

उपवनसंरक्षक
तथा सदस्य सचिव
जैविक विविधता समिती, अकोला

Report

5.2

Conservation of Grassland and Savanna Biodiversity

Vasudha, Dhule

Background

Grasslands/Scrublands are the most neglected issues in the history of biodiversity conservation in India. "Grasses are considered to be the most evolved species of plants. They are remarkable as they have short life cycle yet a long life, i.e. take a short time from germination to reach maturity. Unlike trees, when cut, grasses sprout back almost instantaneously. They are capable of supporting or converting into incredibly huge amount of biomass. They also support a rich and diverse variety of fauna. They are efficient in absorbing rainwater and play a vital role in water retention and hydrology of an area." (Report of the task force on grasslands and deserts-Planning Commission, Govt. of India (11th 5 year plan 2007-2012) http://planning commission.nic.in/ aboutus/committee/wrkgrp11/ tf11_grass.pdf

On the side of biodiversity, grassland / scrubland habitats support many endangered mammals species like Chinkara (*Gazella bennetti*), Black Buck (*Antilope cervicapra*) and many other species of birds, reptiles, etc. Grasslands harbor many indigenous grass species like Kunda grass (*Ischaemum pilosum*), Marvel (*Dichanthium annulatum*.), Jondhali grass (*Sorghum halepense*) Pavnya grass (*Sehima nervosum*), in addition to large number of legume species. "Poaching of tigers and threats of de-notification of legally protected wildlife habitats have dominated the media so much recently that slow disappearance of other endangered wild animals has been overlooked. Not many know that the Great Indian Bustard, and the Lesser Florican endemic to the Indian subcontinent, are now on the brink of extinction from almost 90% of its former range. Hunting and habitat destruction resulted in near extinction of these magnificent birds of Indian grasslands."

On the other hand, many communities, especially nomadic tribes, which are traditionally dependent on these areas, are also in trouble. Traditional hunting communities like 'Phasepardhi' are trying hard to find new economic niche in livelihood canvas as hunting has been banned by Wild Life Protection Act, 1972. Pastorals like 'Dhangar' are struggling for the pasture every day because the grasslands/scrublands are narrowed due to land reform policies. Traditional communities like Gawali, which used to gain livelihood by animal husbandry are experiencing a decline in fodder availability.

Above described situation demands urgent intervention for the conservation of grassland / scrubland biodiversity and capacity building of dependent communities. Such intervention will help to create a viable and replicable model of conservation for sustainable utilization of grassland/scrubland biodiversity in Maharashtra.

Journey with MGBP

a. Geographical location: Dhule district.

b. Names of villages benefitted: Eight villages in Dhule district – Lamkani, Laling, Arvi, Anakwadi, Sonewadi, Sadgoan, Morshewadi, Junner.

c. Community profile: Mainly Gavalis. adivasi, Loni Patil, Hatkr Patil, and Dhangars. But other communities like, sutar, lohar, mali, wani, muslim, bhoi, koli, mahar, chambhar, pardhi, etc. are also involved.

d. Participants / beneficiaries: Villagers mainly of Gavalis, Hatkar Patils, adivasi communities in Laling area while Loni Patil, Dhangars, Mali, Wani, etc. in Lamkani village who are farmers and doing dairy business as support to agriculture.

Table 1. Community profile with village-wise list of participant/ beneficiary families

No.	Communities	Laling	Junner	Sadgaon	Morshe-wadi	Aarvi	Anakwadi	Sonewadi	Lamkani	Total
1.	Gavali	55	35	40	35	30	15	45	-	255
2.	Adivasi	60	40	60	35	65	45	55	60	420
3.	Loni patil	-	-	-	-	-	-	-	110	110
4.	Hatkr patil	22	30	62	30	35	20	15	00	214

No.	Communities	Laling	Junner	Sadgaon	Morshe-wadi	Aarvi	Anakwadi	Sonewadi	Lamkani	Total
5.	Dhangars	-	-	18	-	05	-	-	40	63
6.	Pardhi	-	-	35	-	20	-	-	05	60
7.	Koli	-	-	12	-	25	-	-	15	52
8.	Wani	12	-	-	-	22	-	-	35	69
9.	Bhoi	-	-	-	-	8	-	-	18	26
10.	Chambhar	-	2	4	-	4	-	-	15	25
11.	Mahar	05	10	05	-	08	08	-	25	61
12.	Muslim	06	-	-	-	05	-	-	20	31
13.	Mali	-	-	10	-	18	-	-	30	58
14.	Lohar	-	-	-	-	14	-	-	18	32
15.	Sutar	-	2	5	5	10	-	3	10	35
16.	Rajput	05	8	-	06	-	-	-	15	34
17.	Nhavi	4	3	8	-	15	4	-	18	52
18.	Vanjara	-	-	-	20	10	-	-	00	30
19.	Mang	-	-	-	-	03	-	-	02	05
	Total									1,632

Key issues addressed

i) Restoration of grassland with active participation of villagers and involvement of forest department as area of target is forest land.

ii) Improvement of grassland with main focus on local grasses which are highly nutritive, like pavanya (*Sehima nervosum*), Dongari (*Crysopogon fulvus*), Marvel (*Dicanthium* sp.), etc. These grasses were in abundance few decades ago, but now became rare due to various reasons like uncontrolled grazing, encroachment, ecotourism, establishment of industry, etc.

iii) Improving dairy business by introducing various sustainable practices like asking peoples to use stall feeding instead of free grazing.

iv) Improving fodder quality and long time availability by various techniques like use of silage- 'moor ghass', establishment of fodder bank, (which was functioning few decades ago in Laling area, managed by forest department; old structures like godowns, weighing bridge, staff quarters are still existing in fenced area of near about 10 hectares.

v) Use of artificial insemination techniques to improve breed.

vi) Advising farmers to plant fodder trees like anjan tree (*Hardwikia*), subabhul (*Leucaena leucocephala*) etc on their farmland bunds.

Objectives

- *In-situ* conservation of grassland biodiversity with participation of local communities engaged in animal husbandry-(dairy) and farmers in eight villages of Dhule district.
- *In-situ* conservation of grassland biodiversity with special reference to grasses like pavanya (*Sehima nervosum)*, dongari (*Crysopogon fulvus*), marvel *(Dicanthium sp.)* etc.
- Capacity building of communities engaged in animal husbandry in Dhule district.
- Documentation of traditional knowledge through Peoples Biodiversity Register.

Objectives fulfilled

- In situ conservation of grassland is successful in Lamkani village and partly in Laling grassland area.
- Capacity building of communities in conservation of grassland and improvement in dairy business is also partially fulfilled but efforts initiated in MGBP will be continued in future through formation and strengthening of joint forest management committees, biodiversity management committees and regular meetings of villagers with forest department officials etc.
- Preparation of Peoples Biodiversity Registers are in progress with the help of Maharashtra bio-diversity board. This was started 3 years back. Data collection is going on; difficulties are being faced in putting it in formats provided by MSBB.

Sampling methods

1) Linear transects method

2) Quadrate method.

Major work done under MGBP

(A) In situ conservation of grassland in 1000 hectares (Lamkani 500 ha. + Laling 500 ha.)

This activity was proposed in all eight villages, but due to many adverse conditions like lack of peoples' participation, conflict between communities, continous drought situations, corruption in govt. agencies etc., it was successful in only two areas. In Lamkani village, the movement of controlled grazing was initiated by Dr. Newadkar way back in 2002 and so it was easy to continue it. In Laling, due to good control over grazing by forest department, it is successful.

Conserved grassland areas in Lamkani

B) Identification of grasses and their abundance in different areas

Identification of various local grasses was done with the help of experts and villagers. Their abundance was recorded in successfully conserved areas by using linear transect and quadrate method.

Table 2. Names of Grasses found in this area

S.No.	Local name of the grass	English Name	Scientific Name
1	पवन्या गवत (शाडी) (छोटा)	Rat Tail Grass	*Sehima nervosum*
2	पवन्या (शाडी) गवत (मोठा)		*Sehima sulcata*
3	भाताड्या गवत		*Themeda sp.*
4	डोंगरी गवत		*Chrysopogon fulvus*
5	फुलारे गवत		*Apluda mutica*
6	काळी (मुगार) कुसळ		*Heteropogon polystachyos*
7	पांढरी कुसळ (ढवळी कुसळ)		*Aristida funiculate / sp.*
8	छत्री गवत / गोंडे गवत	Feather Finger Grass	*Chloris virgata*
9	चिमणी गवत (चिडी गवत)		*Sporobolus sp.*
10	बनगी गवत		*Melanocenchris jacquemontii*
11	पाल गवत		*Arthraxon lanceolatus*
12	लाल तांबड गोटा (करड)		*Andropogon pumilus*
13	कसार गवत		*Dichanthium sp.*
14	अंजन गवत	African foxtail grass	*Cenchrus ciliaris*
15	कैलभुरी	Three awns Wiregrass	*Aristida spp.*
16	हजार दाणी	Narrow leaf Indigo	*Indigofera linifolia*
18	शिक्का गवत		*Digitaria species*
19	मारवेल		*Dichanthium caricosum*
20	भगर गवत	Jungle rice/Deccan grass/awnless barnyard grass	*Echinochloa colona*
21	हरणे गवत / भुरभूशी		*Eragrostis sp.*

S.No.	Local name of the grass	English Name	Scientific Name
22	हेमाटा गवत		*Stylosanthes hamata*
23	घाणारे गवत		*Iseilema prostratum*
24	सुगंधी गवत		*Lavendulla bipinnala*
25	बफाऱ्या गवत (दिनानाथ)		*Pennisetum pedicellatum*

Table 3. Trees and shrubs found in Laling and Lamkani

S.No.	Local Name	Scientific Name
1	हेंकळ	*Moytenus emarginata*
2	गुळवेल	*Tinospora cordifolia*
3	रोडगे	*Grewia vilosa*
4	चंदर जोत (चंद्र)	*Jatropha gossypiflia*
5	आमोनी	*Rhus mysurensis*
6	दुधकुडी / कडूदोडी	*Writia tinctoria*
7	कन्सार	*Albizia lebbeck*
8	तरोटा	*Cassia tora*
9	घावटी	*Tridex procumbens*
10	भूईरंगणी	*Solanum surrentens*
11	बोर	*Ziziphus glabrata*
12	शेवगा	*Moringa oleifera*
13	सायफळ	*Boswellia serrata*
14	वसानवेल	*Cocculus hirsutum*
15	निंब	*Azadiracta indica*
16	फांग वेल	*Rivea hypocrateriformis*
17	गली	*Catunaregam spinosa (Xeromphis spinosa)*
18	नेहमीची साबर	*Euphorbia nerifolia*
19	चिकनी साबर	*Euphorbia hivulia*
20	बाभूळ	*Acacia nilotica*
21	वेडा बाभूळ	*Prosopis cineqria*
22	चिंच	*Tamarindus indica*
23	शिसम	*Syzygium*
24	मालतोड / कडीदोडी	*Wattakaka volubilis*
25	खैर	*Acacia catechu*
26	अंजन	*Hardwickia binata*
27	आपटा	*Bauhuinia racemosa*
28	पांढऱ्या फुलांचा बांडगूळ	*Loranthus falcatus*
29	मोकळ	*Lannea coromandolica*
30	धावडा	*Anogeissus latifolia*
31	रुचकीन	*Calatropis procera*
32	धोतरा	*Datura innoxia*

S.No.	Local Name	Scientific Name
33	नाली	*Ipomoea aquatia*
34	रानभेंडी	*Thespesia lampas*
35	लवाळीचा प्रकार	*Cyperus Sp.*
36	माका	*Eclipta alba*
37	निरगुडी	*Vitex negundo*
38	पळस	*Butea monosperma*
39	काचकूयरी	*Melcuna pruriens*
40	कुंद्रू / किल्लू	*Digenia muricata*
41	रानतुळस	*Ocimum americanum*
42	वासमारे	*Hyptis suaveolens*
43	हिवर	*Acacia leucophloea*
44	बेशरम	*Ipomoea carnea*
45	करंज	*Pongamia pinnata*
46	सागरगोटा	*Caesalpinia bonduc*
47	शेवरी	*Sesbania sesban*
48	गुलमोहर	*Delonix regia*
49	कोरफड	*Aloe vera*
50	सिताफळ	*Annona squamosa*
51	रामफळ	*Annona reticulata*
52	धोत्रा	*Datura metel*
53	कडीपत्ता	*Murraya koenigii*
54	एरंड	*Ricinus communis*
55	लिंबू	*Citrus lemon*
56	रुई	*Calotropis gigantea*
57	आंबा	*Mangifera indica*
58	विलायती / इंग्रजी चिंच	*Pithecellobium dulce*
59	अग्निवेल	*Dalechampis indica*
60	शतावरी	*Asparagus racemosus*
61	बेल	*Aegle marmelos*
62	जांभूळ	*Syzygium cumini*
63	उंबर	*Ficus racemosa*
64	अडुळसा	*Adhatoda vasaka*

C) Water and soil conservation works done through various govt. schemes, e.g. NREGA, JALYUKT ABHIYAN, SATYMEV JAYTE WATER CUP competition, IWMP etc.

In Lamkani village, repairing of old earthen nala bunds, four new cement bunds, desiltation of old cement bunds, etc. was done under Jalyukt shivar abhiyaan.

In Junner village, repairing of cement bunds, new earthen bunds, recharge shafts etc. was done under jalyukt shivar abhiyaan.

In Anakwadi and Morshewadi, watershed works done under IWMP.

D) Improvement in animal husbandry practices, e.g. fodder management, betterment in calf rearing practices, Health issues like proper vaccination, regular health camps with the help of animal husbandry department, availability of artificial insemination facility etc.

E) Formation of biodiversity committees and preparation of PBR in all eight villages is in progress.

F) Environment education activities with the help of CEE: In three high schools and 12 primary schools, students are involved through various activities like making school biodiversity maps, seed sowing, making grass herbarium, water testing, shivar pheris, tree plantations, preparation of biodiversity corners etc.

G) Comparative study to document difference in biodiversity with reference to reptiles, birds, insects, butterflies and in overgrazed grassland area and conserved grassland.

Database

Data has been submitted to the RDBMS database in the commonly decided formats.

This consists of the grassland data of (1) Sonewadi (2) Sadgaov (3) Morshewadi (4) Lamkani (5) Laling (6) Junner (7) Aarvi (8) Ankewadi.

For each of these data sets the following data has been generated (1) livestock (2) milk production (3) grazing (4) grass diversity and (5) Agricultural land of each farmer

Unintended outcome

We found one creeper in Lamkani village, called locally as “agin wel” or “agniwel”, common name-Indian Spurge creeper, Botanical name- *Dalechampia indica.* Dr. S.R. Yadav of Kolhapur University informed that that this creeper is found only in Dhule district of Maharashtra. (Link-- https://indiabiodiversity.org/species/show/266495)

Qualitative impact of the work

i) Improvement in quality of various nutritional local grasses.

ii) Improvement in animal husbandry practices.

iii) Improvement in water & soil conservation, thereby rise in irrigation. This is a gross observation, detail parameters are not available, but will be reflected in change in crop pattern in Lamkani village.

iv) In protected areas where free grazing is controlled, grasses like *Aristida* are replaced by *Sehima, Crysopogon, Apluda* and *Dicanthium* species.

Quantitative impact of the work

i) Improvement in quantity of nutritional grasses: It is observed grossly that near about 1.5 to 2 tons of fodder mass is available per hectare in well conserved grassland.

ii) Improvement in milk production: Detailed parameters will be reflected in data sheets

Community participation in MGBP process

- After repeated corner meetings, it was impressed upon the villagers that without people's active participation grassland conservation is impossible.
- In motivational programs, awareness was done by narrating the rich past history of the area –i.e. Dhule district was first in milk production during 1969 to 1972 in Maharashtra state. This was possible only because of well conserved grassland. Discussed the causes of recent condition and solutions to overcome these.

Community's role in designing or reshaping the work

Various activities are done with people's active participation and their experience was utilized in designing and implementation of work. e.g. formation of various committees like, J.F.M., Biodiversity management committees and their role in conservation practices.

After formation of these committees, rules and regulations to control grazing were decided. Regular follow up was done for effective implementation of water and soil conservation works which was implemented through various govt. schemes.

Management of common resources

Management of common resources is bad in most areas. Over-exploitation is common problem. Grasslands and forest lands are overexploited everywhere, with uncontrolled grazing and wood cutting resulting in degradation of biodiversity. In few places, oral rules for sustainable use are present e.g. in Lamkani village and some parts of Laling area grazing is controlled and grass cutting is done after November every year.

Social conflicts around conservation conflicts with neighboring villages

Social conflicts are present between communities and also between villages. e.g.-in Lamkani village few families which are owners of large groups of sheep are against controlled grazing and they have conflicts with other communities regarding grazing practices. With implementation of rules made by village committees and taking help of forest department whenever situation not controlled by local committees, there is improvement in the situation

In Laling grassland, seven villages are involved and they have conflicts regarding area demarcation for grazing, so lot of events of conflicts do occur every year.

Total land of Laling grassland is around 4500 hectares and is surrounded by seven villages. Although grazing demarcation of each village is present in records of forest department, in practice, it is not followed by villagers.

Also, there are conflicts between communities e.g., phasepardhis of Sadgoan and adivasis of Arvi villages are involved in illegal encroachment of grassland. So, other communities are against them, resulting in difficulties in grazing control activities.

These tribes are encroaching grassland area, they are illegally converting this land in to farmlands by using pitfalls in Forest Rights Act with the help of some political parties and some so called social workers helping them in this matter.

Conservation and weaving of social fabric

In Lamkani village changes in social fabric are happening. As a result of grassland conservation, changes are seen in the form of rise in ground water table, availability of fodder, and thereby rise in irrigation and dairy business etc.

With availability of employment in farming and dairy business, migration of youth to cities decreased substantially. With successful grassland conservation efforts, village Lamkani is getting its recognition all over Maharashtra, thereby improving confidence of villagers. They are now easily coming together for other social group activities. e.g. village successfully took part in Satya Mev Jayte water cup competition - 2018 and done remarkable work of water and soil conservation. VASUDHA Dhule, helped them in this activity by providing technical and other management expertise.

Local and global factors influencing conservation related behavior of communities

Local factors are more influencing in conservation behavior, e.g. depending on the severity of scarcity community tries to solve the problem, start thinking over the causes of scarcity, finds ways to overcome it, tries to follow successful stories, but requires some force to guide and inspire.

Traditional conservation practices, sustainable harvest practices: Regarding grassland, traditional conservation practices e.g. controlled grazing, rotational grazing etc. are not followed at all, except in few areas of Laling and Lamkani.

Controlled grazing practice is followed in Lamkani since 2001 and in few areas of Laling since 2015, with joint efforts of J.F.M. and forest department under guidance of VASUDHA and M.G.B.P.

Innovations and technology development by people

In Laling area people are using specially designed phavda (spade) to harvest grass like kusali (*Aristida*). This is made up of thin steel wires with hook shape at end, attached to long bamboo.

This is used in summer, when most of the tall grasses are harvested by cutting. *Aristida* which is of low height, less than 1 foot, is difficult to harvest by cutting and also time consuming. However, with help of specially designed spade it is easy and fast.

Beneficiaries and nature of benefits

Direct beneficiaries are farmers and workers in the form of fodder availability there by improvement in dairy business. Numbers of beneficiaries mentioned in Table 1.

It is observed that in Lamkani and Laling, in some parts where grazing is well controlled, average yield of fodder availability is around 1 to 1.5 tons / hectare. This is estimated by weighing head load and asking villagers numbers of head loads / hectare they can get.

Rise in irrigation facility due to improved water table, especially in Lamkani village. Farm workers are getting employment in village itself.

With the formation and strengthening of J.F.M., Biodiversity management committees and follow up by VASUDHA in the form of regular dialogues with community, forest, animal husbandry and agriculture

departments these activities will be made sustainable.

Lamakni village is declared as GRAMVAN last year by Forest Department, Proposal is submitted to Govt. to make this work more sustainable. Special provision is made for development of fodder bank and special information centre regarding grassland development.

Gramvan- The government has come out with Maharashtra Village Forest Rules 2014. They apply to part of such reserved forests (RF) or protected forests (PF) in the village as assigned under the Indian Forest Act (IFA) 1927. These rules will not be applicable to forests acquired under community forest rights (CFRs) and Forests Rights Act 2006. Government may assign RF (Reserved Forest) or PF (Protected Forest) to a village panchayat effectively managed by joint forest management committee and where effective participation of people has been witnessed in prevention of encroachment, fires, illicit grazing and tree felling, consequently ensuring positive rate of regeneration during last decade. Priority is given to notifying all the JFM areas as village forests where villages have received any prize under Sant Tukaram Gram Van Scheme." The samiti will prepare a ten-year micro plan and an 'annual implementation plan' each year for managing the forests and place the plan before the gram sabha for approval.

Relevance of history in conservation practices

In Laling grassland, long history of conservation in colonial and post-colonial period is recorded

- As per the version of senior citizens of the area, during British era 4700 hectares of Laling grassland was specially protected by fencing the whole area. Grass was harvested and sent to Devalali (Nasik) military camp for horse cavalry (घोडदळ).
- In late seventies, Laling grassland was handed over to Raymond woolen on lease basis for 30 years for their merino woolen project where they tried to do hybrid breed of merino and Indian sheep.

It is told by senior citizens that before Raymonds project, forest department was conserving grassland, and fodder bank was functioning. Later on, once area was handed over to Raymond, forest department system stopped functioning. Raymond was conserving it, but they did many changes, eg., they built many concrete structures, started farming, artificially introduced many other (non-native) varieties of grasses & fodder species etc. The project halted within a decade due to some local political issues and workers strike. But later on forest department managed system could not be revived and villagers started uncontrolled grazing, resulting in degradation of grassland biodiversity.

Species of fodder value, biomass growth and yield.

Species of fodder value predominantly seen are:

1) *Sehima nervosum* (Lamkani)
2) *Crysopogon fulvus* (Lamkani)
3) *Apluda mutica* (Laling/Lamkani)
4) *Heteropogon contortus* (Laling/ Lamkani)
5) *Themeda quadrivalis* (Laling)
6) *Aristida* (Laling).

Effects on water holding capacity, milk yield and other outcomes of grassland management

These all effects are seen in Lamkani village where along with watershed work grassland conservation work is successfully done with consistency.

- Due to increased water holding capacity irrigated land increased by nearly 500 hectares.
- Dairy business flourished due to availability of good quality fodder; now nearly 2000 ltr of milk/ day is sent to outside dairies, as against hardly 200 to 300 ltr/day before grassland conservation measures.
- Many indirect effects like rise in agriculture production due to increased pollination by honeybees and butterflies are noticed by farmers.
- Farmers noticed that minimizing use of insecticides resulted in rise in bird population

Economics of farming versus fodder

In degraded land, economics of farming versus fodder is calculated. Four farmers are practicing this since long time. It is observed that only conserving this land gives more income by selling local grasses. Detailed economics are documented in separate sheets.

Even in irrigated land fodder production and doing dairy business on it shows more income and improving land fertility due to availability of more compost.

20. List of Publications and presentations at conferences etc (published/ accepted/ in process)

Articles published in newspapers:

लोक सहाभागातून लालिंग कुरणाचा पुनरुज्जीवनाचा प्रयत्न – लोकमत 13-8-2017

लोक सहभाग आणी लालिंग कुरण – पुनयनगरी – 25-02-2020

Articles published in Magazines:

कुरण शेती – जलोत्सव 2018, रोटरी डिस्ट्रिक्ट 3131 – 20-03-2018

गवताल मालराण (कुरण) विकास-व्यवस्थापन – जल व मृद संधारनातील अक्षम्य दुर्लक्षित विषय – जल साहित्य सम्मेलन, धुले, 20-21, जन 2018

Participation in workshops:

Participated in Brainstorming Workshop on "supplementary reading and material on school water literacy", Yashada, 22-06-2018

Networking with other MGBP groups

- In thematic group we have good collaboration with SAMVEDANA. They helped us in documentation, data collection methods and preparation of PBR.
- Regional groups of BAIF helped us in animal husbandry practices by providing us good quality fodder seeds, like African tall, BAIF bajra, improved Napier etc. Trainings of four youths done at Uralikanchan for artificial insemination.
- We have supplied grass seeds of Pavanya (*Sehima nervosum*) and dongari (*Crysopogon fulvus*), and some plants of Anjan tree (*Hardwikia*), which is very good for fodder foliage, to BAIF.
- Also supplied grass seeds to JANARTH Sanstha, Nadurbar.

All these collaborations are meaningful and we will continue this in future.

Outreach

- Many people/NGO'S in Dhule district and other parts of the state are consulting us for guidance in grassland conservation practices and also asking for local grass seeds. We are trying to harvest grass seeds to propagate these local nutritious varieties.
- NGOs like Ecological society of India- Pune are regularly coming every year since last 4 years to teach grassland natural restoration and its biodiversity to their students.
- Agharkar Reaserch Institute's Dr. Mandar Datar and their students are also coming to help us and included Lamkani grassland area in to one of their study which is published in a book –"Advances in plant sciences and biotechnology"- chapter-Protected Grasslands of Maharashtra : Diversity, productivity, Threats and conservation.
- Trying to change grazing policy and implementation of grassland protection methods which are in place but forgotten by present administration (forest and revenue departments)

Knowledge Outcomes

a. Interesting / unknown/ unrealized facts which you came across during the work

Lot of weeds like *Parthenium hysterophorus* (congress/ gajar gavat), *Cassia tora* (tarota), *Ocimum americanum* (ran tulas) etc. are spreading fast in Laling grassland area due to human activities –(like overgrazing, constructions for ecotourism, cement nalah bunds, etc,) replacing natural grasses, and thus causing difficulties to restore the grassland ecosystem.

b.New facts noticed

Artificial methods to introduce native grasses in open lands like seed sowing / clumps plantation are not very successful, so it is better to restore it naturally by better conservation methods.

c. Realizations about human nature/ human- nature relationship.

It is realized that if human interventions are banned in nature, its restoration process starts and according to severity of degradation and efforts for restoration, its regeneration process takes place .

d. Observations about ecology- regeneration/ depletion/ conservation-

Grassland as a habitat and its ecological value has been neglected, while major focus was given on forest ecosystem and forest plantations. Even today, large per cent of rural and pastoral communities depend on grasslands for their livestock, while wild herbivores also feed on grasslands of protected area. Therefore, study of human dominated grasslands is necessity and their management at rural level should be given priority considering their economic and ecological significance.

Impact

a. on ecology

In Lamkani village due to long term efforts and with the help of MGBP, complete natural restoration of grassland is achieved.

b. on community

It is observed that due to Lamkani grassland restoration and its effects on water table and availability of fodder (especially during drought situation) communities in surrounding areas are realizing the importance of this neglected ecosystem. Many villagers and NGO's are now visiting Lamkani grassland area to see and understand the process.

c. on academic circle

- Regular visits of many schools and colleges to Lamkani started to see the importance of grassland ecology system in watershed development and animal husbandry (dairy).
- Ecological Society of India-Pune staff are coming every year for study and practicals .
- Nisarg Jagar Sanstha-Baramati (Dr. Mahesh Gaikwad)
- Pani Foundation-Mumbai-(Mr.Amir Khan/ Satyjit Bhatkal/Dr. Avinash Pol)
- Janarth Sanstha-Nandurbar.
- S.S.V.P.S. College, Dhule.

d. on policy level interventions

Through MGBP recommendations to change and implement grazing policy i.e. rotational grazing in community grassland and to complete ban on grazing in protected forest lands will be suggested.

Follow up measures for the same will be done by using laws like biodiversity act and community forest rights act.

Failure stories

1) In Laling grassland area conservation process couldn't succeed as good as in Lamkani.

The probable causes are:

A. Short period- (will get success if efforts are continued for longer period-10 years.)

B. Large area- to monitor-(4700 hectares) and seven villages surrounding, which have conflict over grazing practices.

2) Role of forest department- since long (i.e. after Raymond wollen's withdrawal in 1985), Laling grassland management collapsed completely. Conservation activities which were done prior to 1985 were completely forgotten by forest officials, number of staff deployed also reduced and it is said that fodder bank management like controlling grazing, harvesting of grasses, managing fodder bank etc. which was unique also completely stopped.

3) Now instead of focusing on conservation activities forest department is engaged in so called eco-tourism. There is no system to control tourist, also many activities like building pagodas, roads, rock garden, nakshtra van botanical garden, smruti van, building many cement bandharas etc. Every year lot of funds are utilized for these activities and staff is engaged in completing these works, not looking after conservation activities.

Way forward

- In both sites, i.e. Lamkani and Laling, efforts for *in-situ* conservation of grassland and improvement in animal husbandry practices especially dairy must be continued.
- Support structure- By continuing community awareness activities with help of various laws like biodiversity act, community forest act and joint forest management committees, NAREGA etc. With these efforts and taking support of various govt. schemes and if possible taking help of other NGO'& C.S.R. funds we can continue the work with the help of forest department.
- In Lamkani where conservation work is successful, way forward is better utilization of grassland by good management practices like silage preparation, cutting grasses at proper time, bailing it and improving storage facility. For that, fodder bank which was present in Laling could be established at Lamkani. Its management can be established with the capacity building of biodiversity committee.
- Grass seed plots can be conserved and seed bank facility can be provided, so that we can overcome scarcity of local grass seeds and local community will be benefitted and they will conserve grassland more efficiently.
- Planning to establish "*Grassland Information Centre"* at Lamkani to propagate its importance in rural development.

With the help of seed money provided under MGBP in year 2019-20, at Lamkani villagers were able to harvest grasses and baled them at proper time. Nearly 100 tons of grass bales were prepared and distributed to villagers in Lamkani. As grasses were harvested at proper time and baled with hydraulic baling machine, quality (nutritional value) of fodder is maintained and due to baling it was easier to store it in a smaller area as compared to conventional way of storage.

9) List of staff involved in the project with their posts and one liner introduction .

1) Dr. Dhananjay Vishnu Newadkar – Principle Investigator and treasures of VASUDHA (Vany Susthapan Dhara)

2) Mr. Vasatrao K. Thakre. (Giude and president of VASUDHA (Indira Priydarshani Vrukshamitra)

3) Dr. H.T. Rawte – Consultant, animal husbandry; Retired Dy. Commissioner animal husbandry, Govt. of Maharashtra.

4) Mr. Satish More – senior project assistant

5) Ms. Meena Deore – Paryavaran shikshan mitra

6) Mr. Vilas Sonvane – Junior project assistant

Honorary consultancy - local Botanist – Dr. P.B. Bhamre, Zoologist Dr. P.M. Vyavhare, and Dr. Pravin M. Ahale

Help from Dr. S .R. Yadav – Kolhapur University; Dr. Mandar Datar of Agharkar Research Institute, Pune; Dr. Muratkar of Achalpur College and Mr. Nikhil Bhopale – Founder Green Works Trust / Ex-programme officer, BNHS.


लोकसहभाग अन् लळींग कुरण

पर्यावरण

वर्धापन दिन विशेष

दीपस

ोकसहभागातून लळिंग ुरणाचा पुनरुज्जीवनाचा प्रयत्न

संस्थेचा पुढाकार

४७०० हेक्टर क्षेत्रावर गवताळ माळरानाचे मूळस्थानी नैसर्गिकरित्या पुनरुज्जीवन होणे अपेक्षित आहे

डॉ. धनंजय नेवाडकर

हिरवाईने नटले धुळे तालुक्यातील लळिंग कुरण...

विशेष

कार्यक्रमाचे आयोजन

Report

5.3

Conservation of Grassland and Savanna Biodiversity

Ugam Gramin Vikas Sanstha

Umra, Dist. Hingoli

Background

In 2007 Dr. Madhav Gadgil visited Hingoli for studying biodiversity. His focus was on the Kayadhu river's grass species, particulary *Dichanthium Sehima nervosum* and *Sorghum contraversum*. Dr. Gadgil emphasized the importance of these grasses to promote livelihood and conservation as well as these are endangered. Farmers of this area are aware of the importance of marvel grass (Dichanthium) and the preference of the animals.

Grassland ecosystem is open area of land where grasses are growing on rain and is a home for butterflies, insects, bees, snakes and microorganisms. Grassland is helping to balance climate and environment. Nowadays people are using chemicals to destroy grasses because they are considering them as weeds. Some grasses are very important as people have started livelihood based on them. Once upon a time the river was narrow and flow was for throughout the year, but nowadays the river has become wide and flowing only in rainy season. Hence, grassland ecosystem is important to promote livelihoods and it will help to reduce soil erosion

Grassland ecosystem is very helpful to people. Five years ago, people were depending on agro based production. But now they are aware of the importance of grasses hence 68 per cent farmers are engaged in milk production. Ugam has been working in 12 villages in conservation biodiversity and promotion of livelihood. 5 villages out of 12 villages have milk collection centres. People are engaged in grass based livelihood i.e. grass selling and milk production hence they got daily or weekly income.

Kayadhu river flows though the Hingoli district. Valuable and endangered species are found in the basin of the Kayadhu. In that marvel's three species (*Dichanthium pertusum, Dichanthium caricosum, Dichanthium annulatum*), Pavna (*Sehima nervosum*) and Jondhali (*Sorghum contraversum*) are important to conserve water and soil as well as are used to increase quality milk production. Before 1970, Kayadhu River was perennial but now it has become seasonal. One of the major reasons is destruction of grasslands in the river basin. Those grasses were helping to conserve soil and water. Kayadhu River basin has black soil. The soil is highly fertile. Hence, people were destroying grasses and using the land for agriculture.

The average rainfall of the Hingoli district is in the range of 400 mm to 750 mm, but there are no storage structures. Because of more use of ground water its level is decreasing consistently. Government has worked on watershed development but those structures have silted within a year. This is evident in the studies that were done at Nandapur and Sodegaon villages. Mati Nala Bandh (MNB structure), Cement Nala Bandh (CNB structure) are built before 3-4 years.

In the Takli village we used micro planning tool to know about history of the village. The tool lets us know about decadal facilities in villages. In that grassland belt we studied water sources, livestock, livelihood, forest, milk production, use of tractor in agriculture in 1950-60, 1960-70 till 2017. We observed that before 5 years, 40 per cent of agriculture work was done by tractor which otherwise depends on livestock. Hence people were selling their livestock and grass was burnt to prepare their land for cultivation. We have made the farmers aware of the importance of grassland, livestock and livelihood hence farmers have stopped this practice.

In Takli and Sodegaon village flow of river has been changed. In Hingoli 70 percent agriculture is rainfed. Migration takes place after the October month to April. Landless labour or agri-labour do not get work in the village hence 40 percent farmers were going for sugarcane cutting or construction work at Pune and Mumbai. Many contractors turn into moneylenders to labour and indirectly making them bonded labour. In the twelve villages, 317 hectare land is conserved for promoting livelihood activities. But 50 per cent farmers are belonging to rich families hence they aren't going for grass selling and milk production activities. This situation we can change by hiring local families to work in grassland belt to conserve it and sell. Some farmers have cattle hence they can focus on milk production as well as selling in market or dairy.

Journey with MGBP

Area of operation of the organization: Hingoli district

Key issues addressed

- Making farmers aware of grass biodiversity
- Farmers destroyed grassland belt for agriculture use. Conveying traditional knowledge of farmers to the young farmer generation.

Objectives

1. *In-situ* conservation of grassland biodiversity Jondhali grass, (*Sorghum contraversum*) Pavnya grass (*Sehima nervosum*) and other indigenous grass species.

2. Livelihood strengthening of communities dependent on grassland/ scrubland areas

3. Capacity building of farmers living besides Kayadhu river engaged in animal husbandry. All these farmers are dependent on grassland/scrubland areas for their livelihood

4. Preparation of Peoples Biodiversity Registers for the documentation of traditional knowledge of communities dependent on grassland/scrubland habitats

5. Advocacy efforts for creation of inclusive grassland/ scrubland policy

Objectives fulfilled

1. Conservation of grassland biodiversity

Ugam created awareness among farmers about the importance of grasses to save biodiversity and environment. We have sensitized people about biodiversity. In the first year (2014-15) 201 farmers were motivated to conserved land, in second year (2015-16) cumulative 430 farmers were motivated and third year (2016-17) cumulative 566 farmers were motivated to conserve grassland biodiversity.

In the grassland belt we have conserved 34 types of species (Annexure 1) on 317 hectares of agriculture land.

Activities taken

Micro planning: With people's participation we found grassland belts, available grasses, livestock, understanding of people about biodiversity, and bring out action plan with responsibilities.

Group Meeting**:** We formed farmers' groups and trained them how to conserve and which grasses to conserve. We shared benefits of conservation of biodiversity.

Exposure visit**:** We organized exposure visit to BAIF, Uralikanchan, Mahatma Phule Agriculture University, Rahuri, Ahmednagar, and Krishi Vigyan Kendra, Baramati. There we have plots of fodder, hydroponic units, livestock, horticulture units, grass plots, local varieties, hybrid varieties and gathered information about these.

Made plot in grassland: We have marked the plots belonging to each farmer and provided a unique code

Formation of Grass Protection Committee: The committee protects farmers who refuse destroying grassland belt. It will make the farmers aware about biodiversity and avoid fire to grass belt. The grass protection committee's representative has been coming to Ugam to solve problems regarding biodiversity and Ugam's representative visited all villages weekly.

Home Visit: We have visited families to know about their own ideas to develop grassland. In addition we gathered statistics about livestock, milk production etc.

2. Livelihood Promotion

Ugam has checked nutritional quality of grasses with the help of BAIF. Marvel, Pavana and Jondhali grasses are found to be very valuable for milk production and animal health. The report was shared with farmers and then farmers were motivated to milk production. In 2017- 18, 382 out of 566 farmers are engaged with milk production activities. 45 farmers are selling grasses and 137 farmers are using grass for their own purpose.

300 out of 382 farmers are selling milk at village level milk collection centre. 82 farmers are selling milk at block level in hotels.

Activities undertaken

a. Tested grasses at various stage: marvel, pavna and jondhali grasses are tested by BAIF

b. Meeting: at the village level we have organized various meeting about livelihood promotion. In Harwadi village, we held meeting of Dr. Kauthale and Dr. Nimbalkar about how to develop livelihood upon the grass biodiversity.

c. Capacity Building Workshop:

i. Mahatma Gandhi National Rural Employment Guarantee Scheme: Two farmers from each village were selected to provide training. These farmers go to village and shared information which they gathered in workshop.

ii. Workshop on Forest Right Act and Workshop on Biodiversity Act: Two workshops were held in three years. We selected two representatives from each village to attend these workshops and spread knowledge at village level.

iii. People Biodiversity Register: Workshop on Peoples Biodiversity Register was taken at Ugam and Mr. Shantaram Pandhere was a resource person. He explained how to write PBR. We have started to fill PBR of Harwadi village. In that we are recording whole village diversity with locality, local names and its importance.

Sampling Methods

We used sampling as below:

1. Fodder: Ugam staff visited grassland, noted the grasses and recorded the local name of the grass from senior villagers. At the village level we have appointed a village level animator. He is working on information gathering. For every species we have made herbarium and identified with the help of Dr. Yadav from Shivaji University.

In the 'fodder' sheet we filled information about the season, crop type, crop scientific name, crop Marathi name, vernacular name, part of crop used by the animal etc.

2. Agriculture sheet: We collected information from 566 farmers. At the organization level, we have two animators, each animator is working for six villages. They are filling information with help of village level animator. In this sheet we gather information about year, season, name of the family head, number of members, total land, fallow land (irrigated & rainfed). The total information is collected from the individual beneficiaries.

3. Crop pattern, fodder plot in agriculture, livestock and milk production sheet: The information is collected from 566 farmers. In this sheet, we gathered information about name of the family head, crop type, crop scientific name, crop Marathi name and vernacular name.

4. Grazing Sheet: in twelve villages we made twelve coordinates with the help of GPS location. There we are going monthly to measure and observe grass species. We take the farmers or shepherd with us for identifying the grasses as per the local knowledge.

5. Livestock: In this sheet all sections are filled from the respondents. The information is gathered 6 times in a year.

6. Milk production: In this sheet we collected information of every section from the total beneficiaries.

7. Grass diversity: We have found dense, sparse and medium grassland. We have measure grasses with help of weight machine as well by counting number of stumps, numbers of varieties, number of in-situ grasses and alliance grasses. This activity is done with farmers and local experts who know about grass species. We know about abundance and compare with the fresh weigh and dry weight. Herbarium sheets were made with the help of students and Ugam's staff. During the workshops organized at Ugam, the herbarium sheets were displayed and farmers were encouraged to right the name of the species as they know. This way it was possible to know the various vernacular names of the grass species.

Major work done under MGBP

1. Awareness: Due to the various activities done in the MGB project, farmers are aware about the grass biodiversity as well they know names of species and their local names.

2. Conserved Grassland: Farmers have conserved 317 hectares of grassland to generate livelihood. In 12 villages 566 farmers are direct beneficiaries of Ugam and we are working with those beneficiaries. Those farmers have 3548 livestock.

3. Participatory Guarantee System (PGS): Ugam has introduced PGS. In this system a farmer takes responsibility of two adjoining farmers. Thus, farmers are encouraging and motivating their neighbours about conservation and livelihood.

4. Increase in livestock: On the basis of awareness created by Ugam about grass biodiversity and its potential for livelihood, 429 farmers are engaged in grass selling and milk selling through grass conservation.

5. Milk collection Centre: Balasaheb Suryabhan Nilkanthe (Sodegaon), Dattrao Kalyankar (Kanjara), Dyneshwar Borkar (Nandapur), Gangadhar Balwantrao Shringare (Takalgavhan + Sawangi Bhu) and Baliram Savle (Vasai) have started milk collection centres as milk producers have increased. Total milk production is around 700 liters per day. Before 2014, only two milk collection centres were present in Nandapur and Takalgavhan collecting about 80 litres milk per day.

6. Herbarium: We have made harbarium of 31 grass species found at Samga, Durgdhamni, Wasai, Talki (TN), Khed, Hingani, Sodegaon, Sawangi (B) Harwadi, Kanjara, Pur and Nandapur villages. Harbarium with help of school children and MGBP staff. Those species are identified by Dr. Yadav.

7. Fodder Bank: People gather grass in bulk and store at farm or Home that's called fodder bank. Minimum 2000 bundle (1 bundle is 650 grams) are required for a fodder bank. Many farmers build bank away from the grassland belt. If conflagration took place then farmers will save their fodder bank. From an acre farm farmer will produce 4400 bundle of grass (we have measured by quadrate method). 350 fodder banks were set up by Ugam at 200 villages. People weren't aware about proper cutting of grasses and storage. Ugam has created awareness on these aspects and now all direct beneficiaries are conserving fodder as per suggestions.

8. Organic manure: Grassland belt has increased hence livestock also increased. Hence farmer are making organic manure from cow dung and using or selling to another farmer to increase fertility of farm.

Database

Data has been submitted for database generation.

Unintended outcome

We made farmers aware that grasses are helpful to conserve water and soil. Once upon a time the river was deep and narrow but because of floods soil erosion took place and river is becoming wide year by year.

Ugam has been started work in 12 villages and motivated 566 farmers to conserved grass. This has helped farmers go for milk production as livelihood and five milk centres have been started.

Mr. Sk. Ayub Sk. Kondan (Hingani Village) was motivated and he took decision to construct a loose boulder structure on his farm's tributaries to control water follow and soil erosion. Although this structure was constructed with layman's knowledge, it was technically sound. It helped in control of soil erosion and flow of water, as well as water table also increased.

In Nandapur village Suryabhan Deshmukh also constructed loose boulder structure to control water flow. According to him there has been a change in the location of river flow.

A study was conducted on comparative income from soyabean and marvel grass. 24 samples were selected from 12 villages. It was found that while soyabean crop will give income of Rs. 5500 per acre, grass in the same area gave an income of Rs. 9100.

Ugam has been working on basin of Kayadhu river, but the river flows for maximum six months. Considering the suggestion of villagers to rejuvenate Kayadhu river, Ugam has organized rally from the origin (Agarwadi, Tq, Risod Dist. Washim) of river to Sodegaon village. In this rally 100 participants participated, which included the villagers and government officials. This has helped in initiating Kayadu river agenda in the Government's agenda.

Another case study of Nanadpur showed that after the conservation of grasses the flow in the river increased. In the past the fishermen usually used to get 3 kg of fishes at the end of September. But in recent years the fishermen were catching 15kg at the end of the September. The number of fishes varies in different months. This would be a potential livelihood for the people living on the bank of the river if the river again becomes a perennial river.

Quantitative impact of the work

Before 2014-15, only 91 hectares of land was under grassland and less than 200 farmers from 7 villages were aware of various names of the grasses. And 50 farmers had potential of creating livelihood out of it. After implementation of the project 566 farmers have conserved 317 hectares of grassland during 205 to 2018.

The farmers are engaged through Participatory Guarantee System. The conservation work was undertaken through this. Besides, the groups attend capacity building program at Ugam regularly. 57 PG groups are formed in 11 villages.

Sr. No.	Name of the village	Number of PG groups
1	Durgdhamini	3
2	Vasai	4
3	Takali	4
4	Khed	4
5	Hingani	4
6	Pur	4
7	Nandapur	2
8	Kanjara	5
9	Sodegaon	7
10	Savangi	5
11	Hirwadi	3
	Total	57

After the implementation of the program, around 700 L of milk is collected every day. The improved grassland is major reason for this. Prior to 2014-15, milk collection centers were available at Nandapur and Taklagavan and 80 liters of milk was collected there daily. Now milk centers have been started at Sodegaon, Nandapur, Taklagavan, Kanjara and Vasai.

A loose bold structure is crested at Sodegaon, Hingani, Vasai and Nandapur. This structure helps in conserving soil and decreases the speed of the flowing water and allow percolation of water.

Before the project implementation started in villages, people were not aware of grasses. Only few elderly people were mentioning the names of grasses. Since then, realizing the need to cultivate grass, 99% of the people in the village know the names of the grasses. They have also become aware of the fact that milk production can be enhanced through grass.

438 farmers started using traditional seeds. Besides, the farmers were also trained about grading of seeds and to select good quality seed. Along with this the farmers were also demonstrated about various methods of processing seeds before sowing to enhance crop production.

Carrot grass (Parthenium) has been eradicated on 65 acres of land. Local biodiversity is threatened by carrot grass. Farmers were made aware of it, after pointing out to them that Marvel grass does not germinate where there is carrot grass.

The place where the river flows is fixed, but where there is a turn, the flow cannot take a quick turn due to the speed and the flow changes. However, due to the increase in the size of the village, the river water collides with the turn and if the amount of grass is high, the soil is not carried away and the flow is maintained. However, in summer all the grass is dried and if the flood comes soon, a large amount of soil is carried away at that time. And at such times the flow of the river may change. The direction of flow has been constant since 2016.

The grassland is reserved by all the farmers and is also controlled by PGS. Farmers have been positive about milk production. Since fodder is available for milk production, they are not encroaching the grass field for cultivation of crops.

A new trend is observed among the farmers. The farmers who are aware of the grassland and its importance lease the grasslands at Rs. 5000 to Rs. 10000 from other farmers. They get the production of the grass and sell it. Such farmers either sell it in the market or in the drought relief camps for cattle. This is a method that is currently gaining ground.

Forest fire is common during summer. But 60 per cent farmers were burning the garbage instead of picking it up. As a result, the grass in the field was also burning. But now this percentage has come down to about 3%.

100 farmers are setting up fodder banks. They are building it outside the grass land so that the grass does not get damaged by rain and fire.

The extraction of sand is dangerous to the biodiversity of the river and also causes change in the river flow. Besides, the illegal extraction is not able to give revenue to the Grampanchayat. Hence the villages Hingana and

Khed have banned sand extraction in the village.

A dove has been constructed at Sodegaon with the help of CSR (corporate social responsibility) for the purpose of soil and water conservation. This increased the water level and conserved the soil and also alleviated the water scarcity in the village.

Community participation in MGBP process

In the past, farmers were not aware of grass, they only knew the names of 4 or 5 grasses. When they were told that they could make a living from grass conservation, they doubted whether the livelihood would be sustainable. Kayadhu formed a group of farmers who have land on the banks of the river. If these groups go to the village level every month and cultivate grass, they can preserve the local diversity of the grasses. Therefore, farmers who have no livestock should be able to trade in milk and sell fodder.

The first initiative of Ugam Sanstha was to implement the village participatory micro-planning process. In this process, the problems related to biodiversity were studied with the help of the villagers. Among them were river bank breakage, increasing area under carrot grass and technical study of dairy business. Villagers had prepared an outline plan to remove it. It was also mentioned that some villagers should follow up. In the village participatory micro-planning process, all the villages were introduced to the Maharashtra Gene Bank Program.

Community's role in designing or reshaping the work

Farmers used to graze their cattle in the grass field before the intervention of the organization. They used to encroach the grass land after the month of September. After the intervention, the cattle have been eating good quality grass and the farmers have noticed that the low quality grass is increasing. The public participation method was used to ban grazing. In this, 56 groups were formed. One member of the group controls the other member to see if they have banned grazing. This has preserved high quality grass. Its proportion seems to be increasing.

Some of the species destroy the biodiversity of grassland. The farmers then uprooted the encroaching grass and plants along with the roots. As a result, these grass species became extinct. Four years ago, farmers were using herbicides to destroy grass. But now the herbicide has stopped completely.

According to the villagers, work should be done to revive the Kayadhu river along with the conservation program of grass belt along the Kayadhu River. The Kayadhu river flows only during the monsoons; when the rains stop, the flow of the river stops within a month.

Community management of common resources

We have conserved individual land. For that we have made participatory guarantee system to control on each other. The PGS group is controlling destroying of grassland. In Takli, Samga and Sawangi Bhu. villages we looked for common land to conserve grasses but in common land grasses can't grow fast. Most of village common land is encroaches by people and some villages have land but it is barren. In barren land grass can't grow.

In Hingani village there is common land which is registered in name of temple (Hariharnath Mandir). In this land marvel and pavna grasses have been growing every year. The grass tender is given in village and the money is used for renewal of temple.

Land in the field and grass cultivation is privately owned. Also, in order to prevent the destruction of this land and to protect the biodiversity, a Group Guarantee system has been formed. In this method, one farmer guarantees another farmer that they should reserve the field.This group consists of a promoter (main) and a co-promoter (assistant) and the rest of the members. 56 guarantee groups have been formed. Each of the two members of the groups are trained and the information they receive is passed on to other members. This approach has created unity among the farmers. This method allows the farmers to keep a watch on each other and not allow farmers to destroy the pastures.

Social conflicts around conservation

90% of the farmers on the banks of the river are rich. And farmers who are small farmers but have animals are stealing fodder. This theft rate is seen in the grassland on the side of the road. The early cutting of the grass hampers the seed formation and do not allow seeds to germinate there. The successive cutting of the grass can decrease the quality of the grasses. As a solution to this, farmers build barbed wire fences.

Influence of local and global factors on conservation related behaviour of communities

Conservation period: Traditional practice was farmers conserve after the August month as rain has stopped after this month.

Farmers conserve the grass land after August and stop

grassing till return of monsoon. The cutting of the grass starts from December.

In the past, farmers used to set up fodder banks in the grass land area, but there was risk of fire and rain. A grass bank has been created by Ugam Sanstha. This grassland area is on the banks of river Kayadhu. In this pasture, farmers graze their animals till the month of August. Grass harvest starts from December to March to prepare its fodder bank.

Innovations and technology development by people

Farmers did not develop any new technologies. However, they are extracting produce from the field using sprinkler irrigation. Also, a loose boulder structure has been constructed to prevent soil erosion. In Hingoli district bullocks are used for agricultural work but Raghunath Ghuge from Hingani has trained bluk buffalo and uses than instead of bullocks.

Village Name	Men	Women
Samga	119	119
Durgdhamni	31	31
Vasai	21	21
Takli	26	26
Khed	48	48
Hingani	46	46
Pur	42	42
Kanjara	43	43
Nandapur	27	27
Harwadi	27	27
Sodegaon	67	67
Sawangi	71	71
Total	**568**	**568**

What benefits they have received?

Livelihood (उपजीविका): Farmers who conserved grassland they got livelihood and farmers who had cattle started milk production.

Increased Livestock: The number of cattle increased due to increased grassland. Farmers are buying cattle with the money earned from selling of grass.

Soil Erosion checked: The soil erosion has reduced hence the water in the river stream have increased.

Measures to reassure that benefits to the community continue even after conclusion of MGBP

After the end of MGBP, we will form a committee at the local level to protect the local biodiversity. This committee will be made up of biodiversity experts. Also, all individuals will voluntarily take the initiative. This committee will reserve 317 hectares of cultivated land. Writing of Public Biodiversity Register (PBR) will continue after the completion of this program.

Relevance of history in conservation practices

Hingoli district is backward but if one looks back in history, it was a renowned district for biodiversity conservation. Hingoli district had a lot of grass, so Hingoli district was providing fodder to the whole of Maharashtra. It consisted mostly of Marvel, and Pavana grass. However, due to continuous drought in Hingoli district, the area under pasture has decreased. Besides, the farmers also destroyed grassing land for farming. Due to encroachment, some pastures were taken over by the people, so grass production in Hingoli district slowed down and today it has reached extinction stage. The situation at present is that the fodder is being procured from Yavatmal district or neighboring districts.

During the Nizam's time, when the Nizam's soldiers were coming to Hingoli from Hyderabad, they were stopping at the village of Isapur (Ramana) in Hingoli taluka because of cool climate. The village, Isapur (Ramana) is known for its rich forest cover and biodiversity.

A village Sayala is 12 km from Isapur in Hingoli taluka. The history of this village is that the place is known as Sayala due to the large number of Sayala animals. However, at present, the number of these animal has decreased. In some villages, Sayala are not even seen.

Species of fodder value, biomass growth and yield

मारवेल: (*Dichanthium annulatum*, *Dichanthium pertusum*, *Dichanthium caricosum*) These are marvelous grass species. This grass has been proven to be of high quality by the testing done by BAIF. In August 2016, Marvel, Pavana and Jondhali grass components were inspected at various levels on the banks of Kayadhu River. According to the report, the grass is of high quality. In a pilot study in Samga village, milk produced by buffalo fed with marvel grass showed greater viscosity. More systematic work is required to confirm the results. Marvel grass is measured by the square method. 600 grams of grass is produced in a square. This means that 2427 kg of grass is obtained in one acre.

Observations about ecology

At the time when the work was started by Ugam Sanstha, to reserve the pastures as well as to preserve the biodiversity in them seemed very difficult. However, when a comparative study of grass and crop was done, farmers were convinced that they can get

income from grass. Since then, farmers have been looking at the pastures in a positive light. Farmers can cultivate grass on a large scale but farmers are cultivating on a small scale as the place of sale is not certain. 317 hectares of pasture land has been protected by farmers. The three villages of Sodegaon, Vasai and Kanjara have a large amount of Jondhali grass. In Nandapur and Harwadi areas, the amount of wind grass is higher. Also in the villages of Sawangi Bhu, Samga, Takalgavhan, Pur and Kanjara, three types of Marvel grass can be seen growing very nicely. Gondali and Chhota Marvel are seen growing in 12 villages.

There are 35 types of grasses in the grassland area and maximum number of grasses can be eaten by the animals. Kusali is one grass which the cattle cannot eat it but the proportion of this grass is 5%. In 2016, some farmers destroyed carrot grass in some places. And in 2017, Tarota plant started growing. In 2017-18, Bhutganjya plant started growing. In the meantime, Phulgavat Reshamkata is a new plant that has also destroyed carrot grass.

New understandings/ philosophy/ realizations emerged

Earlier, most of the farmers were reserving their fields after the month of August. Before that, cattle were free to eat. Farmers say that if the river floods and the grass stays under water for a long time, then the grass is bad and then the grass does not grow vigorously. However, in this method, when cattle ate fodder, they ate high quality grass first so that no seed was formed. Also, the rate of recurrence is low. Ever since the issue came to the fore, farmers have been cutting fodder and giving it to cattle. As a result, local grasses have survived.

There is no cost of sowing, cultivating the land, seeds, harvesting of grass to get the yield of grass and those who want to buy it bring their own vehicles so there is no cost of transportation also. Therefore, if planted only once, the grass can last for 15 to 20 years. The same amount of income can be obtained from grass, as one obtains from agriculture, as was shown by the pilot study mentioned earlier. When there is drought, the crop does not germinate but the grass grows to some extent.

Impact

a) on ecology

Studies have shown that due to the breeding of 35 species of grasses, there has been an increase in the species of butterflies, insects, horses, beetles and sonkida. Species records have been studied linearly. This study has been done in collaboration with school children in Kuran area at Sodegaon and Harwadi. The first study was conducted in October 2016. The second study was conducted in August 2017.

b) on community

Along with grass conservation, farmers have planted plants which are helpful in soil and water conservation. This was replicated by the school children and each student planted a tree. Because of this, the concept of planting trees has been understood by all and at the same time, the awareness of trees should survive has been created among the people.

Way forward

Grassland will be conserved for more villages.

We want to replicate the model for another 10 to 15 villages.

Documentation of traditional knowledge

Work will be continued on grass species

Support structure

Micro watershed activities: Ugam has mobilized funds CSR to work on micro watershed development as well as government has run schemes in some villages to ensure grassland development.

List of staff involved in the project with their posts and one liner introduction

Mr. Jayaji Paikrao (PI)

Mr. Vikas Shrirang Kamble (Project Associate)

Mr. Dhananjay Bharat Padghan (Animator)

Mr. Ramrao Sakharam Khandare (Animator)

Ms. Pooja Jadhav (Animator)

Mr. Subhash Narayan Khandare (PSM)

Appendix- I (Species lists)

	गवतं – स्थानिक नाव	(वनस्पतीशास्त्रीय नाव)
1.	मारवेल	Dichanthium caricosum
2.	मारवेल	Dichanthium annulatum
3.	मारवेल	Dichanthium pertusum
4.	जोंधळी	Sorghum contraversum
5.	चिकटा	Setaria faberi
6.	गोंडाळी	Themeda triandra
7.	काळी कूसळी	Heteropogan contortus
8.	कोल्हा शेपूट	Setaria pumila
9.	लाल भरड	Moorochloae ruciforwu
10.	रेशमकाटा	Alternanther atenella
11.	खांडसुरया	Scleria laevis
12.	कसई	Coix gigantea
13.	डोंगरी	Chrysopogan fulvus
14.	पंधाड	Cynodon dactylon
15.	पवना	Sehima nervosum
16.	बोंडी	Apluda mutica
17.	पाल	
18.	बांबू	
19.	कुंदा	Ischaemus pilosum
20.	हराळी	
21.	स्टायलो	Stylosanthes fruticosa
22.	बुरसाळी	Rottbollia cochinchinensis
23.	दशरथ	Pennisitump edicellatum
24.	लीचडा	Commelina benghalensis
25.	केना	
26.	बिंडी	Setaria pumila
27.	फुलराणी	Eragrostis tenella
28.	कानडी	Arthraxonla ceolatus
29.	गोंडवेल	Chloris barbata
30.	लवंग	
31.	लव्हाळ	Cyperus rotundus
32.	बोट्या	Digitaria ciliaris
33.	दिवाळी	Tephrosia purpurea
34.	लहान शेवरा	Alysicarpus tetragonolobus
35.	रई लोना	

Seed Money Project

In-situ conservation of Pavanya (Sehima) to promote livelihood of Ghee production

Ugam implemented Ghee production from Pavanya grass project in 3 villages (Nandapur, Sodegaon, Harwadi) of the Kalamnuri block of Hingoli district. In these villages, Ugam has formed three producer groups who are engaging in dairy development. These farmers were strengthened through various trainings and local exposure visits. In this program 45 farmers have actively participated.

In the Hingoli district, Ugam has conserved grassland biodiversity with help of locals. Basin of the Kayadhu River has various grass species which are very important to promote livelihood. But people destroyed it and start farming there. Hence Ugam mobilized farmers and made them aware about biodiversity and livelihood based on grasses. The grassland belt has 35 grass species and 565 farmers are actively participation in the conservation practice.

Pavanya grass is very important fodder in the villages where Ugam is working. Ghee made out of the milk produced from cattle fed with Pavanya grass has unique smell. Before 40 years there was more availability of pavanya grass. But nowadays, pavanya grass is burnt by the people and the species become rare. That's why new generation doesn't know about the importance of the Pavanya grass. Since 2014, Ugam has been conserving grassland belt, in which Pavanya was also one of the grasses.

Outcomes

-Pavanya grass is very important to dairy development. Because, livestock gives more milk after intake of Pavana Grass.

- Older generation have expressed opinion that pavanya grass ghee is pure ghee and the ghee has more protein and good smell.

- Pavanya grass helps to increase pure ghee production.

- Pavanya grass is important for soil conservation as well as water conservation.

- Pavanya grass grows in medium types of land.

Impact

- People are engaging in the conservation of Pavanya grass. People have conserved 12 acres of land for Pavanya grass. 45 farmers have got sustainable livelihood of diary development as well as ghee production

Cyperus rotundus

Setaria Pumila

Dicanthium annulatum

Annexure 1

सोयाबीन पिकापेक्षा मारवेल गवतापासून मिळते जास्त उत्पन्न

विकास कांबळे

राजीव गांधी विज्ञान व तंत्रज्ञान मंडळ महाराष्ट्र व भारतीय विज्ञान व शिक्षण संशोधन केंद्र व उगम संस्था यांच्या मदतीने टाकळी, खेड, हिंगणी, सोडेगाव, हरवाडी, नांदापूर, पूर, कंजारा, दुर्गधामणी व वसई गावातील 20 शेतकऱ्याच्या मदतीने संशोधन करण्यात आले. त्यातून असा निष्कर्ष मिळाला कि सोयाबीन पिकापेक्षा जास्त उत्पन्न मारवेल गवतापासून मिळते.

सोयाबीन पिक घेण्यासाठी शेतीची मशागत करण्यासाठी 500 रु, वखरणी 500 रु, पेरणी 1200 रु, रासनी 300 रु, कोळपणी 600 रु, निंदनी 1000 रु, फवारणी 1500 रु, कापणी 2200 रु, मळणी 2500 रु, बियाणे 2500 रु, खत 2000 रु, वाहतूक खर्च 200 रु, हमाली 100 रु म्हणजेच एकूण खर्च 15100 होतो. जमीन जर चांगली असेल आणि पाणी जर चांगला पडला तर सोयाबीनचे 900 किलो उत्पादन मिळते. सरासरी भाव 2500 मिळतो म्हणजेच 22500 रुपयाचे उत्पादन होते परंतु खर्च वजा केल्यास 7400 निव्वळ उत्पन्न मिळते. यामध्ये व्यक्तीच्या मजुरीचा समावेश नाही.

कयाधू नदी काठच्या कुराणातील गवत वाढीसाठी वेगळे प्रयत्न करावे लागत नाहीत. हे गवत पूर्वी पासून पाऊस पडला कि आपोआप उगविते म्हणून नांगरणी, वखरणी, पेरणी, कोळपणी, फवारणी, खत, बियाणे खर्च लागत नाही. एकर क्षेत्राला काटेरी कुंपण तयार करण्यासाठी 400 रु. खर्च येतो, तसेच या क्षेत्रात नको असलेली किंवा काटेरी वनस्पती काढण्यासाठी म्हणजे खिसाई खर्च 200 रु. येतो. कापणी खर्च 2700 रु. येतो. म्हणजेच एकूण खर्च 3300 रुपये येतो. चौरस पद्धतीतून संशोधन केल्यास असे लक्षात आले कि, एक मिटरच्या चौरस मधून सरासरी 600 ग्राम गवत मिळते. तर एका एकर मध्ये 4046 मीटर चौरस होतात त्यातून मिळणारे गवत 2427600 ग्राम असते म्हणजेच 2427 किलो गवताचे उत्पादन मिळते. गवताची एक पेंढीचे वजन 600 ते 900 ग्राम असते. 900 ग्रामनुसार 2696 एवढ्या पेंढ्या तयार होतात. एका पेंढीची किंमत डिसेंबर महिन्यात 8 रुपये प्रमाणे 12568 रुपये होतात. मार्च,महिन्यात हिंगोली शहरातील बाजारातील भाव 15 रुपये पेंढी होता. या भावाने सर्व पेंढीचे 40440 रु होतात. मे महिन्यात अजून भाव वाढण्याची शक्यता नाकारता येत नाही. 12568 रुपयाचे उत्पादन झाले त्यातून एकूण खर्च 3300 वजा केल्यास 9268 रुपयाचे निव्वळ उत्पन्न मिळते.

सोयाबीन पासून मिळणारे उत्पन्न 7400 आहे तर मारवेल गवतापासून मिळणारे उत्पन्न 9268 आहे म्हणजेच 1868 रुपयाची तफावत आहे. पाऊस कमी झाला किंवा योग्य वेळी नाही पडला तर पिकावर परिणाम होतो मात्र गवतावर परिमाण होतो नाही. चाऱ्याचे प्रमाण कमी झाल्यास भाव जास्त मिळतो. चाराचा वाहतूक खर्च हा खरेदी करणारा करतो तर सोयाबीन मध्ये विक्रेत्याला खर्च करावा लागतो. गवताला जास्त मेहनत घेण्याची गरज नाही.

सोयाबीन पिकावर शेतकऱ्याला घरी प्रक्रिया करू शकत नाही म्हणून त्याचे मूल्यवर्धित करणे शक्य नाही. परंतु गवत उत्पन्न घेतले तर दुधाचा व्यवसाय करू शकतात, दुधापासून तूप, दही, खवा किंवा अन्य पदार्थ बनविता येऊ शकते म्हणून मूल्यवर्धित करणे शक्य आहे. शेतकऱ्यांनी तणनाशकाचा वापर करू नये यामुळे स्थानिक गवते नष्ट होतात तसेच त्यावर जगणारे जीव नष्ट होतात

संशोधनात धनंजय पडघन, सुभाष खंदारे, मुख्तधीर पठाण, प्रतिभा पवार व सुवर्णा खिल्लारे यांनी माहिती संकलित केली तर विकास कांबळे यांनी संशोधनात्मक विश्लेषण केले.

Alysicarpus tetragonolobus

Commelina benghalensis

Dinebra retroflexa

Alternanthera brasiliana

Sehima nervosum

Stylosasnthes fruticosa

Sehima nervosum

Cynodon dactylon

Dichanthium pertusum

Eco-restoration of Community Forest Resource Lands

Report

6.1

Eco- restoration of Community Forest Resources Lands

Janarth Adivasi Vikas Sanstha
Shahada, Nandurbar District

Background

There is a severe deforestation in last several decades. People in the work field, especially tribal community, had an organic relationship with the forest. They were dependent on the forest for NTFP, herbal medicines, forest fruits and vegetables. Forest became government property during British rule between 1865 and 1878. Indian government which came into power post-independence continued to follow the same laws—this disconnected tribals from the forest. Indian forest department also failed to consider the forest as 'valuable asset'. In contrast, forest officers gave freehand to contractors to cut the woods, which lead to enormous deforestation.

People encroached the deforested area and started farming for their livelihood. People gave sustained struggle over the past several decades, under the leadership of various movements for achieving land rights over the forest. However, it took the 21st century for the government to undo their mistake and bring in 'Forest Rights Act 2006'. This law gave forest dweller communities their right over the 'encroached' lands. This law also acknowledged the community's right over the forest as a common resource. This law allowed the community protection, conservation, enhancement and regeneration of the forest and thereby achieving sustainable development. Bringing this opportunity into reality is a challenge for the tribal and other communities. People can make good use of the encroached lands under personal forest rights. However, the forest which comes under community property rights has scarce tree cover. On such forest lands, there is a need for forest regeneration with community participation and leadership and find a connection to people's life in order to ensure sustainable development.

Since 2000, Virpur and Bhute villages are protecting their forest (total 1800 hectares) by founding Forest Management Committees. Men and women took turns for patrolling to protect the forest. Those two villages were part of the MGBP since the initial stages. However, after Forest Rights Act 2006, people in nearby villages started encroaching the community forest land of Virpur and Bhute villages. In order to gain their forest rights; they started cutting forest from some parts. Residents of Virpur and Bhute villages filed complaints about this to forest department officials and collector but the efforts went futile. With this depressing experience in the past, Bhute village withdrew the participation from the program whereas Virpur villagers continued their determined participation. They continued their efforts of community forest regeneration and sustainable environment management, but now their common forest area has shrunk.

In the past two years, Nagziri and Kotbandhani villages got community forest rights (Nagziri 2000 hectares and Kotnandhani 4000 hectares). These villages passed the resolution in Gramsabha to engage Janarth Adivasi Vikas Sanstha as a technical consultant since April 2016. Therefore, these two villages are now included in community forest development and forest eco-restoration programme.

Journey with MGBP

Key issues

i) Protection of 150 species (The list of 150 species is given in Annexure 1)

ii) Planting 60,000 saplings in 5 years (The table with list of trees is given in Annexure 2)

iii) Watershed management development works

iv) Preparing People's Biodiversity Register

v) Women empowerment

vi) Survey of community forest

vii) Achieving livelihood through MGNREGA and other schemes

viii) Community forest rights to Virpur village

Objectives

As MGBP started in 2014, objectives of conservation, protection, registration and raising people's standard of life were revisited. The objectives are to be implemented in Shahada block of Nandurbar district and are as under:

1) To focus on 80 plant and animal species selected by local communities

2) To implement biodiversity enhancing activities with the help of Government watershed development, Afforestation and Rural Employment Guarantee Schemes

3) To generate substantial employment for women and landless labourers

4) To generate employment through processing and value addition to Non-Timber Forest Produce

5) To enhance earnings through investigation of nutritive value and novel uses of Non-timber Forest Produce

6) To generate energy through biomass utilization

Achievements

i) Protection of 150 species including 82 trees, 25 wild vegetables, 14 kinds of grass, six creepers. 126 floral species are well documented with photographs and uses. Twenty-five birds are noted in 206 hectares of community forest at Virpur. Enlisting species at Nagziri and Kotbandhani is in process. The list of the 110 species mentioned above is given in Annexure 1.

ii) Plantation of 56,500 saplings in 5 years. – 22,000 saplings were planted in three villages till 2017. 19,000 saplings are planted in 2018. (Apart from this, FDCM and forest department have planted 1 lakh saplings in three villages till 2017). In 2019 plantation of 8000 saplings in Virpur, 5,000 saplings in Nagziri and Sablapani and 2,500 saplings in Kotbandhani. (Apart from these, the Forest Department planted 25,000 saplings in Nagziri). Total 56,500 saplings were planted until 2019. Out of these 30,000 saplings are growing in these three villages. (Some pictures of the growing plantation are given in Annexure 3)

iii) Watershed management- Action planning for 2018-19 related to 'Jalayukt shivar' in Virpur and Nagziri. Many bunding works are done in Virpur. Three cement bunds and गाबियन bunds are constructed by the forest department. In 2019-2020, 150 stone bunds, 2 cement bunds in Virpur and 25000 pits on 25 hectares in Nagziri for mixed plantation are done. In Nagziri 50 stone bunds, 7 hand-pumps and a village well have been constructed.

iv) Biodiversity register – Virpur biodiversity register is ready and attached in data. Nagziri Biodiversity Register of 2 Padas (Hamlets) is ready and of rest of 10 Padas will be completed in future and Biodiversity Register of Kotbandhani will be completed in future.

v) Women empowerment- For the first time, Women's Gramsabhas took place in year 2016 and 2017 in Virpur. Women passed a resolution regarding the rationing issue. Women participation is 50% in plantation, watering saplings, and nursery. Women's participation in the wild vegetable program is 90%. Lot more work needs to be done in case of women participation in decision making.

vi) Survey of community forest rights- Survey of 150 hectares out of 206 hectares of forest in Virpur is done. Nagziri and Kotbandhani are pending, which will be completed in future.

vii) Earning livelihood through NREGA and other schemes- Virpur and Nagziri villagers got 8000 human days' worth livelihood in 2017.

viii) Community forest rights to Virpur village- Virpur got community forest rights over 206 hectares in May 2018.

ix) Action plans have been prepared in Gramsabhas of all three villages (Virpur, Nagziri and Kotbandhani) for the activities to be taken in community forest land as well as in villages. These Action Plans have been shared with Forest Department, Tribal Development Department and also with Collectorate of Nandurbar district.

x) In Nagziri and Kotbandhani, village roads of 400 meters each have been constructed.

xi) In Nagziri and Kotbandhani, 250 laborers had worked for Forest Department. Even after 8 months they did not receive wages for this work. This issue was taken to Collector by a delegation and the labors received their wages.

Sampling methods

In 2014, the quadrant method introduced by the forest department was used to survey 70 hectares of forest in Virpur.

Quadrant method- quadrants of 100 * 100 m were made, and all the tree species inside the quadrant were counted, The Girth at Breast Height (GBH) was measured and noted for trees having GBH above 10 cms. Trees having GBH below 10 cms also were noted.

Height of trees was measured by 10-m long bamboo marked with a 0.5 m and 1 m marking.

The reason for changing the quadrant method

Though this method has been used by the forest department for years, it is time-consuming, and more importantly, other plant species are not noted in this method. A practical workshop was held by Lok Paryay, Aurangabad, through which we learnt tapu based बिंदु रेषा आधारित जंगल मोजणी. Bhayagara tapu of Virpur was measured with this method. The same method was followed for the remaining forest.

The new method: बिंदु रेषा आधारित जंगल मोजणी

As stated above, during the workshop held by Lok Paryay, Aurangabad, instead of the time consuming quadrant method, which also was not suitable to note other small plant species, a method namely बिंदु रेषा आधारित जंगल मोजणी, was finalised. The method is narrated as given below:

Select a Tapu to be surveyed. 1) Select a point on east border of the Tapu. This point should be in the middle of the selected border. One person with compass in hand should start walking from east to west. While walking caution needs to be taken to keep the walk in east-west direction with the help of compass as the compass needle is always pointing in north-south direction. Another person in survey team should follow in footsteps of person with compass. This person counts number of steps up to west border point. Number of steps counted to be divided by six. For example, if distance is 400 steps then division would be 66.66. Points on east border and west border are to be marked with stones or any marker. On this East-West line 5 points are to be marked on every 66 steps distance. On every point (of these 5) we have to survey trees, bushes and grasses. Draw a square of 1 square meter. From this selected point we have to select nearest tree (tree should be a full grown tree of 5 to 6 feet height) along the lines from central point to four corners of the square. Measure the distance of the tree from selected point. Then measure and record girth of those trees. Record names of bushes, grasses, weeds of all four sections of the square.

Then Select two points approximately in the middle of the north-south border and follow the same procedure along north-south line.

Data from all 40 points (10 points along east-west and north-south lines and 4 corners of squares around those points) are recorded. From formula given below we can calculate average per hectare (no. of trees of the species which are recorded).

N	N0=	Proportion of vacant qtrs. (vacant qtrs N0 / Tot qtrs 200)=	Correction Factor (Cf)	Average Distance from point. (rp)	1/(rp*rp)	Absolute Density (Corrected) LamdaC=	Trees/ Ha= LamdaC*10000
40	0	0	1	2.8210256	0.1257	0.1257	1256.57

(Where N is number of squares)

Survey method was changed to टापू निहाय रेषा बिंदु आधारित सर्व्हे in 2017. A survey of 21 tapus over 150 hectares was done. Latitudes- longitudes were noted. 25-30 youngsters participated in this survey.

Biodiversity register of Virpur was prepared in 2008 in 28 samples. 2016 onwards following sampling was followed:

Nagziri survey started in 2017.

Sr. No.	Local Name	Scientific Name	Habitat	Local condition		Season	Useful part	Use Photo	Related Traditional knowledge
				Earlier	Current				
	1	2	3	4		5	6	7	8

Major work done under MGBP

1. After continuous efforts, Virpur village has been entitled to community claim over 206 hectares.

2. Project Office of 30 Feet*18 Feet is constructed in Virpur, and it is in use.

3. 150 hectares of Virpur forest species counting and GPS mapping done by Point line sampling. Out of 36 Tapu (islands), in 21 tapus species are counted and recorded in register.

4. Two tapus species counting is done at Umrapani in Nagziri village.

5. Plantation- 22 thousand saplings in three years. 10480 saplings are surviving.

6. Drumstick saplings were distributed to women. (Photo shared in Annexure 3). 60 drumstick saplings have survived and grown 5-8 feet. Ten of them are fruiting.

7. Purchased watering machine

8. Channel is dug for watering saplings at Korvandi hamlet at Nagziri

9. Digging of wells (12 feet diameter and 14 feet deep) for providing potable water in Umarapani village.

10. Nursery is prepared at Virpur. 5000 saplings are grown in the first year. 3000 saplings are grown in the second year.

11. Vanarai bund was constructed with the participation of students and villagers in Korvandi hamlet of Nagziri.

12. NREGA work (by Rs.192/- daily wage)

Marking potholes – 6 labourers for 120 days= 720 human days

Digging potholes- 30 laborers for 45 days = 1350 human days

Plantation – 102 laborers for 15 days = 1530 human days

Total human days = 3600

Total income generation (3600 * 192) = 6,91,200/-

13. Rock bund at Virpur- 10 bunds in various water channels. Total 0.74 meter length. *1-meter width*1-meter height; 10 labourers for eight days work

14. Thorny compound: - well in forest area record no. (525)- protective compound for saplings growing at Neeli chari- Danga Tekdi and Pipu Sapati

15. Well digging and building- Well in forest area no. 526 at Sabdipani for watering saplings

16. i) Platform built for saplings and mulching done with leaf and soil to hold water

ii) Singling of teak trees. Cuttings are used as fuel for villagers.

iii) Weeding of grasses and 'bhutganja' around saplings.

iv) Watering channels dug around saplings

v) 1000 feet 1-inch pipeline was run from 100-litre capacity water tank for watering saplings under PESA funds

vi) Experiment of watering saplings through saline was done

vii) Vanarai bund was constructed in water channel at Sabdipani through Shramadaan

viii) Ban on grazing and cutting wood is achieved in Neeli Chari- Danga Hill, Pipu Sapati and Limba hill

Unintended outcomes

1. Two new villages Nagziri and Kotbandhani were connected to the work. Since 16 April 2016, total 6000 hectares- 2000 hectares in Nagziri and 4000 hectares in Kotbandhani is declared as 'community claimed land'. Work has started over these lands.

2. There was obstruction by some other organization in Nagziri and Kotbandhani.

3. Nagziri Gramsabha passed a resolution with consensus to grow wild vegetables on 100-hectare common land.

4. 60 thousand Khair saplings in Virpur (2016) and 25 thousand mixed saplings in Nagziri are planted by forest authority.

Qualitative impact

1. Importance of Tenbhur trees was well discussed in village meetings. As an impact Tembhur trees are burnt less during the main tribal festival of Holi.

2. Students and villagers of Virpur made Holi (holy bonfire) of '*bhutganja*' weed for environmental conservation.

3. Forest vegetable fairs were organized: Forest vegetable fairs (Vanbhaji Mahotsav) are being organized every year for the last 4 years in Virpur, Nagziri and Kotbandhani villages alternately. The forest vegetables are becoming rare. They are nutritious and need to reach more people. The aim is that the forest vegetables should get market, which will provide employment opportunity for women. In these forest vegetable festivals, women and men from Virpur, Kotbandhani and Nagziri participated. Women exhibited their preparation of forest vegetables. The details are given in the following table. The recipies of 20 vegetables were written down. Members of gramsabha of Nagziri and Kotbandhani have principally agreed to keep 100 hectares of community forest land reserved for women to grow ranbhaji (Photos are shared in Annexure 3).

Table 1:

Sr. No.	Date	Place	Participating villages	Participants		No. of vegetable samples	No. of types of vegetables used
				men	women		
1	7/10/2014	Virpur	1	30	25	60	23
2	15/9/2015	Virpur	1	42	60	102	42
3	3/10/2016	Nagziri	3	40	62	76	31
4	12/10/2017	Kotbandhani	3	100	40	110	42

4. Villagers got work under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) with the follow up of the organization. The MGNREGA work was started in Virpur on Garvali hill and Ambui hill. It involved 1) digging potholes, 2) tree plantation, 3) watering saplings, 4) mulching, and 5) building platform around saplings. Women participated in all these works.

5. CCT bunds and tree plantation in 25 hectares of Virpur forest by Forest department (2018).

6. Rock structures of closed trenches works are sanctioned (2018)

7. Nagziri and Kotbandhani village farmers became willing to build farm bunding. In 2018, it is done over 10 hectares.

8. The land is identified to make forest Vegetable Park.

9. Studies of dhavdha gum, povadya and tendu leaf have started.

10. Recipes are collected of 20 forest vegetables.

11. 2000 out of 4000 saplings survived in Korbandi hamlet at Nagziri because of machine watering.

Community participation

Initiation

1. Villagers of Virpur were protecting forest since 2003. There were some arguments with the information about private ownership forest plots. Some people held the stand of continuing community forest protection and conservation. Twenty families continued the work after the programme started. Nagziri and Kotbandhani villages got Community forest rights. Forest and revenue department gave these rights to avoid deforestation. In order to achieve better protection and conservation Sarpanch of Nagziri and Province official connected Janarth organization and 200 families of Virpur since they were involved in the process of biodiversity conservation and protection. Many men and women participated in that program. People's participation was seen in Nagziri after meetings in 10 hamlets. Women's participation increased through forest vegetable programme.

2. In September 2015 province official Mr Gawale, Forest department & forest authority official, Adivasi Ekta Parishad, villagers, youth participated in the plantation. Virpur villagers witnessed forest protection and conservation since 2003. Biodiversity committee is connected with almost all persons through participation in the school management committee. All villagers wished to have received community forest rights, and it was essential to have done plantation in the presence of officials and with community participation over the land where villagers have no rights over.

3. In 2016-17 two wells in Sabdipani, Virpur and one well at Umarapani were dug with People's participation. (Photos are shared in Annexure 3).

4. In 2016-17 Z.P. school students and teachers participated in the plantation

To make the school children aware about biodiversity ZP schools in 10 villages were contacted and various programmes were taken with the students. The details are given below.

200 Students and ten teachers of schools from these ten villages- Virpur, Nande, Chichora, Rampur, Chikhli, Ranipur, Islampur, Lakkdkot, Nagziri, Kotbandhani

Mobilization of Schools/ Groups/ Students around biodiversity in 2016-17:

1) Seed collection 7 Schools- 13 types of seeds-70 Students

2) Shivar Pheri -11 Schools-270 Students

3) Thali Upakram –9 Schools- 225 Students

4) Village History – 2 Schools-40 Students

5) Short Film on Holi Dance , PSM

6) Putting water drums for birds -10 Schools-90 Students

7) Recording project formats made by students - 10 Schools -65 Students

Mobilization of Schools/ Groups/ Students around biodiversity in 2017-18:

1) Photography

2) Essay on Holi festival

3) The difference in the food through three generations

4) Shivar Feri (Visit to fields)

5) Herbarium

6) Pot of herbal medicines

7) Dashaparni medicine

In 2018-19 and 2019-20 through discussion the school teachers were involved in the activity and they asked the students to select a project and complete it. Followup was done with teachers.

5. There is a positive environment related to biodiversity in the school because of inputs of biodiversity committee. Students participated in Bird watching camp and villagers and students did procession on World Environmental Day.

6. A study tour was held to Baripada on 4 September to understand forest management process where ten women and 26 men joined. In Baripada, the people have protected 150 hectares of community forest. The villagers raise contribution in kind and give honorium to the watchman. They have planted 350 Mahu trees and they decide a date to collect the produce i.e. Mahu flowers which are collected unitedly on the same day. They organize Forest vegetables Festival. They have initiated forest tourism and they have employed a guide

to give information about various trees in the forest to the visitors. They also have put up exhibition about various local species.

Similar tour was held at Pipalkhuta on 7 June 2015 where 20 women and 15 men from Virpur participated. The villagers protect 200 hectares of forest land. The forest area adjacent to every house is protected by the family. The village has received award from "Gram Swachchata Abhiyan". They have taken the programme of plantation with support from BAIF organization.

Role in designing or reshaping the work related to village community forest

1. Tapu based mapping of village forest was done with people's participation.

2. Planning of plantation, watershed management, nursery, stone bunds, etc. was prepared.

3. 1000-1200 feet pipeline from the village was dug for watering the plantations.

4. Nagziri villagers did shramdaan to plant 2000 plants.

5. People participated in forest protection because of the convincing efforts of the organization.

Management of village level common resources

1. Ban on grazing and woodcutting – Plantation took place in Virpur in 2015 in 50 acres of koop no. 525. Villagers go to this part in a special ceremony during July. On that occasion, old and senior people of the village go there for a prayer of the totem. That time wages for the land labourers are decided. Organization and villagers have planted custard apple, mahua, jamun, charoli, mango, kadaya, fruit plants in these 50 acres. Grazing is banned in that part. This ban is unwritten oral understanding.

2. Under MGBP, Janarth has done plantations on 25 hectares village forest in Nagziri. In the Nagziri gramsabha on 26th January 2018, people discussed the problems caused by grazing animals entering the plantation area and passed a resolution of banning of grazing. They collectively decided to charge fine or confiscate the animals that enter in that area. This resolution effectively caused grazing ban in that area.

Plantations near farms showed survival because of close monitoring of the farmers. Janarth helped in watering those plants from February to June. Villagers monitored the saplings. No conflict was seen among the villagers. Instead, people were supportive and voluntarily watering with 25% less wages than government and urban wages.

If someone from another village is cutting woods from community resources, the person with protection responsibility of that part can oppose him. If the other person continues the cutting, Sarpanch and senior person from the village can go to the forest and oppose cutting. If some villager wants wood or bamboo for house construction, Sarpanch, Karbhari or police patil can guide him about which wood could be chopped. Dry wood outside the boundary is cut for fuel. It is taken from outside community protected area. Livelihood is a big issue in the villages. Local villagers take permission from forest protectors to harvest NTFP like gum, honey, wild fruits- flowers, tendu, etc. In 2016, in hamlet of Kotbandhani some villagers collectively harvested eight quintals of Dhavda gum with Sarpanch and Karbhari's permission. Similarly, they also collected three quintal *takla* (*Cassia indica*) seeds.

There is no written or rigid rule about this, and villagers together take decisions based on the situation. In 2016-17 with Janarth's initiative, a village meeting decided that if any person or businessman purchases gum, 5% of the profit should be given to the village. This experiment was done in one case, but it will take time for this process to become a practice.

Social conflicts

There are some incidences of personal theft of wood, bamboo selling, tendu, gum, honey and wild fruits. There is still encroachment over forest land for farming even in the Kotbandhani, Nagziri, Virpur villages.

Conservation of social fabric

1. Unity was seen in Virpur in the issues like women gramsabha, forest protection and Plantations. The thorny compound was done by villagers by half remuneration and half shramdaan.

2. Addressing to the efforts of organization, villagers come together for making village development plan with consensus.

Influence of local and global factors

1. People of Nagziri, Kotbandhani have used their wisdom and local technique for bringing water by manually made channeling from a major water source to the farm.

2. People traditionally know the use of herbal medicine.

Traditional conservation and harvest practices

1. Charoli seed harvesting method: ripened charoli fruits are harvested from the plant and are ground in rock grinder. Ground seeds are soaked in water and air-dried. Then they are milled in stone mill (*jaate*). Later it is taken in a bamboo plate (soop), and edible part is separated skillfully.

2. Method of seed conservation: Jowar, Bajra, maize, rice and black gram are skillfully cleaned by bamboo plates. Alternatively, some of the edible grains are taken and sun-dried and stored along with neem leaves. Seed grains are properly dried in winter and summer. These grains are cleaned and sown as the monsoon starts. Sometimes entire grain cobs are dried over the loft for an entire year.

3. Method of storing grains: Bamboo basket (*kangi*) is plastered with soil cow dung paste and dried. Neem leaves are mixed with grains and kept in the *kangi* upto the brim, and then the mouth of *kangi* is covered with more neem leaves. Kangi is then covered by teak leaves and plastered from the top. When grains need to be taken out of *kangi* a ritual is followed, and then grains can be taken out.

4. Sour rosella leaves and flowers- good teak leaves are kept inside bamboo basket rosella leaves, and flowers are kept in the basket up to the brim. The teak leaf is rolled over them. This rolled-over leaf is hanged on the top bamboo of the house. These rosella leaves and flower are taken out in winter or summer by making a hole in the teak leaf. Rosella leaves make a sour vegetable. The hole is sealed by piece of cloth.

Relevance of history in conservation practices

Under the PESA act, villages holding the community forest rights reserve the permission to extract minor mining (like rocks, murum, soil, sand) from their reserved lands.

Beneficiaries

The village people have rights over the community forest land and the forest produce. So, the beneficiaries are all the villagers, as the details given below.

Table 2:

Sr. No.	Village Name	Total population	Total men	Total women
1	Virpur	2362	1175	1187
2	Nagziri	2970	1476	1494
3	Kotbandhani	1937	952	985

1. Virpur village for 206 hectare community forest right.

2. Students from Nagziri, Virpur, Kotbandhani primary schools getting exposure to environment-related new skills

3. It is expected that horticulture plants planted at Virpur, Nagziri will give yield in the next 2-3 years.

4. Study and counting of birds.

5. Plantation, CCT work, fuel availability because of singling of trees through NREGA.

People's preference for livelihood species

Wild edibles- Various types of fruits like Mango, Custard apple, Jamun, Karvand, karaja, torna, dhamne, agan, kutrandya, aal, olme, amla, oknya, mahua, charoli, tembru.

Wood for house construction- bamboo, rohicha, karay, baru, bhatdya grass (as fodder)

Fuel wood and agricultural instruments- Teens, dhavda, salai, padas, Kadaya for gum, honey, herbal medicines.

Community Forest Rights (CFR) experience

Since 2002, community forest management committees were formed in Virpur and Bhute Akaspur with the names Raja Pantha Ganda Thakur and Ayben Mata, respectively. In total 1800 hectares of forest was registered. Janarth Adivasi Vikas Sanstha was working on health issues and integrated development in these two villages since 1996-97. The organization was working in 18 other villages in addition to these two. There was religious singers' group in Virpur. People from this group got ready to protect the forest in their village. Three people's team took turns every week. Slowly as the villagers got convinced of their work, they joined the protection work, and the teams became as big as 20 members. Forest development authority started CCT work in 25 hectares. Villagers got fuelwood because of the singling of trees. People did shramdaan to build vanrai bund on flowing water channel. Around 2006, women's teams of 5-6 members also roamed in the forest. In Bhute village women teams used to do patrolling and catch the thieves and charge fine on them in the village. Forest department was requested to sign the registration, but the department refused. Later, we were connected with state-level joint biodiversity and forest management committee alliance. We exchanged information. That is how Virpur and Bhute village prepared file demanding community forest rights as per the Forest Rights Act 2006. That file was not taken further by Forest development authority office, Taloda for 7-8 years. In 2006 we came in touch with Dr Madhav Gadgil, and in the meantime, Virpur and Bhute villages' biodiversity mapping, registration, forest and village maps were done. Both villages together protected forest till 2010. In the meanwhile, around 2006-2007 people got mislead by the information that encroached land will be given entitlement in the encroacher's name. This event caused the breaking of the forest from 2010. But Virpur Koop no. 525 and 526 were still intact. As MGBP started in 2014, meetings were held in Virpur. Information about forest protection and conservation was given to people.

People responded positively to that. Virpur village got 206.43 ha. of community forest rights in May 2018. This is how Virpur men and women participated.

Conservation strategies

Very specific efforts were not made in this aspect.

People do not cut forest in Sabdipani hill in Virpur and Bapdev hill in Nagziri considering them as sacred groves.

As a custom, prayer is held on these hills for better cropping before every monsoon. So, no one cuts trees on this hill.

Non-monetary engagement with the forest

Income-generating trees, eg, mango, custard apple, mahu, charoli, tembur,

Teenas for construction wood, fuelwood, farm instruments

Dhavda, Salai, Palas, Kadaya for gum

Other forest produce like Honey, herbal medicine, forest vegetables, forest fruits- flowers, water, soil and stones for house construction, Mahua seed for edible oil,

Bamboo for wedding pandal, musical instruments, basket, broomstick etc.

List of Publications and presentations

Recipe book regarding forest edibles like vegetables, wild tubers, wild flowers and wild fruits found in Satpuda hilly region in progress (not published yet). We are looking for support to publish it.

Networking

1. Two thematic meetings at Aurangabad and Shahada were useful in understanding data collection and quadrant / point line survey.

2. Villagers were shown the video of Mendha Lekha's collective work. Khoj organization helped with G.P.S. Lokparyay gave inspiration and enthusiasm.

3. BAIF helped in information and processing.

4. Beneficiaries visited Lamkani. That gave inspiration.

5. Dr. Mandar Datar of Agharkar Institute, Dr. S.P. Yadav of Shivaji University, Kolhapur visited the field for plant identification.

7. Rajendra Gadgil and Shilpa Gadgil bird watchers from Jalgaon visited and explained about birds and butterflies and their importance in biodiversity to activists and villagers.

8. Dr. Watve's guidance during common meetings and training at IISER

9. Help from Satish Awate and his enthusiastic team

10. There is a local consultant committee of the following persons-

Dr. H.M. Patil, Botanist

Dr. Manoj Gayakwad, Economist

Mr. Sambhudada Patil, Technician and skilled farmer.

Mr. Giridhar Birare, Ex- surveyor, Forest department

Outreach

CEE program gave the opportunity to connect with students/ teachers of 10 schools, group education officer, group development officer, project officer (Taloda/ Nandurbar) and district education officer. (The activities with the schools are given above under "Community Participation").

Knowledge-related outcome

***Kadaya* (*Sterculina urens*) -** older people informed that they used to sell gum of this tree and purchase food in return.

Dhol (traditional drum)- Wooden drum is preferred traditional musical instrument by tribals. Primarily bhil community uses dhol during weddings, holi, and traditional tribal rituals like indl, bhongrya, mevada. Dhol is mostly used during happy occasions. Dhol is not played in case of sad occasions like death. Mandal or dholak (a smaller version of dhol) is played. There are big competitions of playing dhol among tribal communities for prize money from Rs. 300 to 50,000.

Traditional knowledge and use of wisdom

1. Method to pluck mango- A small hook (Shikli) is tied at one end of 15-20 feet tall bamboo. The hook is tied by okhra rope. Mango is hooked in the shikli and plucked. One person sits on the mango branch and keeps all the plucked fruits in the bucket. A bucket is tied with the rope. Once the bucket is filled, it is released down to the people standing under the tree. All the plucked mangoes are kept on palash leaves to protect them from damages. Tasty mangoes are made into pickles, and some are eaten after ripening.

2. Method to ripen mangoes- the old bamboo basket is mud plastered or internally covered by forest leaves. Good mangoes are kept inside the basket, and then it is covered by Mahua and Tembhur leaves. Basket top is plastered by cow dung and mud to make it airtight. The top plastering is removed after 8-10 days, and ripened mangoes are consumed. Risali- Muhavi leaves are preferred because they are yellow and it is believed that this will give yellow colour to mangoes too.

3. Oil extraction from Mahua seed (tolambi): ripened mahua seed (tolanbi) is harvested and sun-dried. It is further ground in rock grinder. Small and big pieces are separated in a traditional bamboo winnower (Soop). Bigger pieces are ground again. Water is kept for boiling in the pot and ground tolambi is kept in the bamboo basket over the boiling water. This ground tolambi is steamed and taken in a cloth. This cloth bag is kept in a specialized wooden instrument where it is squeezed in a specific way yielding tolambi oil.

4. Method to make Mahua liquor- Mahua flowers, 4.5 kg wheat, five kg jaggery, 250 gm Navsagar (ammonium chloride) is mixed with two pots of water and stored in a big mudpot. The bark of *teenas* or *reyna* is brought from the forest. One kg of bark is ground and added in the mud pot. Within 4-5 days mahua starts smelling, or froth starts coming out of mudpot. Mahua ferments well. Stone chulha is made in the river bank or stream. Mud vessel, bamboo tube, copper pot, palash leaves and wood is needed at this stage. The chulha is fired and vessel is kept over it. Fermented mahua juice is poured in that. Inverted mudpot is kept over the vessel. The mudpot has a small hole. Once steam starts coming out of that hole, it indicates that soon liquor will start distilling. Bamboo tube is placed near the hole. It is plastered with mud and cloth to avoid steam from coming out. A copper pot is kept in river or stream, and a bamboo pipe is inserted in that. Liquor starts pouring out in the copper pot. As the liquor starts pouring out, fire is simmered; otherwise all the water may come out in one go. In such case, liquor is considered as bad and non-consumable. First 4 inches of liquor is stiff and later 6 inches of liquor is weaker. Weaker liquor is called as 'phool'. Pure Mahua liquor is considered as medicine over asthma.

5. Method of ripening tembhur (Mahua fruit)- Tembhur is harvested. Two connected potholes are made in such a way that smoke can pass from one to another. In one pothole *tembhur* is kept surrounded by rice straw. Soil is poured on the top. Cow dung cakes are kept in another pothole and burnt. The smoke passes to another pothole. Such smoking process is done for 3-4 days. Ripened fruit is then taken out and consumed.

6. Fishing method: River stream is manipulated and made into a puddle by arranging small stones on one side. Teak leaves are tied to the stones. Sand is poured on those leaves. The bark of *hinguvaraya* is powdered and poured on the sand. Fish in the puddle get mildly drugged and start floating over the water. They are caught and consumed.

7. Okhra, rosella leaves, rosella flowers, raw mango, goat meat, and bull meat is chopped into pieces and thoroughly dried and consumed as needed.

Realizations about human-human/ human-nature relationship

Senior and socially reputed persons of the village collectively resolve conflict in case of farm-related family issues or social, economic transaction-related issues. Women cannot be involved as a referee. However, birth of a girl child is welcomed, and the groom's parents give money to the bride's parents during the wedding. In case of divorce, bride's parents need to return the money to the groom. Daughter is not given rights in the paternal estate. In Adivasi Pawra community, marrying with maternal uncle's daughter is not accepted. Marriages among Bhil and Pawra communities are not allowed. Gavhal (Bonde) community is considered as lowest among the hierarchy. Their traditional profession is playing music at weddings and funerals, and grazing animals. They are not allowed inside houses.

Widows are allowed in holy ceremonies but are asked to sit separately. Widows have specific duties during marriages, pooja, rituals, and funerals. e.g. offering "prashad" in the name of the dead person, cooking for a funeral, bathing the dead body, applying turmeric, etc.

Having a bigger family, extra land and extra money gives more reputation. Land distribution in bigger families is causing less land to next generation per family. Therefore, there is more deforestation for expansion of the farm.

Observations about ecology- regeneration/ depletion/ conservation

1) As per local villagers, these days they do not get crabs like earlier times because increased use of chemical fertilizers, pesticides have affected the grasses consumed by crabs.

2) Rare wild vegetables- Wild vegetables are getting less because of more chemical fertilizer and pesticides as well as outside vegetable vendors bringing vegetables. Use of traditionally grown vegetables is reduced since market vegetables are readily available.

New understandings/ philosophy/ realizations emerged

1) People's participation and people taking responsibility can be achieved if we can weave people's dreams and aspirations and dream of sustainable development through biodiversity.

2) New systems will sustain only if old social systems (e.g.- Caste panchayat, etc.), customs and decision makings are well understood.

3) New hybrid varieties are preferred over old diverse crop varieties because of market influences.

4) Every plant is medicinally important. Grazing animals do not eat custard apple tree. It gives quick produce. Trees die if the bark is removed. Naturally, Dhavda gum is secreted less. A lot of gum can be extracted by injecting chemical in the trees, e.g. if a tree gives maximum 500 gm of gum; artificial extraction would yield 4-5 kg of gum.

5) Wild edibles grow well in the muddy or watery area. E.g.- Zila bhaji, naikui bhaji, bhui matla, bamchi bhaji.

6) Plants growing in rocky areas do not grow in flatlands. E.g.- Jirnya, Bofi, Najrya.

Database

Data has been restructured as per the requirement discussed in meetings with Dr. Edlabadkar and submitted for inclusion in database

Impact

Visually forest is seen to have grown in and around the villages where the organization is working.

We need to analyse further for impact on ecology, community, academic circle and policy level.

Failure stories

1. Medicinal plants like Jirnya, Bofi, Najrya were planted but because of different weather and habitat (they grow in rock crevices) they did not grow well in our forest.

2. Smokeless chulha- Women from each hamlet of the village were asked to make smokeless chulha. However, the expenses and wood are not affordable, so this chulha was not used.

3. Use of saline bottles- Saline bottles were used to water 100 saplings, but wild rats chewed the tubes and bottles were choked.

Alternatives

1.There were many superstitions related to the drumstick tree. After a few meetings with women, we were successful in conveying that drumstick has high nutritional value. Now women are ready to plant drumstick plants in the backyard. 65 plants out of 200 planted are still surviving.

2.People's mentality was not inclined to forest conservation. Activists held several meetings in hamlets of Virpur, Nagziri and Kotbandhani. These meeting brought about change in their mindset, and people are now willing to protect the forest.

Way forward

1. Plantation of horticultural and other useful trees

2. Formation of a nursery of local trees

3. Preparing bore running on solar energy for plantation of forest vegetables 100 hectares.

4. Canal bunding, stone bunding, farm bunding as necessary

5. Water holes for wild animals and birds.

6. Raising butterfly park

7. Nutritional analysis of wild vegetables and other plants.

8. Food processing of Custard apple and ber, marketing the same

9. Honey bee training and raising livelihood from Honey bee domestication

10. Trying to raise livelihood and other objects from forest, agriculture and other government departments.

11. Programs related to Bird watching and bird registration

12. Maintaining existing communication network and developing the new network as needed.

13. It is important to study related to a butterfly garden, biodiversity, tourism and livelihood.

14. Training and empowerment of village-level committees.

15. Efforts for food processing and marketing of local wild edibles (like mahua, charoli, custard apple, gum, tendupatta, tenbhur fruit, mangos, povadya) for village level environmental sensitization and employment generation.

Staff

Sr. No.	Name	Post	Introduction	Joining month/ year	Relieving date/ year
1	Vikram Kanhere	Principle Investigator	Education as a social worker, health, biodiversity, economic development, community building etc.	January 2014	31 March 2020
2	Ranjana Kanhere	Co-investigator	Working as a social activist in the sector of education, health, biodiversity, economic development, community building, etc.	January 2014	31 March 2020
3	Chunilal Brahmane	Project coordinator	Working as a social activist in the sector of education, health, biodiversity, economic development, community building, etc.	January 2014	31 March 2020
4	Karamsing Pawar	Program co-ordinator	Worked as J.F.M. committee member as 17 years and working as a social activist in the sector of health, environment etc.	January 2014	31 March 2020
5	Vinod Ghodse	Environmental Educator	Worked as a teacher, trainer	January 2014	31 March 2020
6	Dilwarsing Padwi	Field coordinator	Working as a social activist in the sector of health, education, etc.	January 2014	31 March 2020
7	Chhagan Bhil	Village coordinator	Working as social activist in the sector of health and environment for the past 3 years	April 2016	31 March 2020
8	Bharsing Pawar	Village coordinator	Worked as J.F.M. committee member for the past 10 years and working as social activist for the past 3 years.	January 2014	31 March 2020
9	Mukesh Pawar	Village coordinator	Working as a social activist	January 2014	31 March 2020

Annexure 1

List of Species

Sr. No	Scientific name	Marathi name	Category
1	*Maytenus rothiana*	vehaki	Tree
2	*Lagerstroemia parviflora*	bondara	Tree
3	*Pterocarpus marsupium*	biya	Tree
4	*Bauhinia racemosa*	aapta	Tree
5	*Terminalia tomentosa*	hadla	Tree
6	*Helecteris isora*	atai	Shrub
7	*Ziziphus xylopyrus*	bhorgota	Tree
8	*Cassine paniculata*	sikara	Tree
9	*Acacia nilotica*	babhul	Tree
10	*Schrebera swietenioides*	mokha	Tree
11	*Holarhhena pubescens*	kuvli	Tree
12	*Butea monosperma*	palas	Tree
13	*Sterculia urens*	kadaya	Tree
14	*Hymendictyon obovaty*	modla	Tree
15	*Euphorbi neriifolia*	havara	Tree
16	*Mitragyna parviflora*	kohomb	Tree
17	*Garuga pinnata*	kakad	Tree
18	*Aegle marmelos*	bel	Tree (Fruit)
19	*Dalbergia paniculata*	fas	Tree
20	*Wrightia tinctoria*	dudh kuvli	Tree
21	*Boswelia serrata*	halta	Tree
22	*Holopelea integrifolia*	kokrunja	Tree
23	*Anogeissus latifolia*	dhavda	Tree
24	*Lannea coromandeliana*	modva	Tree
25	*Tectona grandis*	saag	Tree
26	*Acacia leucophoea*	ivara	Tree
27	*Erythrina suberosa*	bhangra	Tree
28	*Acacia catechu*	khair	Tree
29	*Albizzia amara*	subabhul	Tree
30	*Ougeinia ougeinensis*	tinas	Tree
31	*Emblica offcinalis*	aavla	Tree (Fruit)
32	*Syzygium cumini*	jambhul	Tree (Fruit)
33	*Annona squamosa*	sitafal	Tree (Fruit)
34	*Annona reticulata*	ramfal	Tree (Fruit)
35	*Morinda pubescen*	aal	Tree (Fruit)
36	*Madhuca indica*	mahu	Tree (Flower, Fruit)

Sr. No	Scientific name	Marathi name	Category
37	*Ziziphus mauritina*	bor	Tree (Fruit)
38	*Manilkara zapota*	chikku	Tree (Fruit)
39	*Feronia elephantum*	kouth	Tree (Fruit)
40	*Cordia macleodii*	god hag	Tree (Fruit)
41	*Beridalia crenulata*	aahana	Tree (Fruit)
42	*Moringa conkanensis*	jangli shevga	Tree
43	*Sideroxyion tomentosum*	khate kuhumbe	Tree (Fruit)
44	*Grewia tilaefolia*	dhamna	Tree (Fruit)
45	*Ficus racemosa*	umbar	Tree (Fruit)
46	*Ficus benghalensis*	wad	Tree (Fruit)
47	*Tamarindus indica*	chinch	Tree (Fruit)
48	*Mangifera indica*	aamba	Tree (Fruit)
49	*Diospyros melanoxylon*	tembhur	Tree (Fruit)
50	*Ficus hispidus*	ded umber	Shrub (Fruit)
51	*Buchanania latifolia*	charoli	Tree (Fruit)
52	*Flacourtia ramonchii*	parha bor	Tree
53	*Terminalia bellirica*	behda	Tree (Fruit)
54	*Cassia fistula*	germova	Tree
55	*Ficus religiosa*	pipu	Tree (Fruit)
56	*Catunaregum spinosa*	gavo	Tree
57	*Lantana camara*	aarkatya ful	Shrub
58	*Amaranthus oleraceus*	matla pala	Grass (Ranbhaji)
59	*Amaranthus cruentus*	raajgira pala	Grass (Ranbhaji)
60	*Cassia tora*	povadya pala	Grass (Ranbhaji)
61	*Bambusa arundinacea*	baambu vahte	Grass (Ranbhaji)
62	*Moringa oleifera*	shevga	Tree (Ranbhaji)
63	*Portulaca oleracea*	khatgui pala	Creeper (grows in water)
64	*Commelina benghalensis*	kenya pala	Grass (Ranbhaji)
65	*Spondias pinnata*	aambala pala	Shrub (Ranbhaji)
66	*Cocculus hirsutus*	vasan vel	Climber (Ranbhaji)
67	*Celosia argentia*	movka pala	Grass (Ranbhaji)
68	*Smithia bigemina*	naaykoi pala	Creeper (Ranbhaji) (grows in water)
69	*Oxalis corniculata*	jhila pala	Creeper (Ranbhaji) (grows in water)
70	*Portulaca quadrifida*	bam pala	Shrub (Ranbhaji)
71	*Colocasia esculenta*	aahva pala (pothi pane)	Shrub (Ranbhaji)
72	*Dioscorea bulbifera*	vaas kand	Climber (Ranbhaji)
73	*Amaranthus spinosus*	kateri matla pala	Shrub (Ranbhaji)

Sr. No	Scientific name	Marathi name	Category
74	*Abrus precatorius*	gunjvel	Climber
75	*Caesalpinia decapetala*	silarkate vel	Climber
76	*Rivea hypocrateriformis*	fangi pala vel	Climber (Ranbhaji)
77	*Tinospora cardifolia*	gudvel	Climber
78	*Hyptis saveolens*	bhutganja	Grass
79	*Tridax procumbens*	ghav pala	Grass
80	*Alysicarpus taragonalobus*	hevro	Grass
81	*Apluda mutica*	fulya gavat	Grass
82	*Aristida reducta*	hukvo	Grass
83	*Ocimum gratissimum*	rantulas	Shrub
84	*Tribulus terrestris*	gokhru	Shrub
85	*Cymbopogon martini*	royasa	Grass
86	*Hibiscus cannabinus*	khato palo	Shrub (Ranbhaji)
87	*Luffa aegyptiaca*	gilka bhaji	Climber
88	*Cucurbita argyrosperma*	kova pala	Climber
89	*Cucurbita maxima*	chakri kova	Climber
90	*Vigna unguiculata*	chavli pala	Shrub
91	*Laginaria sineraria*	dudhya fal	Climber
92	*Trichosanthes cucumerina*	parvad	Climber
93	*Pithecalobium dulce*	gorkh chinch	Tree
94	*Azadirachta indica*	limb	Tree
95	*Dalbergia latifolia*	sisam	Tree
96	*Terminalia chebula*	hirda	Tree
97	*Ailanthus altissima*	Varud	Tree
98	*Helecteris isora*	aatai	Tree
99	*Holostemma annulare*	Shiricha Pala	Climber (Ranbhaji)
100	*Manilkara hexndra*	Khirani	Tree
101		orvo	Tree
102		orani	Tree
103		reyna	Tree
104		aakli	Tree
105		butikhana	Tree
106		sitaumbe	Tree
107		inguvro	Tree
108		bhovrvel	Climber
109		morusavel	Climber
110		Tad	Tree

अ.क्र.	पक्ष्यांची स्थानिक नावे	पक्ष्यांची नावे (मराठी)	पक्ष्यांची इंग्रजी नावे	Scientific Names
1.	गिलचीडी	चिमणी	House Sparrow	Passer domesticus
2.	नेलपात्रे	वेडा राघू	Green Bee-eater	Merops orientalis
3.	पेसरा / पेचरा	बुलबुल	Red Vented Balbal	Pycnonotus cafer
4.	केरसला/कावचीडो	कोतवाल	Black Drongo	Dicrurus macrocercus
5.	पोपटो	किर पोपट	Rose Ringed / Parakeet	Melopsittacus undulates
6.	कोयल/ कोयल	आशियाई कोकिळ	Asian Coel	Eudynamys scolopaceus
7.	जागर पिच्या / कावपिच्या	दयाळ	Orientetal Magpie Robin	Copsychus saularis
8.	चांबार कावळा / माकडकुबा	मोठा भारद्वाज	Greater coucal	Centropus sinensis
9.	कबुतर / पेरवा	पारवा	Rock Pigeon	Columba livia
10.	ओल्गी	होला	Callinging Dove	Spilopelia chinensis
11.	मेना / हारवी	साळुंकी	Common Myna	Acridotheres tristis
12.	मेना / बोरियो	ब्राम्हणी	Brahminy starling	Sturnia pagodarum
13.	कालपिची	भारतीय दयाळ	Indian Robin	Saxicoloides fulicatus
14.	टिटवळी	टिटवी	Realattled Lapwing	Vanellus indicus
15.	माळ टिटवळी	माळ टिटवी	Yellow Wattled / Lapwing	Vanellus malabaricus
16.	लिल्या / टिटायो	राखी / वटवट्या	Ashy Prinia	Prinia socialis
17.	तिरला / निळो / वागलिल्या	शिंपी	Common Tailor Bird	Orthotomus sutorius
18.	कुतळा	तांबट	Cppresmith Barbet	Megalaima haemacephala
19.	डिंडो / खिल्ला	पांढर्या छातीच्या खंड्या	White Breasted Kingfisher	Halcyon smyrnensis
20.	पांढर्या कंठाच्या नाचन	आबुळ्या	White Brawell Fantall	Rhipidura aureola
21.	जारया ईंद्रसिल	सुगरण	Bay Wader	Ploceus philippinus
22.	बोथरी चिडी	गांधारी खाटिक	Bay Backed Shrinke	Lanius vittatus
23.	खेके	साधा तातभाई	Common Babbler	Turdoides caudate
24.	बोगला / बगलो / बग्या	गाय बगळा	Cattle Fgret	Bubulcus ibis
25.	भुईदोड्या	चष्मेवाला	Oriental White	Zosterops palpebrosus
26.	हिकरो / हिकरा	कपशी / घार / मुरार	Black Shoulder Kite	Elanus axillaris
27.	हिक्रा	शिक्रा	Shikra	Accipiter badius
28.	घुवडा / घुवर	घार	Black Kite	Milvus migrans
29.	पानकुकडी	भारतीय पान कावळा	Indian Cormorant	Phalacrocorax fuscicollis
30.	घुबड	ठिपकेवाला पिंगळा	Spoted Owel	Strix occidentalis
31.	बेगी / देवश्या घोडा	भारतीय राखी / धनेश	Indian Gray Hornbil	Ocyceros birostris
32.	टापो	हुदहुद	Hoopeo	Picidae picinae
33.	काठाओ	भारतीय निलपंख	Indian Rollerr	Coracias benghalensis
34.	टासा	युरोपियन निलपंख	Europieon Roller	Coracias garrulus
35.	तातो / तापो	ठिपकेवाली तुतारी		
36.	केन्या	साधी भिगरी	Barn Swallow	Hirundo rustica
37.	गाव पोकळी	गाव पोकळी	House Swift	Apus nipalensis

Annexure 2

List of Trees Planted

अ.क्र.	2015 मध्ये लागवड	2016 मध्ये लागवड	2017 मध्ये लागवड	2018 मध्ये लागवड	2019 मध्ये लागवड
1	सिताफळ	सिताफळ	सिताफळ	सीताफळ	सीताफळ
2	महू	महू	जांभूळ	महू	चिंच
3	जांभूळ	बोर	गोरख चिंच	जांभूळ	आवळा
4	खट्टी चिंच	जांभूळ	बोर	कडु लिंब	महू
5	बेळा	बांबू	आवळा	आंबे	जांभूळ
6	कडू लिंब	कडाया	चारोळी	कोठ	बांबू
7	चारोळी	चारोळी	महू	आवळा	चिंच
8	गोरख चिंच	आंबा	बांबू	करंज	बोर
9		गोरख चिंच	खाटी चिंच	बांबू	शेवगा
10			शेवगा	जंगली कापूस	कवठ
11			आंबा	खाटी चिंच	करंज
12					बेहडा
13					बेल
14					वड
15					पिंपळ
16					शिसू
17					साग
18					हादगा
19					गुलमोहर
20					रेंदरी
21					रिठा
22					शिवण
23					ओरवा
24					कडू लिंब
25					सुरू
26					कडाया
27					गोरख चिंच
28					लिंब
29					कोरवा

Annexure 3

Some pictures about plantation

Watering seedlings in Virpur community forest

The (white coloured) tank of 1000 ltrs. for watering seedlings

Girls carrying saplings for plantation

Plantation photo -1

Plantation photo -2

Plantation photo -3

Plantation photo -4

Plantation photo -5

Plantation photo -6

Drumstick saplings distributed to women

Forest Vegetable Festival (Ran-bhajya Mahotsav)

Activities with school children

Well at Sabdipani, Virpur

Well at Umarapani, Nagziri

Report

6.2

Eco- restoration of Community Forest Resources Lands

Bharatiya Lok va Paryavaran Vikas Sanstha (LOKPARYAY)

Background

The Marathwada region is permanently drought-prone area in Maharashtra state. As per the Crisis Management Plan on drought- 2014, the drought in Marathwada region is observed once in five years.[1] So, there is a history of migration of landless labours and poor-marginal farmers as harvest labour, particularly from Beed and Aurangabad districts. The average annual rainfall of Aurangabad district is 705.08 mm.[2] The Gangapur and Vaijapur talukas are most drought-affected talukas from Aurangabad district.[3] At Community Bio-Diversity Park, Parala-Junone (one of the main villages under MGBP since 2015), during the last five years, it is observed that no single year rain was near to average.

Table 1: Rainfall at Community Biodiversity Park Parala-junone-2015-19

Sr. No.	Year	Average rainfall in Aurangabad dist. (mm.)	Actual rainfall in Aurangabad dist. (mm.)	Actual CBDP, Parala-Junone Rainfall (mm)
1	2015	724	496.4	**161.2**
2	2016	724	739.9	**339.6**
3	2017	724	834.5	**381.02**
4	2018	724	499.9	**113**
5	2019	724	189.6	**130**

The Soygaon taluka behind Ajantha Caves is a comparatively hilly area and good in rainfall. So, the forest is better.

On this background, Lokparyay selected villages-Parala (Vaijapur) and Wadi-S. (Soygaon) as the main villages and adjacent ten villages for campaign area under one of the MGBP themes “Biodiversity and Eco restoration”. As per initial study under a pilot program in 2008 guided by Dr. Madhav Gadgil, Lokparyay observed that thousands of acres "forest" land in Manyad river basin- a hilly area of the villages-Mamdapur- Parala-Vadji-Bhadli-Talwada is entirely barren.

The Bhil-tribal-Scheduled Tribe-ST communities along with some other Scheduled Caste-SC & Vimukt Jati Nomadic Tribe-VJNT communities were cultivating forest land since Nizam period, i.e. before dissolution Nizam state in 1948.[4] Lokparyay was guiding near about 60% families from Aurangabad, Phulambri, Sillod, Vaijapur taluka in Aurangabad district.[5] The following number of local people of various communities have regularized their rights over the pastureland with the help of Lokparyay (Table 2).

Table 2:

District	Backward persons	Other persons	Total persons	Encroached wasteland (ha.)	Encroached Gairan (pasture) land (ha.)
Aurangabad	1900	600	2500	12	2500

(**Source-**1991 GR, Govt. of Maharashtra.)

However, they were harassed by both the Forest department and the non-tribal political, dominant community from the villages. The same issue was reported from other villages:Vadji, Khandala, Shivoor, Raghunathpur wadi; Nimgaon-Gondgaon, Tunki, Loni-kh, etc.The issue of Gairan land (pasture land) is present in Vaijapur, Phulambri, Aurangabad, Sillod and Khuldabad taluka of Aurangabad since 1960. Loksamiti-Lokparyay took the initiative to guide these communities on 1991 Government Resolution-GR published by Govt. of Maharashtra about waste and pasture lands.[6] Loksamittee succeeded to implement this GR in next year's plan, i.e.the plan of 1992-93-94. More than 600 families from SC-VJNT & ST communities were allotted about 1200 acres of Waste-Pasture land in 1992.[7]

After 40 years of peaceful, democratic community struggle for forest right, 155 Bhil-tribal families from the villages-Parala, Bhadli, Talwada and Vakla from Manyad river basin-forest hilly area succeeded to get forest right under FRA-2006[8].

Lokparyay took the initiative to implement FRA-2006. Total 219 families of Vaijapur and Khuldabad and Soygaon taluka from Aurangabad district and Nandgaon taluka from Nashik District succeeded to get forest rights over 870.533 acres (348.21 ha.). They are as follows (Table 3)

Table 3:

District: Aurangabad				
Sr. No.	**Taluka**	**Villages**	**Total no. of families**	**Forest land right over Acre (ha.)**
1	Vaijapur	Vadji, Parala, Bhadli, Talwad (Galmodi), Vakla (Bortale) and Loni-khurd	154	714.533 Acre (285.821 ha.)
2	Khuldabad	Thakarwadi, Lamangaon, Takli-R.R.	28	42 acres (16.8 ha.)
3	Soygaon	Wadi-S., Banoti, Palshi, Dastapur, Bormal (Jangali Kota), Kinhi	23	92 acres (36.8 ha.)
District: Nashik				
1	Nandgaon	Bortale (Kasari)	14	22 acres (8.8 ha.)
Total families: 219 (Bhil & Thakar tribes)			**Total Acre (ha.)**	**870.533acre (348.21ha.)**

Main villages are Parala and Wadi-S. In addition, adjacent ten villages are selected for campaign. Parala forest land is barren land. So, here is the main challenge to develop biodiversity and eco-restoration. Furthermore, the forest at Wadi-S.is comparatively better but is depleting. Here the issue is to protect the biodiversity.

Journey with MGBP

1. Area of operation of the organization (districts): Parala and Wadi-Sutonda (Wadi-S.) are two main villages, and adjacent ten villages from Aurangabad district are under campaigning area. These are as follows:

Table 4: Villages covered under MGB project

No.	**Name of village**	**No.**	**Name of village**
	Taluka-Vaijapur, District-Aurangabad		**Taluka-Soygaon, District-Aurangabad**
1	Parala (main village)	7	Wadi-Sutonda (main village)
2	Wadji	8	Banoti
3	Bhadli	9	Palashi
4	Talwada	10	Dastapur
5	Wakla	11	Kinhi
6	Loni-Khurd	12	Bormal (Jangli Kota)

Key issues

There was severe drought in Marathwada during the period 2014 to 2019.

Conservation

Lokparyay concentrated on the issues like collection of tree seeds and seedlings, and collection of traditional agricultural seeds

Documentation of community knowledge

Documentation of traditional knowledge on NTFPs and their traditional harvesting practices; traditional knowledge on natural colour from Palas flowers; listing of tree species along with shrubs, grass and ranbhaji (forest vegetables) and their use, documentation of traditional knowledge on medicinal plants.

Awareness among NTFP Collectors

Organization of Vaidus, Study of NTFPs like fuel wood, small Prawn (Zinge), locally available native fish, Bibba, Tendu Patta, Gum (Dink), Honey, Agates, color stones, collection of seed and seedlings of vanished plants like Hadga, Bhutya kes, etc.

Objectives

MGB programme was designed in 2008 under the guidance of Dr. Madhav Gadgil. At that time, Lokparyay was assigned the following objectives.

1. To generate green cover over 988 acres (395.5 ha) of land which was claimed for CFR at that time in two talukas of one district.

2. To regenerate 90 plants species as remembered by the communities in 2008.

3. To implement watershed development, afforestation programmes and National Rural Employment Guarantee Schemes and various schemes of Krishi and Energy Depts. with the help of Govt. programmes.

4. To generate substantial employment for women and landless labour.

5. To generate employment through processing and value addition to non-timber forest produce and agriculture produce.

6. To enhance earnings through investigation of nutritive value and novel uses of non-timber forest produce and agriculture produce.

7. To generate energy through biomass utilization and encouragement to work on rural fuel issue.

Achievements

1. During the MGB pilot project which was started in 2008, 90 tree species were listed which were from RET category. This objective is fulfilled in Community Biodiversity Park-CBDP, Parala-Junone. Dr. S.R. Yadav and his students from Shivaji University, Kolhapur, visited Parala in November-2017. They identified 125 plants (Annexure-1). However, Lokparyay could not list birds & animals.

2. Regeneration of Tree Species: Lokparyay could regenerate only 19 tree species selected by the community from Parala and adjacent villages up to September 2017. They have regenerated on their bunds as well as on forest land owned by the Forest Department just adjacent to their forest-agriculture land sanctioned under FRA.

Besides the original list of the tree species, the community took the initiative to regenerate 19 more tree species on their bunds (Table 5).

Table 5: Regenerated trees by community

Sr. No.	Tree	
	Traditional name	Scientific name
1	Kadunimb	*Azadirachta indica*
2	Peru	*Psidium guajava*
3	Chinch	*Tamarindus indica*
4	Bamboo	*Bambusoideae*
5	Amba	*Mangifera indica*
6	Jambhul	*Syzygium cumini*
7	Kadipatta	*Murraya koenigii*
8	Limboo	*Citrus aurantifolia*
9	Kavath	*Limonia acidissima*
10	Ramphal	*Annona reticulata*
11	Umbar	*Ficus racemosa*
12	Ritha	*Sapindus mukorossi*
13	Chapha	Michelia champaca
14	Awala	*Emblica officinalis*
15	Bel	*Aegle marmelos*
16	Shevaga	*Moringa oleifera*
17	Rayjambhul	
18	Apta	*Bauhinia racemosa*
19	Hadga	*Sesbania grandiflora*

3. Watershed development, afforestation and Mahatma Gandhi National Rural Employment Guarantee Schemes-MGNREGA and various schemes of Krishi and Energy Depts.: Aurangabad Collector, through BDO, sanctioned 79 irrigation wells for tribal farmers under MGNREGA in Parala and adjacent villages.[9] Out of those, more than 35 wells are completed. Agriculture Department has initiated various types of activities on agriculture land like soil and water conservation.

6453 Seedlings of more than 30 tree species are distributed through the forest as well as social forest dept. to the farmers. Simultaneously 2,66,475 seeds of 18 tree species were spread by the students in the planned CFR lands.

4. Employment under MGNREGA: Employment was made available on their own land for more than 2000 tribal farmers-labors during November to May every year. This is only in one village Parala. Employment was made available to nearly 1400 people in other villages (Annexure 2).

5. Employment through processing and value addition to Non-timber Forest Produce and Agriculture produce: Due to FRA, seasonal migration is reduced up to 35-40%. It means 35-40% tribal population (i.e., about 219 families totaling near about 600 tribal women and men) from hilly-forest area is engaged in employment in either agriculture or collection of NTFPs.

Earnings through organic farming and novel use of Non-timber Forest Produce, and Agriculture produce: The development of the assured market at Aurangabad and other urban centres for the organic agriculture production of traditional seeds like Usvad Bajari, Ghungarya Bhuimug (groundnut), Til (Sesamum), Red Onion, etc. is under process. It is one of the primary sources of earning for farmer community.

6. Processing of NTFP: During the project period, the study on the processing of Palas flowers and preparation of Palas flowers, Gum, etc. is completed. After completion of the study report, it will be submitted to the Tribal department of Govt. of Maharashtra for processing units.

7. Energy through biomass utilization and encouragement to work on rural fuel issue: Due to barren land in forest land, Lokparyay could not start the utilization of energy through biomass. However, the organisation has established 100% solar power panels at Community Biodiversity Park, Parala-Junone.

8. The benefit of farmers through watershed development: Watershed development programme as well as irrigation wells will improve the condition of tribal families from Manyad river basin forest area from the village Parala. It has created assured protective irrigation for more than 260 acres of agriculture land.

Knowledge of ecology, propagation, utility and properties of more than 90 plants selected by local communities: Knowledge of Lokparyay team along with community about ecology and Biodiversity particularly NTFP utility, properties of the species like grass, forest vegetables (Ranbhaji), shrubs and medicinal plants will be added. Ground-level picture is very encouraging. Initially, Lokparyay decided that it will work on 90 plants. However, at the end of the 4th year, Dr. S.R. Yadav from Shivaji University, Kolhapur visited Community Bio-diversity Park, Parala-Junone. He, along with his students, identified 125 plant species.

Availability of Ranbhaji

Ranbhaji (forest vegetables) is the traditional food of the forest-dwelling community. Initially, during MGB pilot study-2008, Ranbhaji were not mentioned in the study report. One of the main reasons was that the entire community was landless labour. They were either working as agriculture labour in the village, or all the families were migrating as harvest labour. However, when formal MGB Programme was initiated in 2014, Bhil tribal women, suggested to include the Ranbhaji in the study. A significant change in their life was 155 tribal families from six adjacent villages and 79 out of 155 from Parala villages under MGBP were sanctioned forest rights in 2011 under FRA-2006. So, for the first time they were enjoying a stable, secure life in the Manyad river-forest–hilly area. No one was asking them to move out of the forest land. Immediately, Lokparyay observed one of the most significant changes in their life - one of the couples in the Bhil family never migrate. They search for Ranbhaji during the rainy season and consume them.

After continuous drought during the period 2013-2016 in Aurangabad district, Lokparyay collected data in 2016. Most of the families shared that now they are protecting various species of shrubs. So, the proportion of availability of Ranbhaji is increased. As per the initial study, 36 Ranbhaji were identified by the community from Parala. (Annexure-3) They are collecting Ranbhaji from August to November-December, depending on rainy season. During this period, they do not have to purchase any vegetable from weekly Bazar at villages-Loni-kh., Vadji & Bharadi.

Sampling methods

"Bindu kendrit chatkor nirikshan paddhati" (Reference point rectangle observation method): Initially, Dr. Vijay Edalabadkar and Dr. Madhav Gadgil conducted a training programme on **"Bindu kendrit chatkor nirikshan paddhati"** at Community Bio-diversity Park, Parala-Junone. Lokparyay team followed the instructions and collected data. The team used Compass to fix the four points East-west and North-south at Tapu. Then, mark five equal points on North-South & East-West line dividing by six. Latitude

and Longitude of all the 14 points, including extreme points (North, South, East, West) were taken by using a mobile app. Make four rectangles like North-East, North-West, South-East & South-West on every reference point. Now the distance of only one tree which is nearest to the particular reference point was measured. Its height & girth was also measured.

Major work done under MGBP

i) All studies of NTFPs like Zinge, Natural colour from Palas flowers, etc. are documented in Marathi.

ii) More than 50% plant species which were identified during 2018 are protected and conserved on bunds of the agriculture-forest land of the tribal farmers from four Tapu of villages Parala, Wadi-S and adjacent villages.

iii) The plant Hadga, which had vanished from the main village-Parala, was brought from other sources and more than 35 plants are planted and protected on CBDP, and individual farms. Now, very nutritious flowers of the Hadga are available from Sept-2018.

i) ***PBR:*** Parala PBR is ready. The baseline for the PBR is the study in 2008. The PBR has been repeated after 10 years in 2018 and the PBR book has been published.

ii) Community Bio-Diversity Park (CBDP) is developed on more than 1.35 ha. land at Village-Parala-Junone.

iii) Though there was drought during 2013-2018 at CBDP, Parala-Junone, CBDP was developed within 5.5 years. Water was purchased to protect the plants in CBDP. We could not save 18 plants during critical period. There is a Community Bio-diversity Care Taker to regularly record the data related to CBDP. The data shows that there are 2337 plants of 84 species**.** Seeds of the plants are brought by either various types of birds or by air.

Response from Community & Students

a) More than 700 people along with tribal youth participated in various programme like plantation, training, consultations, and gathering.

b) More than 600 students from different schools from villages-Parala, Krantinagar, Bhadli, Wadi, etc. visited as part of environment education.

c) Regular visits of various school girls and boys in big numbers, observing biodiversity, playing, Anand shala shibir, observing cultural map of village-Parala, Cultural programmes, etc.

BDMC: The Bio-Diversity Management Committees-BDMCs are formed in eight villages. They are as follows: (Table 6)

Table 6:

No.	Villages where BDMCs are formed
1	Wadi-S.
2	Banoti
3	Kinhi
4	Dastapur
5	Palashi
6	Bormal (Jangali kota)
7	Parala
8	Bhadli

People's Bio-Register-PBR: Lokparyay has completed PBR in only one village-Parala. The base document used for updating PBR was 2008 study during pilot project of MGBP under guidance of Dr. Madhav Gadgil. The major change in the status of Tribal community from Parala is that most of the Bhil families have succeeded to get forest right under FRA-2008. So, all of them have become farmers. During 2008, they were working as landless labor.

The second issue which was observed and which is

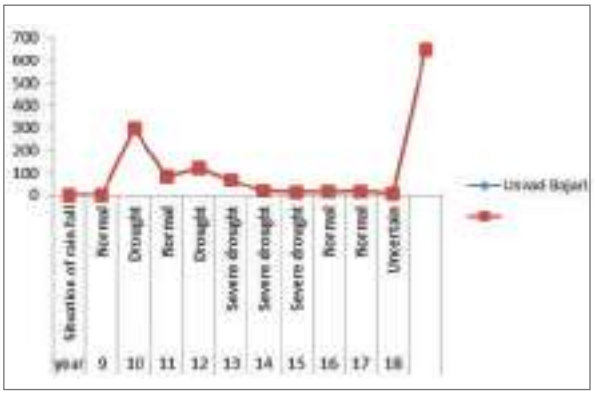
going to be important in updating PBR in future is, when education level increases, the new generation is never interested in understanding the importance of traditional knowledge about bio-diversity and their surroundings. The older generation is becoming older and older. It shows the historical importance of PBR. There are only few years in which PBR should be prepared. After ten years it is not possible to catch entire traditional knowledge which is oral.

Traditional Seed Bank

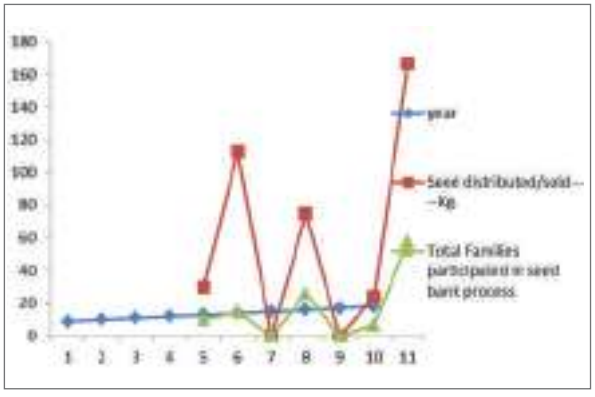
Lokparyay has established Seed Bank of traditional seeds like Usvad Bajari, Red onion from Parala and Ghungarya groundnut, Til-Havari from village-Wadi-S. at Community Bio diversity Park-CBDP, Parala-Junone. Families participated in the Seed Bank from Aurangabad district are using specially Usvad Bajari & Ghungarya Bhuimug. They are as follows: (Table 7).

Table 7:

			Usavad Bajari		Ghungarya Bhuimug	
Sr. No.	**Year**	**Situation of rainfall**	**Total families participated in seed bank process**	**Seed distributed/ sold**	**Total families participated in seed bank process**	**Seed distributed/ sold**
1	2009	Normal	1	1 Kg. seed brought from farmer		
2	2010	Drought	297	297 Kg.		
3	2011	Normal	85	85 Kg.		
4	2012	Drought	123	123 Kg.		
5	2013	Severe drought	66	66 Kg.	10	30 Kg.
6	2014	Severe drought	19	19 Kg.	15	38 Kg., 75 Kg. peanuts.
7	2015	Severe drought	14	14 Kg.	0	00.00Kg.
8	2016	Not normal but shower rain	17	17 Kg.	26	75 Kg.
9	2017	Not normal but shower rain	18	18 Kg.	0	Total crop was destroyed by Pigs.
10	2018	Uncertain	7	7 Kg.	7	24 Kg.
			647 Farmers	**647 Kg.**	**167 Kg. seed**	**58 farmers**



Graph-I



Graph-II

Policy and Strategy: When MGB Project was submitted to RGST; as per plan Lokparyay decided to establish Traditional Seed Banks-TSB at Parala-Junone during 2009. Lokparyay asked its community leaders, who are all farmers to collect traditional seed from their activity area. The system was finalized that give one Kg. seed to interested famer; and demand 2 Kg. in return to the community. Simultaneously, Karyakarta can sell the seed to known persons. It will be considered as their family income. The rate of the organic seed could be more than market price.

Usvad Bajari: There was only one farmer who was living far away from village Parala and was using Usvad Bajari. But no one was interested to use this traditional seed. Ekanath Bagul, Loni-kh.one of senior Karyakarta and now Paryavaran Mitra under MGBP, collected only one Kg. Usvad Bajari from this farmer in 2009. Due to normal rain first year yield was encouraging. This seed was planted in 0.75 acre and total yield was 15 quintal and total fodder was 250 Pendhya (bundles). It was organic yield. Total turnover of Usvad Bajari was 647 Kg. and it was distributed to 647 farmers during 2009 to 2018. Forest right beneficiary tribal farmers were given Usvad Bajari and other seeds every year. List is same as FRA. (Annexure-4) It was distributed through one of the farmers with good practices Ekanath Bagul-Paryavaran Mitra-PM, village-Loni-Kh.

Even in severe drought, he used ½ Kg.seed and yield was 6 quintal in ½ acre. The seed was sold on request for Rs. 200/Kg. during severe drought in Marathwada region. At end of 16-17, Lokparyay has reached out to more than 200 farmers from Vaijapur and Soyagaon.

Ghungarya Bhuimug: Dipak Bagul, from Wadi-S. is one of the Bhil-tribal Karyakarta from Ajantha hills. His parents were using Ghungarya Bhuimug. They never purchased seed from market. After forest right was sanctioned to his family, first time he sold 6 payali i.e. 30 Kg. (traditional measurement system-1 payali (5 Kg.) Ghungarya Bhuimug seeds for Rs. 200/Payali to the SC-ST farmers from adjacent area. It was one of assured source of income during drought period. Next year was severe drought. They sold 38 Kg. for Rs. 70/Kg. to the farmers from villages-Kinhi, Dastapur. Same year they sold 75 Kg. peanuts for Rs. 100/Kg.to one of the institutions. The yield is minimum 10 quintal in 20 guntha (½ acre.) and it gives 6 quintal peanuts. Total turnover of Ghungarya Bhuimug seed was 213 Kg. during 3 years. Now it has become main source of income. Total turnover during four years was 167 Kg. and it was sold for 58 farmers.

Photo Bank with process documentation: Lokparyay has developed its Photo Bank of selective photos during MGBP Period-2014-19, as a process documentation. Lokparyay has shared the photos for website and Photo Bank developed by CEE, Pune.

"ZELTA" (Catcher) a periodical was published. Library on "Bio-Diversity and Eco restoration" has been developed at Lokparyay-MGBP Office at Aurangabad. More than 150 books on various topics are collected.

Agricultural biodiversity

Details of sampling methods

Objective: To study the change in biodiversity and livelihood status of tribal families during five years period of MGB Program,

- Selected villages and Tapu for survey: Two main villages 1) Parala (Taluka-Vaijapur), Three Tapu and 2) Wadi-S. (Taluka-Soygaon), one Tapu
- Selected families for survey: 30 families from 4 Tapu
- Forest land from Village-Parala is completely barren and comparatively forest is moderate in village-Wadi-S.

Variables used during selection of families

1) Seasonal water facility from well (protective irrigation),

2) Seasonal irrigation from natural flow of river / stream only in rainy season,

3) Organic farming by using traditional seeds,

4) Soil and water conservation activities on agriculture land,

5) Children attending schools,

6) Some of the couples are migrating as a harvest labor,

7) More than four years old trees-biodiversity on bunds of the agriculture land.

8) Only shrubs are in agriculture land,

9) Regular salary remuneration from forest or any other source,

10) Sale of traditional seeds like onion, pepper, Bajra, Maize, etc,

11) Sufficient fuel wood in agriculture land,

12) Income from traditional poultry, Goat rearing, or dairy business,

Minimum two families of each variable were identified.

Main source: Two methods were used. 1) Collection of information by filling the forms of every family, (Annexure-4), 2) Qualitative information by interviewing community leaders,

Secondary source: Published Booklets, News, Govt. reports.

Unintended outcomes

i) Bhil-Tribal farmer families who migrate as the harvest labor every year have started to continue the education of their children at the zilla parishad schools from the village. Students passed matriculation and are going to colleges at Aurangabad.

ii) Tribal families are enrolling their kids in new Anganwadi. The background of this process was initiated from 2010. Lokparyay published its report on malnutrition of women and children from Bhil-tribe community in 2012. This report was widely published in new papers. The Marathi daily Sakal published special supplement on this report. Health camps with the help of PHC, Loni-kh., Shivoor were organized at village-Bhadli, Vakla, etc. adjacent villages under MGBP.[10] Then, it was considered seriously by Mr. Kunal Kumar, then Collector of Aurangabad and the Chief Executive Officer-CEO, Zilla Parishad, Aurangabad. At that time, Lokparyay asked for two main demands like regular visits of Integrated Children Development Scheme-ICDS Staff and initiation of new Anganwadi at the villages Parala and adjacent hilly area. After continuous follow up, 15 new Anganwadi were sanctioned in the same area during 2013-14.[11] There was a rigorous campaign on education particularly tribal children under MGBP since 2014 onwards. Even Lokparyay offered its hall constructed for Bal Anand Jeevan Shala (Childhood Care & Development Center) at Community Bio diversity Park, Parala-Junone. It has been one of the main activity centers of environment education for students.

iii) Thakar-Bhil-Tribal communities from the adjacent village-Kasari-Bortale (Taluka-Nandgaon, district-Nashik) started to collect various types of stones-agates from their hilly area. during the project period. But they have no scientific information about it.

iv)The leaders particularly youngsters of Thakar-Bhil-Tribal communities from the Kannad taluka took initiative to implement Forest Right Act-2006 (FRA). It was started by distribution of more than 400 caste certificates to Bhil-tribe from Chimnapur and other villages. The Sub-Divisional Officer-SDO, Tahasildar, Kannad and Lokparyay team was invited as guest for the community gathering at Chimnapur. The community leaders who took initiative were participants in each and every public programme at Community Bio-Diversity Park, Parala-Junone. All programmes were organized by community contribution.

v) Mr. Sheshrao Sonavane, Bhil tribal youth leader from Chimnapur and his wife Vithabai, Police Patil have started to collect information about traditional Mango varieties.

vi) ***Fishery Society:*** Lokparyay has claimed community forest right-CFR on four Tapu from villages-Parala and Wadi-S. Most of the Bhil-tribal families have got individual forest right under FRA. But as a community they are enjoying community right of fishing from villages-Parala, Wadi-S. and adjacent villages. Initially, Bhil from Villages-Parala and Wadi-S.asserted their traditional right over fishing at Manyad Storage Tank, Parala and Nimchouki Irrigation Tank at Wadi-S. They did it peacefully by arguing on the basis of FRA-2006. Lokparyay just build up their confidence and guided them on the basis of FRA-2006. Then the impact observed was tremendous. It can be visualized at working area under MGBP and outside also.

Process at Wadi-S.: Dipak Bagul, first graduate, youngster from Bhil community and gram Panchayat member took initiative in implementation of FRA. After success under FRA, he mobilized youngsters who were fishing but they were not enjoying their traditional right over fishing at irrigation tank, Nimchouki, Wadi-S. They have work under Maratha leadership. Bhil families from Wadi-S. were sanctioned forest right under FRA. But the Bhoi community was landless labor. On this background, the Maratha leaders succeeded to develop conflict between Bhil and Bhoi communities. At this moment, Lokparyay applied its strategy to develop friendship within these two communities. Though Dipak was Bhil youth, he skillfully convinced his community on forest right as a major source of income. After continuous dialogue and interactions within these two communities he succeeded to bring both these communities particularly youths together. He defeated the usual divisive political strategy of Maratha leadership. Now 15 – 16 families from both communities are fishing at Nimchouki tank without any conflict since 2015.

They took one of the interesting decisions that any family from the village can collect up to maximum 3 Kg. fish for its consumption. But if it goes beyond this weight; the particular family has to pay 5% commission in cash to the fishery society. The second important understanding is both the posts chairman and secretary is alternately distributed among Bhoi and Bhil communities since 2015. Fishing is the only source of income for Bhoi community.

Based on this encouraging experience, at the insistence of Lokparyay, Aurangabad district Fishery Officer through Project Officer, ITDP and Collector, Aurangabad issued special order to all fishery societies in adjacent villages. It is applied to 10 irrigation tanks from 22 villages including area under MGBP. Near about 15-20 tribal families from every village are enjoying their traditional fishing rights. Due to Lokparyay initiative, fishing has become the major source of income for minimum 320 families.

There are traditional fishes like Ger, Kundher, Tathe, Male, Murya, Vam, Kire, Dok, Crab, Zinge fishes in these tanks. It is observed during last many years that traditional zinge were eaten by the new variety of fishes supplied by fishery department. Based on this experience, the community prefers traditional fishes along with new fish varieties like Kombada, Katla, Lalpari, Ravas and Mangur.

Process at Parala: Lokparyay arranged the interaction between the community leaders from Wadi-S.who successfully handled the issue and youngsters from Bhil community. Then Bhil community particularly youngsters raised the issue of traditional right over fishing in Parala Gram Sabha. Immediately youngsters started to assert their traditional fishing rights. So, Maratha persons had to quit their control over fishery in Manyad storage Tank, Parala. They never interfered since 2015. This shifting was peaceful because Maratha persons and their community experienced the power of Gram Sabha and FRA in favor of tribals.

Now, every family from Bhil community is earning minimum Rs. 70-80 thousand per year. It has become major source of income for more than 35 Bhil families. Besides that, every family is consuming fish minimum 2 to 4 Kg. per week. They are selling maximum fish to the traders at bigger market at Nandgaon (district-Nashik). The rate is Rs. 140/ per Kg. and the rate in the village is Rs. 150 to 200 per Kg.

Entire traditional fishes (Gaonran fishes) except "Ger" are eaten by the new varieties of fishes given by Government to the Society. The main reason shared by the community is the traditional fish called "Ger" is more agile. The maximum weight of Ger is only 250 grams. There are new varieties like Komda, Mirgal and Rohu in storage tank. The maximum weight of these new fishes is 50 to 60 Kg. each.

Seven to eight women from Bhil community are engaged in collecting Zinge a traditional fish at upper stream of Manyad river at village-Vadji. Every woman is collecting minimum 5 Kg. cleaned and dried zinge during the season i.e. six months. The rate is Rs. 200/Kg. Their main income is agriculture production and income from zinge is supplementary. Dnyaneshar More, Lokparyay Karyakarta and a youngster from Bhil community is their leader.

Geological diversity: In addition, we identified some stones which constitute geological diversity. Prof. Ajit Vartak with CEE Team identified these stones in Manyad river basin-hilly-forest area. These are as follows:

1) Agate, Banded Agate

2) Quartz, Rose Quartz

3) Apophyllite

4) Amethist-purple

5) Scolecite - Very small needle-shaped crystals

6) Calcite, Green calcite

7) Heulandite

Qualitative impact

i) Reduction in migration: After getting forest right to Bhil-tribal community under FRA-2006, Lokparyay implemented planned activities related to livelihood, like traditional poultry, regular use of traditional seeds like Usvad Bajari, Red Onion, Ghungarya Bhuimug, etc. in agriculture, developing dairy of traditional cow, goatery, irrigation well, soil and water conservation activities, increase in traditional fish like Murya, etc., crabs, zinge, more use of these NTFPs, protection of shrubs for fuel wood and forest vegetables (Ranbhaji) and change in traditional business, etc. So, at the end of 6th year, it is observed that the migration is reduced to 67%. Continuous dialogue and exposure tours with families including young generation, encourage to shift over migration as harvest labor to develop their own alternative source of income. It also encourages educating children from tribal community. It is shown in Table 8.

Table 8:

% of reduction in migration of families during 2013-14 to 19-20			
Family basti no.	**Total families surveyed**	**Reduction in migration of families**	**Reduction in migration of families %**
1	5	5	100
2	3	2	66.67
3	4	3	75
4	2	1	50
5	5	4	80
6	2	1	50
7	5	4	80

% of reduction in migration of families during 2013-14 to 19-20			
Family basti no.	**Total families surveyed**	**Reduction in migration of families**	**Reduction in migration of families %**
8	5	4	80
9	4	2	50
10	3	2	66.67
11	3	2	66.67
12	3	2	66.67
13	7	5	71.43
14	3	0	100
15	5	2	40
16	5	2	40
Total families	**64**	**41**	
Total reduction in migration of families			**67.06%**

ii) Continuation in education of children from migrated tribal families: Lokparyay is running Bal Anand Jeevan Shala-BAJS (Childhood Care & Development Center) at CBDP, Parala-Junone since last six years.[12] Simultaneously, Lokparyay is trying to convince migrated tribal families and their community on "education is a basic right of every child". Now, they are enrolling their children's names in either Adivasi Ashram Shala or Zilla Parishad schools in their own villages. BAJS is managed on 100% urban community like profesors, doctors, etc. from Aurangabad.[14]

iii) Reduction in child marriage of Tribal Girls.: Lokparyay under MGBP, organized various campaigns. One of the positive campaigns was "Give education to your daughter up to twelth standard. Not all but few families agreed. Even some are convinced beyond that like Kantilalbhau-Alkatai More, an ideal Bhil-tribal family from Parala. Their daughter Maina and her two sisters are in college at Aurangabad. Sunita, a single widow mother & one of the Bhil-Adivasi Activists from village-Avvalgaon, gave education to her daughter Sapana up to graduation. It reduces the proportion in child marriage. Migration as harvest labor encourages child marriage in Bhil tribe. She is now Zillah parishad member from Shivoor circle.

iv) Women's Participation in decision making process at Panchayat Raj: Like many other training camps & campaigns, Lokparyay organized training camps under MGBP on "73rd Constitutional Amendment" at BDP, Parala-Junone. The girls like Sapna participated in the camps. Graduate Sapna from Bhil-tribe was invited by many political groups to fill the forms for the Z.P. reserve seats. Sapana from Sivoor and Shobha from Vakala (one of the villages under LP-MGBP project area) were elected as ZP Members on Aurangabad Z.P. Now, it became easy to get some Govt. schemes for SC-ST-VJNT communities. Thus, tribal women are participating, but slowly, in decision making process at Panchayat Raj Institutions.

Quantitative impact

1) One of the parameters is no. of species regenerated and protected by individual farmers' v/s on the forest land. During the MGBP period-2014-19, Lokparyay has collected the list of the Tree-Shrubs-Grass-Liana-Forest vegetables (Ranbhaji) on the agriculture land and its bunds. Farmers have regenerated and protected total 28 tree species, 18 types of Shrubs, 22 grass species and 18 forest vegetables (Ranbhaji); where only few species are in forest land which is controlled and owned by forest dept.

2) The second parameter is documentation. About traditional knowledge of NTFPs, their study and its process.

Lokparyay has collected information about seven NTFPs like Karvand, Tendu Patta, Bhutya kes, Color from Palas flowers, Gum, Fuel Wood & Zinge (small prawn) including Forest vegetables (Ranbhaji) from villages Parala and Wadi.

Processed: Lokparyay has processed one NTFP i.e. natural color from Palas flowers.

Sale of organic agriculture production: Lokparyay has tried to sell three organic agriculture products like Usvad Bajari, Red onion, Ghungarya bhuimug along with color of Palas flowers.

Socially committed market: Organic Agriculture productions like Usvad Bajari, Ghungarya Bhuimug, Red Onion, teel are sold at Aurangabad. Meetings of women networks are organizing to develop "socially committed market-So-Co-M" for such productions at Aurangabad. The powder of Palas flowers as natural color was totally purchased by CEE, Pune in 2016.

Lokparyay is trying to develop So-Co-M since 2013. Awareness towards organic-natural food and other productions is increasing among urban middle class. So, the experts and rural community should develop such urban committed market. Before that small and decentralized experiments should be developed. Various women organisations, trade unions along with Government staff could be potential class for this market.

Community participation

Lokparyay has live dialogue with community. Tribal community is cultivating forest land since Nizam period.[15] "Bi-diversity & Eco restoration" under MGBP was initiated with tribal, VJNT, SC communities; it was observed that the communities did not catch the concept and activity behind it. So, the community participation was just passive. On this background, Lokparyay initiated the MGBP process with association of their livelihood issues like to develop urban market to their organic agriculture productions, special attention on issues related to FRA, live dialogue with Govt. departments, education of the children from migrated harvest labor families, assertion on soil and water conservation activities under MGNREGA, organization of Ranbhaji competitions, celebration of social days, etc. Then at the end of four years, Lokparyay has observed that there is tremendous change in attitude of the communities towards "Biodiversity & Eco restoration" on their farms and around forest area. Simultaneously Lokparyay organized many study tours on their livelihood issues. In this way, Lokparyay succeeded to get more support from these communities.

Lokparyay succeeded to regenerate 31 (36.47%) of initially identified rare plant species on private agriculture-forest land as well as on adjacent forest land owned by forest department and in Community Biodiversity Park. Community is protecting these species on their own.

Role in designing or reshaping the work: Tribal community including community leaders from adjacent villages played important role in selection of seedlings, plantation, supervision, carrying for plantation on individual bunds of their agriculture farms and guidance to CBDP care karyakarta.

Lokparyay consulted regularly with community leaders, both men and women. They suggested that Lokparyay should develop demonstrative model for them. So, it was decided to develop the model "Community Bio-diversity Park-CBDP" on 1 hectare at Parala-Junone. Community started to join & contribute to CBDP about selection of species, and method of caring the plants in drought. Thus, the MGBP was actually shaped by the community.

Lokparyay regularly organized community meetings on need of biodiversity on the bunds of agro-forest land allotted under FRA. More than 5500 seedlings were distributed to the farmers from Manyad river basin. More than 36.47% seedlings were protected on their bunds and on the demand of community, 25 plant species are newly planted over bunds of agriculture land as well at Community Bio diversity Park.

Management of common (shared) resources

There are many unwritten, oral traditions of community to manage their common resources. They are carried from one generation to next one. Some of them are as follows:

Forest: There is common understanding about not to touch any private tree and their fruits, etc. If any farmer needs a particular small branch for making agricultural equipment like plough, leaves, flowers, etc; he/she asks to the owner (woman or male farmer) to get permission.

The Tribal farmers have voluntarily planted few local tree species on degraded forest land which belongs to forest department. It is just adjacent to their individual agriculture-forest land allotted under FRA. Some of the good examples from tribal farmer families are like Subhash Shripati, Chabubhau More (Tapu-Henkaldara), Kantilalbhau More (Tapu-Tapakyache Lavan), Sumantai More (Manyad vasti, near Manyad storage tank), etc. from village-Parala.

Fishery: Most of the Bhil-tribal women catch zinge at the upper side of the river streams. At the same time tribal youngsters go for catching fish at Manyad Storage Tank or irrigation tank on Manyad River. But there are no any conflicts on their traditional rights over fishing. But they are exploited by semi-rural-semi urban leaders from political, landed community. And it is observed in many villages like Wadi-S. 102 km. away from Parala.

Initially, it was observed that most of the community leaders who were engaged in fishery under the fishery society controlled by political-established leadership. So Lokparyay was interacting with Bhil-tribal community leaders that traditional right over fishery can be reestablished under FRA-2006. The same act

and its rules were applied during forest right. Then community leaders were convinced and asked the political leaders to leave the control over fishery right. Tribal community leaders started to assert their fishing rights in Manyad storage tank without consulting the political leaders. Bhil tribe leaders are enjoying their traditional fishing rights since 2016.

No one goes for fishing during breeding period of fish even in financial worse conditions. Understanding behind fishing is to continue generation cycle of fish.

Lokparyay has skillfully handled conflicts in fishery societies over Manyad storage tank, Parala and Nimchouki irrigation dam at Wad-S.

Now more than 20 families from Bhil, Bhoi communities are getting fish from these water bodies. But only Parala families can sell the fish in Nandgaon market. 10-12 Bhoi families from the village-Varthan, (which is 4 Km.away from Wadi-S.); have regular income. Bhil families from Wadi-S. can only eat the fishes in front of Fishery society members. Five women are getting income from Zinge.

Water: The politically strong community always controls water resources for agriculture. This community collectively operates for their common interests on irrigation facilities. SC-ST-VJNT communities are always neglected. Lokparyay is thinking to initiate the process to claim equal water right for SC-ST-VJNT Communities over Manyad storage Tank at Parala. But it is not comparatively easy like FRA & Fishery. Most of the landed community which governs Gram Panchayat uses this water for sugarcane agriculture. Because of SC-ST-VJNT equal claim over water resources will disturb their financial power. Using their contradiction within themselves and socio-political power of these discriminated communities, the movement over equal water right should be developed. Then only the issue of livelihood with dignity would be addressed properly. This is a potential but inevitable conflict in near future.

Social conflicts

As mentioned above, Tribal community is enjoying individual forest right. But the Dhangar community never tolerates this type of social change. They destroyed the crops in agriculture land got under FRA. This is the actual social conflict. There is no any conflict in between villages but between Tribal & Dhangar community.[16]

Though Dhangar community is from VJNT community, Lokparyay supported Bhil community. When some of the khillars (the Dhangar persons who are roaming with sheep) attacked on Tribal farmers whose crops were destroyed, Lokparyay guided those farmers to lodge the complaints against culprits. Now Dhangar community is ready to claim CFR at their villages. Joint meeting with these two community leaders was organized. Then cordial relationship between these two communities was established.

The methodology and thought process followed behind this issue by Lokparyay; through continuous dialogue, mutual faith was created about mediator. He/she was accepted by both the communities which are involved. It creates faith over leadership. The issue of tribal community was re-establishing on their traditional right over forest land for agriculture and the Dhangar community issue of grazing land for their sheep was resolved. Then the leadership asked the Dhangar community to follow the FRA to get their traditional community forest rights over forest land for grazing rights. Thus, the conflicting issue was resolved.

Conservation of social fabric

After continuous meaningful dialogue with Dhangar community the Dhangar from the villages from Talwada (taluka-Vaijapur) and Kasari (taluka-Nandgaon, district-Nashik) requested Lokparyay to initiates CFR process under FRA process along with Government managed facilities mentioned in Chapter-II (section-3).2 under FRA-2006. Maximum 2.5-acre (1 h.) forest land can be diverted for thirteen facilities like schools, hospitals, anganwadi, fair price shops, water tank, etc.

On this background, Lokparyay has initiated CFR process for Dhangar community from Nandgaon and Vaijapur taluka. Now it can be easily observed that there is normal and mutual understanding between Dhangar and Bhil communities. More important aspect of this relationship and atmosphere is good to develop Eco-restoration in Manyad river basin-forest area at Parala as well as adjacent villages. Simultaneously Lokparyay is organizing Ranbhaji competitions for entire women community from villages. It is creating awareness towards biodiversity on their agriculture lands. So, women from all communities and their family members are encouraging their sons and daughters to participate CEE activities in their schools. Thus, social fabric helps for environment education and Eco-restoration.

Global factors are encouraging and propagating marketed seeds, chemical fertilizers, pesticides and discouraging local, traditional seeds in agriculture. Monoculture is used in forest like Gliricidia. Conflict and gap between urban and rural culture is increasing. Crisis about fuel wood has become very critical. All these global-local issues are disturbing biodiversity. So, there is need to establish social fabric among all communities.

Traditional conservation and harvest practices

Bortale (village-Kasari, taluka- Nandgaon, district-Nashik) Bhil-Thakar-tribal colony is situated on the top of the hill of village-Kasari. Forest right was sanctioned for these communities. Their colony is also situated for 60 years. There is no electricity. Primary school is sanctioned during 2012. It is completely in forest land. So, Deptartment was not allowing land for electricity poles and school.

Lokparyay initiated the process under FRA since 2015.

Kasari Gram Sabha passed such resolution. Though Dhangar community is majority in village-Kasari, it is giving full support to Bhil-Thakar communities. This is the positive impact of Lokparyay soico-political combination of SC-ST-VJNT Communities. Communities from Bortale organized various programmes for their demands including CFR along with Dhangar community leaders. Lokparyay guided them. Tahasildar sanctioned their first demand –permission for electricity poles through forest land. Immediatly forest department sanctioned their forest right under Forest Right Act, Chapter-II (section-3).2 under FRA-2006. SDO being head of taluka Forest Right Committee sanctioned the same forest right. And now entire tribal colony in forest is electrified. Lokparyay has initiated the process to claim forest land for school along with CFR.

Innovations and technology development by people

Total forest area under forest department has hardly few trees, shrubs and grass species. So, there is no question of traditional methods of conservation. But the tribal farmers are protecting many plant species on their bunds of the private agricultural land. During MGBP process, they shared their few but bitter experiences with Lokparyay Karyakarta that forest department never consulted with them in conservation practices. They were just asked to work as labor (foreigners?) in forest activities. Simultaneously they were expressing their emotional feelings on conservation of various tree species on their farm bunds. This individual forest right was sanctioned after continuous efforts since last forty years. Lokparyay asked them to select their own species. So, they are interested in conservation process.

On this background, some of the farmer families diverted natural flow of river-nala water for irrigation for agriculture land as well as for this type of conservation, without Government assistance. They are applying their common sense, traditional knowledge and experience.

Relevance of history in conservation practices

British policies on forest and agriculture destroyed the traditional Forest and agriculture system. Since then the revolutionary farmer and social reformer Mahatma Jotirao Phule from Junnar taluka of Pune district vehemently criticized these anti-people policies.[17] After independence, Maharashtra Government tried to follow his vision like Soil and Water Conservation Programme called “Mati Adva, Pani Jirva” (soil, and water conservation) under Maharashtra Employment Guarantee Scheme-EGS.

Ahilyabai Holkar, the state's woman from the village-Chondi, Maharashtra and Indore state (Madhya Pradesh), who had developed many natural water sources by constructing many tanks on her way to Indote to Chondi her birth place in Ahmednagar district. One of the best examples is Ahilyabai Holkar tank near Ghrushnewar Temple at Verul, District-Aurangabad.

Shivaji Maharaj, the King from Maharashtra ordered regarding the conservation of forest. Saint Tukaram wrote famous Abhang (poem) describing natural relationship between human being and the trees and shrubs.

Table 9: Beneficiaries Demography

No.	Sex/Caste	Total Population	% of population
1	**Total population in 12 villages**	30422	
2	Total population-Male	15862	**52.14%**
3	Total population-Female	14560	**47.86%**
4	**Total SC Population**	2650	
5	Total SC-Male	1443	**54.45%**

No.	Sex/Caste	Total Population	% of population
6	Total SC-Female	1207	**45.55%**
7	**Total ST Population**	3797	
8	Total ST-Male	1981	**52.17%**
9	Total ST-Female	1816	**47.83%**
Banjara-VJNT & Muslim Communities and students from all 12 villages are involved in MGBP Programme.			

***(Source-** Census-2011, Government of India)*

Lokparyay had initiated the MGB Programme in 12 villages from Vaijapur and Soygaon taluka of Aurangabad dist. Total population particularly women in these 12 villages is involved in MGBP. It is communicated by continuous campaign on different events like weekly Bazaars, regional and village level Fairs, etc. The SC-ST-Banjara-VJNT communities and students from selected schools are directly participating in the MGBP. Village-Parala and Wadi-Sutonda are the main villages; where entire SC-ST-VJNT Communities are totally benefitted. All students from these twelve villages are directly benefitted under the Environment Education Programmes under the guidance of CEE, Pune.

Table 10: Benefits

Sr. No.	Benefit details	Benefits for the period	Measures to reassure that benefits to the community continue even after conclusion of MGBP	
1	Traditional seed Bank-TSB	Long term	More than 250 Farmers are using traditional seeds from TSB and addition of traditional seeds in TSB will be continued,	Sustainable
2	Nursery & distribution of seedlings	Long term	Yearly monitoring of how many plants are survived	External support needed for non-livelihood species
3	Preparation of natural color from Palas flowers	Long term	Submission of study report to tribal department and follow up through various types of advocacy.	
4	Special programme on Soil & water conservation activities under EGS-NAREGA through Tribal-Agriculture departments	Long term	Monitoring on repairing of water structures.	
5	Indira Awas Yojana, Ramabai Awas Yojana and through various departments like social welfare, Integrated Tribal Development Project-ITDP, Shabari Finance Development Corporation, etc.	Long term	Houses allotted should be in joint names of wife-husband & single woman.	
6	Irrigation wells* through NAREGA	Long term	Monitoring and measurement of water level every year. And training on recharging system.	
7	Farm Ponds-“Shet tale” for SC-ST Farmers	Long term	Monitoring & repairing of farm ponds through youth team & Govt. machinery.	

Sr. No.	Benefit details	Benefits for the period	Measures to reassure that benefits to the community continue even after conclusion of MGBP
8	Tractor scheme for SC Farmers,	Short term	No surety.
9	Guidance on supplementary businesses like traditional chickens' poultry, Cows, Collection of various NTFPs like Karvand, Tenbhurni, Mango, Jambhul, Tendu Patta, Gum, Colored stones-Agets-quartz, Organic pesticides, compost, etc.	Long term	Study & guidance on processing-marketing, quality control & various entrepreneurship programmes through Govt. departments.
10	Seed distribution through Krushi Vibahg,	Short term	No surety
11	Particular guidance on scholarships & Hostel* to Tribal students, particularly Girl students.	Long term	Rural Students' particularly girls from Tribal-VJNT communities' guidance Centre will be developed.
12	Community Agriculture Equipment Bank-CAEB	Long term	CAEB will be handed over to community.
13	Paryavaran Schools	Long term	Youth team will be formed to carry forward this activity.
14	Community Guidance Centre on various schemes related to Agri., laws, Training etc.,	Long term	Centre will be permanently established at BDP, Parala.
15	Family Counseling Center*	Long term	Loksamiti-Lokparyay is running this center since last 30 year. Now it will be systemized.
16	Solar energy*	Long term	Guidance to the SC-ST Community, so that they will switch over to the alternative source of energy. Decentralized form of community models will be developed in Manyad river basin.
17	Bio-diversity Park-BDP	Long term	Lokparyay with community and Gram Sabha will try to get CFR and BDP would be developed in forest area.

Lokparyay has mobilized and tapped from various Government Schemes and Private organizations like Rotary of Aurangabad-Elite for Agriculture Community Equipment Bank-CAEB; for Solar power panel of lighting, Mr. Padma Tapadiya, the builder from Aurangabad generously made it possible; the Solar heater for BAJS was donated by Reliance workers, BAJS is run by the public contribution at CBDP, Parala-Junone.

People's preference for livelihood species

Community preference for livelihood is for fruit trees like Mango, Tamarind, Guava along with Bamboo, Hadga, Tembhurni, seeds like Ranbhaji & various types of fodder as well as fruit species.

CFR Experience

Lokparyay is working on CFR since last more than 5 years. But there is least response from both the forest as well as revenue departments to sanction it. On the contrary, most of the cases are treated under "Beneficiary Forest Right" as CFR! There are three types of forest rights mentioned in FRA. 1) Individual Forest Right, 2) Community Forest Right and 3) Beneficiary Forest Right.[17] At least, Tribal community is asked for claiming such rights. But no one from Dhangar community guides them to claim on CFR. It gives chance to anti-social elements to create conflicts between Tribal, Dhangar and general communities from village.

Conservation strategies

Lokparyay has developed Community Bio diversity Park-CBDP at Parala-Junone as a model for community. The objectives behind it were 1) to develop the concept CBDP and make it visible to the ST and forest dwelling community. 2) To encourage ST and forest dwelling community to assert on development of such BDPs in forest area through Gram Sabha.

Secondly, every year, Govt. through forest department is declaring ambitious plan of plantation. But there is no further plan for at least four years to protect these plants. On this background, Lokparyay will submit a plan for their protection under Employment Guarantee Scheme-EGS or MGNAREGA at least for Manyad river-forest area through Gram Sabha.

a) Non-monetary engagement with the forest

The relationship between forest department and ST-forest dwelling communities decides how and in which way sustenance is achieved. To achieve it by non-monetary engagement with forest, there should be the active participation of these communities (not entire community in the main village in OTSP area!) in each and every activity in forest area. e.g. selection of plant species, soil and water conservation activities, protection and conservation of forest like supply of water, to develop moisture content in the dry area like Marathwada, permanent source of income to the community, special training on NTFP processing and marketing, financial assistance to those who are trained, to develop alternative source of energy like solar power energy, alternative income sources like "natural-farm house", living with the nature club, etc. should be developed.

Based on last experiences particularly during MGBP period, every tribal farmer who is cultivating forest-agriculture land should be encouraged to plant, protect and conserves the various species on their farm bund as well as adjacent forest land with the joint management.

Then and then only sustenance of ST and forest dweller communities is possible by non-monetory engagement with forest. Implementation of the programme on "Bio-Diversity and Eco restoration" on private farm is one of the effective ways to get active involvement of community linked with their livelihood.

List of Publications and presentations

i. "ZELTA" a periodical is published in Marathi narrating Lokparyay activities under MGBP.

ii. A paper on "Community Bio- diversity Park: The Visual Demonstrative Model on 'Bio- Diversity and Eco restoration' for community" was presented in Fifth Bharatiya Vigyan Sammelan and Expo on 11-14th May-2017 at Fergusson College, Pune. The paper was published in its Souvenir.

Two stories on "understanding about scientific knowledge of community associated with agriculture in forest hilly area."

b) Networking

Some of the organisations of thematic group (Bio-diversity and Eco restoration) MGBP are trying to form network based on experiences since last 5.5 years. CEE, Pune has taken initiative. One of the major components will be environment education.

Outreach

Lokparyay has good, live communication and emotional binding with the people particularly ST-SC-VJNT communities from seven talukas of two districts-Aurangabad and Nashik. 12 villages which are direct beneficiaries in MGB Programme since 2014. But as mentioned above, all other taluka and villages are involved in social movement under different forums formed by Lokparyay-Loksamiti since last 42 years.

Lokparyay has not much outreach at international level networks but has national level network on forest rights. Lokparyay is a member of VJNT and women network from Marathwada region. Lokparyay was one of the partners in designing Pardhi Vikas Arakhada (Pardhi Development Plan) under the institution Centre for Social and Rural Development-CSRD, Ahmednagar.

Lokparyay is joining hands with networks like Maharashtra Bhatke-Vimukt Manch-MBVM along with NTFP Forum initiated by one of NGOs Econet, Pune.

1) MBVM: "Maharashtra Bhtake-Vimukt Manch" is a forum of many organisations initiated by ECONET, Pune which are working with Pardhi and other VJNT communities. After continuous follow up, Maharashtra Government passed a GR on regularization of Gairan land under houses. So that, it would be easy to get sanction for housing schemes under tribal & social welfare departments.

2) NTFP Forum is a forum of different organisations which are working on various aspects of NTFPs and tribal community. The process was initiated during last decade at Aurangabad by the NGO called ECONET, Pune. Now, Econet has asked old organisations like Lokparyay to restart new process on NTFP and Lokparyay had responded positively.

Knowledge-related outcome

Scientific inquiries

As stated above, Lokparyay has solid community base. So, with the help of communities following activities would be taken forward.

i) A model of non-formal individual-community Forest management with their livelihood is under process. Lokparyay needs more than three-four years' time period for its visibility of impacts on the ground.

ii) The process of initiative, preparation and completion of one of PBRs would be continued.

iii) Lokparyay will try to develop and protect Natural Community Bio diversity Parks in and around Manyad River-Forest hilly area from Vadji to Vakla-Kasari-Bortale i.e near about 20 km. area.

iv) Environment education Programmes in Government schools.

Interesting / unknown/ unrealized facts

Lokparyay realized that community is taking initiative in conservation of forest. They have their own understanding about participation in conservation which is directly related to their livelihood. So, interesting stories but usually called as rebellion attitude of the tribal community are observed during MGBP period.

There are few examples in the village-Parala and Wadi-S. e.g. 1) some of the Bhil families have started to conserve and protect various plant species on the land owned by forest dept. and adjacent to tribal agriculture land. The forest staff is taking objection for this type of activities. But the fact is that they have done it without any support from Govt. or forest dept. In that sense, these tribal families are showing rebellion attitude.

Traditional knowledge/ wisdom:

As mentioned above, two strong stories are written by Lokparyay. Simultaneously it was observed the tribal children-students from forest-hilly area have vast knowledge and understanding about biodiversity and their surroundings.

Lokparyay is collecting various stories about Bhutya kes, a tree species which vanished from village-Wadi-S. Dr. Yadav has identified more than hundred plant species only from the area of just three acres of land; where local community only knows 15-19 species. And at the same time, Prof. Vartak identified 6.5 crore year's oldest stone made by volcano from Manyad river basin-forest-hilly area of Parala.

Lokparyay is thinking to develop stone museum at CBDP, Parala-Junone.

Realizations about human nature/ human- nature relationship

Every rural community particularly the ST & forest dweller community has its unique relationship with nature. The community always looks it in terms of their livelihood. It tries to adjust accordingly. It manages to fulfill its every need except oil, salt, etc., according to the nature-seasons. Forest based communities always try to find out various ways to overcome natural calamities.

But it is also observed that though it has glorious history of traditional community forest right; individual ownership spirit even in tribal-VJNT communities is the same as other communities. And this is the worldwide phenomenon. If any community comes in to contact of modern education system and world full of technological advancement, then it is impossible to keep them isolated from entire world. In that sense, though their example of the community forest management and their concept are emerged as ideal but not replicable!

There should not be conflict between sense of community and individualism. If you think in change in global, modern scenario, then keeping basic principles intact, old concepts should be reframed in new context like community spirit and individual spirit. Historically, there was great debate in this context but in different-political context.

On this back ground, the livelihood issue and conservation concept must be linked directly with each other. Lokparyay wants to state that only Community Forest Right should not be addressed. We have to understand its growing needs and expectations of the new, educated, tribal youth. It does not mean that Lokparyay has its complete model. But Lokparyay wants to work on this line in future.

Observations about ecology- regeneration/ depletion / conservation

The observation since British period, i.e. 18th century, is that there is no any period where anyone can show increase in bio-diversified- green cover. Still huge amount of money is spent on regeneration.

On the contrary, the traditions followed by communities at various places in all over India like Private Forest in Raigad, Ratnagiri-Sindhudurg districts of Konkan region, it is observed that such areas are full of bio-diversity without any support from the Government, etc. These are ideal models in biodiversity. So, there should be rethinking of role, responsibility and community participation in forest management.

New understandings/ philosophy/ realizations emerged

i) The feelings of individual ownership are most powerful than community feelings.

ii) This is the cumulative impact-effect. It is the driving force of modern-industrial development model.

iii) The present education system should be redesigned in such a way, where the educated youth can easily co-relate him/ her with the tradition along with new technology. There should not be contradiction between them. They can develop completely new concepts with Bio-diversity and Eco-restoration. The 2011 census of India shows that the percentage of urban centers has

gone up to 45 to 48%. It is also observed that during weekend most of the families are moving towards green centers like Lonavala-Khandala-Mahabaleshwar-Kulu-Manali, etc. So, it disturbs the transport as well as traffic system. It shows there is urgent need to conservation and regeneration i.e. green cover at multiple sites.

iv) Simultaneously the urbanized-educated-so called modern human society has to run away from the urban-cement area towards forest-green area. This is the irony of modernism!!

v) So, accordingly, we have to change our age-old ideas without emotions and without compromising aim and objectives.

Species lists/inventory

The list of the plant species is attached (Annexure-1)

Environment education process with students & teacher community

1. Introductory highlights of characteristics of school education in general

Schools selected are in remote area except one ie. ZP. High school at Loni-Kh., Banoti, Wadi-S.

- Two types of primary schools & high schools. Some high schools are run by private institutions and some are Z.P. primary schools.
- Teachers' residence is at Taluka place except few at main village. So, except schools hours they have no any contact: No informal dialogue with students and community.
- No other extra activity to well-trained students from tribal, Nomadic communities.
- No regular public transport system from remotest area to main high school like Loni-kh, Shivoor, Vaijapur. It affects badly the girls' education.
- Govt. schools, high schools are in worse condition. No proper sanitation facilities exist. Some schools look like cattle homes even
- No proper attention on environmental education. No proper monitoring system. Etc.

2. Describe the participating school numbers in your cluster under MGB project with numbers and distances, logic behind their selection.

- Some of the selection criteria were schools near hilly area.
- Students from tribal, nomadic tribe communities are gradually moving towards education.
- Being permanent drought in Vaijapur taluka, proportion of migration as harvest labour is high in these communities.
- 12 schools out of 20 from main village-Wadi-S., and Parala clusters were active in Anandshala Shibir organised under CEE guidance including Community Biodiversity Park, Parala-Junone (Tal-Vaijapur). All schools in clusters from main villages-Wadi-S. and Parala are in radius of twenty km. (Annexure: 2)

3. Overview of training workshops for Paryavaran Shikshan Mitra and other members from your organization

Trainings at Patnadevi, Hivare bazar and Pune for PSM and other members involved in paryavaran education acquired new knowledge along with techniques like good, effective photography and various functions of camera.

Though PSM and members are from rural area and traditional farmers, Shivar pheri under guidance of CEE team, gave us insight about our own shivar (our surroundings, like birds, trees, liana, grass, butterflies, insects, river water, fish, frogs, etc.). It has changed our attitude towards nature. We came to known many new factors around our agro-farms and hilly area and river basin.

Training on Dashparni was very useful to PSM, PM, members as a farmer, at the same time they learned new technique to measure trees, grass, etc.

4. Overview of Anandshala Shibirs for schools in your cluster with representative feedback from teachers, students, parents

Mr. Subhash Pardeshi, most enthusiastic teacher from Wadi-cluster joined in Hivrebazar Anandshala Shibir. Actual project decided in Shibir was “Jhad Navache Gaon”. Plan was to select one big tree and observe entire things on it including insects, birds, aunts, squirrels, etc. and take note.

But in school along with all students, Pardeshi put an alternative plan. To prepare village names from trees. Name of altered project was ‘‘झाड नावाचे गाव.... झाडांत गावाचे नाव’’ (Jhad navache gaon----------Jhadat gavache nav)” And it was observed that students along with teachers were very much involved in this project. They completed it before time.

Idea on “Ranbhaji Mahostav” (programme on forest vegetables) was welcomed by teacher and students. On one of the Sundays, the students went in forest area and collected 22 types of Ranbhaji. The next day the vegetable was prepared and brought to school.

Types of Ranbhaji were Ambadi, Tandulkundra, Phang, Muthkule, Gholdashamya, Shevaga flowers and leaves, Chatni from Banana, Alu vade, etc. Most interesting thing was all students particularly girl students wrote recipe of all Ranbhaji displayed.

One of the objectives in environ education was to create

more interest among students-teachers, parents in such type of education. Students were admitting freely that first time in their school days, they could establish live dialogue with oldest persons like grand mother and aunt in their houses.

Same experiences were shared by students during competition on "Biodiversity in my agro-farm" by students from Sainath high school, Parala (Tal-Vaijapur).

Head master Mr. Choudhary and Mr. Malkar expressed the same views. Even they asked Lokparyay to organise such type of activities regularly in their school.

5. Discussion of Shivar Feri and local environment linked school projects done by students in the area

All students expressed that "Pitara" was very useful for them. First time they were handling camera and telescope freely. So, they could observe birds, leaves, flowers, squirrels without disturbing them. It was amazing experience. The informative material distributed during Shivar pheri, helped them to identify the names of the butterflies, birds easily.

Even girl students said that their parents were not allowing them to enter forest area. But because of continuous activities organized by Lokparyay-PSM, PM under CEE guidance, parents were allowing them with teacers & PSM.

6. Paryavaran Shikshan Mitra's key takeaways from educational activities

PSM along with PM said that the frequency of the various type of activities along with Anand Shibir must be increased. Lokparyay chairperson Mangal Khinwasara should take initiative to open dialogue with all lady teachers to take part in environment education activities. It will help to maximize girl student participation in the programmes organized in different parts of Maharashtra.

PSM along with PM and members who took part in pogrammes have requested CEE that this programme should be continued. CEE must guide them on regular use of Pitara and other things distributed during the period. PSM expressed regret on not completion of school biodiversity register-SBR.

7. Conclusive remarks by PIs on specific experience of these educational activities and general comments upon the role of education in developmental activities conducted by organization.

And suggestions on further strengthening education in your area by improving content quality as well as delivery.

As I said earlier, Lokparyay has enriched during MGBP period. Activities on environment education designed by CEE with PSM-Members are very interesting to student community. Some of the teachers are taking interest in these activities.

But the most important part in this process is that interested student community will pressurise their teachers to join in environment education activities. Few schools will take interest in future.

Few suggestions: 1) CEE must take lead to continue such activities, 2) CEE has long experience in this field. So, CEE must convince at least state govt. to give responsibility to CEE for monitor the subject teaching in schools its content, process, methodology, tools, etc. 3) Environment education must be linked with livelihood. So, young generation will take interest in this topic. Accordingly, CEE should take initiative to design its syllabus.

Database(s) generated

Data generation process by Lokparyay during the period in Relational Data Base Management-RDBM system under the guidance of Dr. Edalabadkar is completed. In this process total data generated under RDBMs is as follows.:(Table 11)

Table 11: Total Data generated

Table	Number of Records
1. Vill-biodiversity	137
2. Special_utility	121
3. Tapu_Information	4
4. Qualitative abundance of Species on Tapus:	159
5. Tapu_Transect for PCQM	40

Impact

on ecology: Community has planted and protected multiple species with no. of trees on their agro-forest land got under FRA. This is direct impact on ecology. The list is attached herewith.

on community: Tribal community particularly from Manyad river basin-forest-hilly area realized that they can regenerate barren forest land. They have full of confidence over developing more bio-diversity on their bund and agro-forest land.

on academia: Daily "Agrowon" is regularly publishing articles on various experiences, studies, findings during the process of MGBP period-2014-2019. So, academic circle including media persons are thinking seriously on this process.

Policy Recommendation

Five years for very unique experiment like MGBP is short period. Lokparyay is thinking that at the end of eight to ten years, policy level interventions are possible. At least, there will be some concrete data to share with Government.

RGST or MBDB, Nagpur along with any other Dept. should carry forward this unique process with same community based organisations.

a) The decision on preparation of Natural Color from Palas flowers was implemented only in first year. During first year, 90-liter liquid color and 9-kilogram powder was sold at Aurangabad & Pune.

After consultation with Lokparyay Karyakarta and community leaders, it was realized that there is financial availability for the SC-ST-VJNT communities from their Financial Corporations of Maharashtra Govt. But limitation is a proper guidance to the youths from these Communities. So, it was decided to study on Natural Color from Palas flowers as a model of processing NTFP. For this, village-Dastapur, one of the campaign villages under MGBP was selected. There are many Palas trees in its forest area. After study, the findings will be submitted to tribal department. The second important part is because of its profit, youths will be encouraged on more plantations of Palas and other species for this type of entrepreneurship at their own villages. So, it will directly help for regeneration and environment protection.

Parala and adjacent villages were to regenerate rare plant species on the barren land of forest. On the background of continuous drought in Aurangabad district from 2014 to 2019, Lokparyay could complete hardly any objective up to September-2018.

Way forward

Lokparyay Karyakarta and the team of community leaders are thinking to continue on three programmes. These are as follows--

Environment Education: Environment Education activities in the villages-Vadji, Parala, Bhadli, Talwada, Wakla, Loni-kh., Wadi-S., Banoti, Dastapur, Bormal, Kinhi, Palashi. Development of **"Community Bio-diversity Parks-CBDP"** at Manyad river basin-forest hilly area from the villages-Parala, Bhadli, Vakla and Wadi-S., Dastapur from Aurangabad district and at adjacent village-Kasari-Bortale from Nashik district.

a) People's Bio-diversity Registered-PBR: PBR in the villages-Bhadli, Talwada, Wakla, Wadi.

Community Forest Right-CFR: The process on CFR will be speedily completed in the villages Parala & Wadi. The new process in the villages Bhadli, Talwada and Wakla will be initiated.

Community & Individual Forest Management-CIFM: **"**Bio-diversity & Eco restoration" study and documentation of **CIFM** practices.

Fund raising initiative by CEE, Pune: CEE, Pune has taken initiative to form a Forum of few organisations like Lokparyay and to raise the fund to continue some of the activities of MGBP

Policy related Work

1) Forest dept. with State Bio diversity Board, Nagpur, Agriculture dept., Tribal dept., and other concerned dept. should join hands with MGBP partners to carry forward its programme.

2) The experiences on community forest management is best compared to lonely efforts of forest dept.

3) The forest dept. along with S.B. Board and community based organisations-NGOs can develop Natural Community Bio diversity Parks on hundreds of acres of barren forest land.

4) The small scale NTFP Processing Units can be established to generate assured employment.

Staff

Table 12: Lokparyay is working on MGBP with following staff-Karyaykarta.

Sr. No.	Name	Designation	Introduction	Date of joining	Date of relieving
1	Shantaram Pandere	Principle Investigator-PI	Working with SC-ST-VJNT Communities on their rights over natural resources as well as on life with dignity as full worker since last 40 years at Aurangabad & Nashik districts. He is from NT community.	01.10.13	31.03.2020
2	Ravindra Garud	Paryavaran Shikshan Mitra-PSM	Working with SC-ST-VJNT Communities on their rights over natural resources as well as on livelihood activities for life with dignity. He is one of the most talented staffs under MGBP. He is farmer from SC community	01.03.14	31.03.2020
3	Ekanath Bagul	Paryavaran Mitra-PM	Working with SC-ST-VJNT Communities on their rights over natural resources as well as on livelihood activities for life with dignity since last 35 years. He is He is one of farmers from SC community & engaged in experimenting on organic farming with traditional seeds.	11.11.17	31.03.2020
4	Bhima Wathore	Operator & office in-charge	Working as DTP Operator since last 10 years at Aurangabad. He is from SC community.	01.03.14	31.03.2020
5	Ramdas Battise	Accountant	Working as an Accountant since last 7 years at Aurangabad. He is from SC community.	01.03.14	31.03.2020
6	Pandurang Borade	Data operator	Engineer by degree. Now he is working as a part time with Lokparyay.	15.07.2019	31.03.2020

Annexure 1

List of active schools in main villages-Parala, Wadi-S. & adjacent villages under guidance of CEE, Pune.

Sr. No.	School name	Taluka & Village
1	Z.P. Primary School, Wadi-S.	Tal.: Soyagaon, Vill. Wadi-S.
2	Z.P. Primary School, Palashi	Tal.: Soyagaon, Vill. Palashi
3	Z.P. Prashala, Banoti	Tal.: Soyagaon, Vill. Banoti
4	Non Granted Tribal Ashram Shala, Banoti	Tal.: Soyagaon, Vill. Banoti
5	Hon.Yashawant Chavan Medium High School, Kinhi	Tal.: Soyagaon, Vill. Kinhi
6	Z.P. Primary School, Kinhi	Tal.: Soyagaon, Vill. Kinhi
7	Z.P. Primary School, Parala	Tal.: Vaijapur, Vill. Parala
8	Sainath High School, Parala	Tal.: Vaijapur, Vill. Parala
9	Z.P. Primary School, Vadji	Tal.: Vaijapur, Vill. Vadji
10	Z.P. Primary School, Bhadli	Tal.: Vaijapur, Vill. Bhadli
11	New High School, Talwada	Tal.: Vaijapur, Vill. Talwada
12	Vinayakarao Patil High School, Loni-kh.	Tal.: Vaijapur, Vill. Loni-kh.

Annexure 2

Community Biodiversity Park-CBDP, Parala-Junone

125, Identified Plant List (Tree, Shrubs, Grass) by Scientist Dr. S.R. Yadav and his research team, Shivaji University. Kolhapur

Sr. No.	Botanical Name	Family	Common Name	मराठी नांव
1	*Abrus precatorius* L.	Fabaceae	Gunj	गुंज
2	*Abutilon indicum* (L.) Sweet	Malvaceae	Shikka gavat	शिक्का गवत
3	*Acacia nilotica* (L.) Willd.	Mimosaceae	Babhal	बाभळ
4	*Acanthospermum hispidum* DC. Prodr.	Astraceae	Shankaroba	शंकरोबा
5	*Achyranthes aspera* L.	Amaranthaceae	Aghada	आघाडा
6	*Albizia amara* (Roxb.) Bovin	Fabaceae	Lalai	लळई
7	*Alternanthera tenella* Colla	Amaranthaceae		कुसळ
8	*Alysicarpus heyneanus* Wight & Arn.	Fabaceae	Modha shevara	मोढा शेवगा
9	*Ammannia baccifera* L.	Lythraceae	Kala maka	काळा मका
10	*Andrographis paniculata* (Burm.f.) Wall.	Acanthacceae		आकाश (अकथेसिए)
11	*Andropogon pumilus* Roxb.	Poaceae		साखर गाई (गवत मुख्यत: ज्यात चरबीचा समावेश असलेली वनस्पती)
12	*Apluda mutica* L.	Poaceae	Bondi	बोंडी
13	*Argyreia* sp.	Convolvulaceae		गारवेल (हरणपदी कुल)
14	*Aristida fulvosa*	Poaceae		
15	*Aristida funiculata* Trin. & Rupr.	Poaceae	Lahan kusali	लहान कुसळी
16	*Aristida hystrix*	Poaceae	Barik kusali	बारीक कुसळी
17	*Aristida redacta* Stapf	Poaceae		
18	*Artabotrys hexapetalous* (L.f.)	Annonaceae	Hirava chafa	हिरवा चाफा
19	*Arthraxon lanceolatus* (Roxb.) Hochst.	Poaceae	Kandi gavat	कांडी गवत
20	*Asclepias curassavica* L.	Apocynaceae		
21	*Asparagus racemosus* Willd.	Asparagaceae	Shatavari	शतावरी
22	*Azadirachta indica* Juss.	Meliaceae	Limb	लिंब
23	*Bauhinia variegata* L.	Fabaceae	Pandhara apata	पांढरा आपटा
24	*Blepharis maderaspatensis* (L.) Roth	Acanthaceae	Ekamoli	एकमोळी
25	*Boerhavia repens* L. var. diffusa (L.) Hook.f.	Nectygenaceae	Punarnava	पुनःर्नवा
26	*Butea monosperma* (Lam.) Taub.	Fabaceae	Palas	पळस

Sr. No.	Botanical Name	Family	Common Name	मराठी नांव
27	*Calotropis procera* (Ait.) R.	Apocynaceae	Rui	रुई
28	*Canscora diffusa* (Vahl) R. Br.	Juncaniaceae		
29	*Cassia obtusifolia* L.	Fabaceae	Tarota	तरोटा
30	*Cassia occidentalis* L.	Fabaceae	Devtarota	देवतरोटा
31	*Cassia pumila* Lam.	Fabaceae		टाकळा
32	*Cassia siamea* Lam.	Fabaceae		
33	*Catharathus roseus* (L.) G.	Apocynaceae	Sadafuli	सदाफुली
34	*Celosia argentea* L.	Amaranthaceae	Kuradu	कुरडू
35	*Cestrum nocturnum* L.	Solanaceae		धोत्रा
36	*Chloris virgata* Sw.	Poaceae		
37	*Chrysopogon fulvus* (Spreng.) Chiov.	Poaceae	Dongari, bhokar	डोंगरी, भोकर
38	*Clerodendrum fomidis*	Lamiaceae	Arni	आरणी
39	*Commelina* sp.	Commelinaceae	Kenpat, Ranzendu	केनपट, रानझेंडू
40	*Corchorus trilocularis* L.	Malvaceae	Bahufali	बहुफुली
41	*Cucumis callosus* var. agrestris	Cucurbitaceae	Chenni, Sherani	चेन्नी, शेरनी
42	*Cynanchum viminale*	Apocynaceae		होणे (कुत्र्याचे कुटूंब)
43	*Cynodon dactylon* (L.) Pers.	Poaceae	Harali	हरळी
44	*Cyperus rotundus* L.	Cyperaceae	Nagar mutha	नागर मुठा
45	*Dalbergia glaucum*	Fabaceae	Siris	शिरीष
46	*Dicanthium caricosum*	Poaceae		
47	*Dichanthium pertusum*	Poaceae	Marvel	मारवेल
48	*Digitaria marginata*	Poaceae	Gopya gavat	गोप्या गवत
49	*Dolichandrone falcata* (Wall. ex DC.) Seem	Bignoniaceae	Medhashingi	मेढसिंगी
50	*Eclipta prostrata* (L.) L.	Astraceae		
51	*Emblica officinalis* Gaertn.	Phylanthaceae	Awala	आवळा
52	*Enicostema axillare* (Lam.) A. Raynal	Juncenaceae		
53	*Eragrostis ciliaris* (L.) R. Br.	Poaceae		
54	*Eragrostis tenella* (L.) P.	Poaceae		
55	*Euphorbia hirta* L.	Euphorbiaceae		गोवर्धन
56	*Evolvulus alsinoides* (L.) L.	Convolvulaceae	Shankhpushpi	शंखपुष्पी
57	*Fimbristylis ferruginea* (L.) Vahl	Cyperaceae		लव्हाळ
58	*Flacourtia ramanchia*	Salicaceae	Karanti	कारंटी
59	*Glossocardia bosvallea* (L. f.) DC.	Astraceae		ग्लोसकार्डिया
60	*Gmelina arborea* Roxb.	Verbinaceae	Shivsag	शिवसाग

Sr. No.	Botanical Name	Family	Common Name	मराठी नांव
61	*Grewia flavescens* Juss.	Malvaceae		ग्रेसिया जूस
62	*Hemidesmus indicus* (L.) Sch.	Apocynaceae	Kavalyachi muli	कावळ्याची मुळी
63	*Heteropogon contortus*	Poaceae	Kusali gavat	कुसळी गवत
64	*Heteropogon triticeus* (R.Br.) Stapf ex Craib.	Poaceae	Modhi panhari Kuasali	मोढी पन्हारी कुसळी
65	*Hibiscus lobatus* (Murray) O. Kuntze	Malvaceae	Lahan jaswand	लहान जास्वंद
66	*Hoppea dichotoma* Heyne ex Willd.	Junceniaceae		जुनसेनिया
67	*Hoya sinigalensis*	Apocynaceae	Wilayati tik	विलायती टिक
68	*Hyptis suaveolens*	Lamiaceae	Bhutganjya	भूतगांजा
69	*Indigofera cordifolia* Heyne ex Roth	Fabaceae	Godhadi	गोधडी
70	*Indigofera linifolia* (L.f.) Retz.	Fabaceae		
71	*Indigofera parvifolia*	Fabaceae		इंडिगोफेरा पॅरविफोलिआ
72	*Iphigenia magnifica* Ans. & Rao	Asparagaceae		नील वनस्पती
73	Ipo*moea calycina*	Convolvulaceae		
74	*Ipomoea obscura*	Convolvulaceae		
75	*Justicia japonica*	Acanthaceae		
76	*Lantena camera*	Verbinaceae	Raymonia	रायमोनीया
77	Lavandula bipinnata (Roth) O.	Lamiaceae	Ranbhang	रानभांग
78	*Lepidagathis sp.*	Acanthaceae	Bhuigend	भुईगेंद
79	*Leucas longifolia* Benth.	Lamiaceae		
80	*Lophopogon tridentatus* (Roxb.) Hack.	Poaceae		
81	*Luecena lecocephala*	Fabaceae	Subabhul	सुबाभुळ
82	*Mansonia sinegalensis*	Geraniaceae		
83	*Maytenus rothiana* (Walp.) L.	Celastraceae	Hekalun	हेंकळ
84	*Melanocenchris jacquemontii* Jaub. & Spach,	Poaceae		
85	*Mimusops elengi* L.	Sapotaceae	Bakul	बकुळ
86	*Moringa oleifera* Lam.	Moringaceae	Shevaga	शेवगा
87	*Nyctanthes arbor-tristis* L.	Oleaceae	Parijatak	पारिजातक
88	*Ocimum americanum* L.	Lamiaceae	Rantulas	रानतुळस
89	*Parthenium hysterophorus* L.	Astraceae	Kongres	काँग्रेस
90	*Pennisetum purpureum* Schum. Beskr.	Poaceae	Ranbajara	रानबाजरा
91	*Pergularia daemia* (Forssk.) Chiov.	Apocynaceae	Utarang	उतरंग
92	*Peristrophe paniculata* (Forssk.) Brummit.	Acanthaceae	Jangali koranti	जंगली कोरांटी
93	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Jangali khajur	जंगली खजूर

Sr. No.	Botanical Name	Family	Common Name	मराठी नांव
94	*Phyllanthus amarus* Schum & Thonn.	Phylanthaceae	Bhui awala	भुई आवळा
95	*Pulicaria wightiana* (DC.) Cl.	Astraceae		
96	*Punica granatum* L.	Punicaceae	Dalimb	डाळींब
97	*Pupalia lappacea* (L.) Juss.	Amaranthaceae		
98	*Rhus sinuata* Thunb.	Anacardiaceae	Amoni	अमोणी
99	*Rhynchosia minima* (L.) DC.	Fabaceae	Tinpaliwel	तिनपानीवेल
100	*Rungia elegans* Dalz.	Acanthaceae	Panyatil nili fule	पाण्यातील निळी फुले
101	*Securinega leucopyrus* (Willd.) Muell.	Phyllanthaceae	Pandharfali, Tetuni, Pithorni	पांढरफळी, टेटुनी पिठोर्नी
102	*Sesbania bispinosa* (Jacq.) Steud.	Fabaceae	Shevara	शेवगा
103	*Sesbania grandiflora* (L.) Poir	Fabaceae	Hadaga	हादगा
104	*Sida acuta* Burm.f.	Malvaceae	Bala	बाला
105	*Solanum americanum* Mill.	Solanaceae	Amoni, Kali kamonii	आमोणी, काळी कामोणी
106	*Sopubia delphinifolia* (L.) G.	Scrophulariaceae		
107	*Sporobolus indicus* (L.) R. Br	Poaceae		
108	*Stylosanthes fruticosa* (Retz.) Alst.	Fabaceae		
109	*Tamarindus indica* L.	Fabaceae	Chinch	चिंच
110	*Tephrosia purpurea* (L.) Pers.	Fabaceae	Unhali	उन्हाळी
111	*Tephrosia trifoliate*	Fabaceae		
112	*Terminalia catappa* L.	Fabaceae	Badam	बदाम
113	*Terminalia paniculata* Roth	Combretaceae	Kinjal	किंजळ
114	*Themeda triandra* Forssk.	Poaceae	Gondhali	गोंधळी
115	*Tinospora cordifolia* (Willd.) Miers ex Hook.f. & Thoms.	Apocynaceae	Gulvel	गुळवेल
116	*Tribulus terrestris* L.	Zygophyllaceae	Sarata	सराटा
117	*Tridax procumbens* L.	Astraceae	Tantan	टणटण
118	*Triumfetta rhomboidea* Jacq.	Malavaceae	Zinzuradya	झिंजुर्ड्या
119	*Typha angustifolia* L.	Poaceae		
120	*Vigna indica*	Fabaceae		
121	*Wattakaka volubilis* (L.f.) Stapf.	Apocynaceae		
122	*Xanthium indicum* Koen.	Astraceae	Landaga	लांडगा
123	*Zinnia linearis* Benth.	Astraceae		
124	*Ziziphus mauritiana* Lam.	Rhamnaceae	Bor	बोर
125	*Zornia diaphylla*	Fabaceae		

Annexure 3

Employment was made available on their own forest land for more than 2000 tribal farmers-labors under MGNAREGA during months July-November-May every year. This is only in one village-Parala. Near about situation was same in adjacent villages. But employment was maid available less than 1400 families in other villages.

क्र.	कामांचा तपशिल	कालखंड	गट नं./ हेक्टर
१	* २–फूट रुंद,२–फुट लांब व २–फुट खोलीचे खड्डे;	मार्च अखेर ते मे पर्यंत	३५२ (२० हे.), ३७६ (३० हे.),
२	नर्सरी	जाने.ते जुलै	२ आणि ३ लाख रोपांच्य दोन.
३	** या खड्ड्यांमध्ये झाडे लावणे. तसेच खुरपणी आदी कामं.	जुलै ते जानेवारी पर्यंत	३५२ (२० हे.), ३७६ (३० हे.),
४	पाणी अडवा, पाणी जिरवा (सर्वंकष पाणलोट क्षेत्र विकास) योजनेची कामं; सलग चर खणणे;	मार्च अखेर ते मे पर्यंत	३५७, ३५८, ३५९, ३६० (४० हे.)
५	***बांध बंदिस्ती व सपाटिकरणाची कामं.	मार्च ते मे पर्यंत	३५२ (१० हे.), ३५८ (१५ हे.), ३५९, ३६० (५० हे.)
६	नरेगा अंतर्गत सिंचन विहीरीची कामं;	ऑक्टोबर ते मे–जून पर्यंत	३५७, ३५८, ३५९, ३६० (४० हे.)

Annexure 4

36 Ranbhaji (forest vegetables) under utilization by tribal community from Manyad river basin-forest area.

Information shared by tribal community leaders-Hirabai More, Mathurabai More and Chabubhaau More,

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
१	फांगाची भाजी			पाने तोडुन बाजरीच्या पिठात मिक्स करुन मुटकुळे करणे. जिरे, लसूण, मिठ, पिठात मळून भांड्यात भाजी टाकून पाण्यात उकडून घेणे.
२	सराट्याची भाजी	ज्येष्ठ ते श्रावण	Tribulus terrestris 	शिजवून मिठ, मिरची लावून, लसुण कढईत परतून घेणे. मिठ, मिरची, लसूण लावून घेणे. त्यात बाजरीचे पिठ मिसळूण पातळ भाजी बनविणे.
३	गेटाची भाजी			शिजवून झाल्यानंतर पाणी काढणे. त्यात लसून, हिरवी मिरची व मिठ घालणे.
४	कोयलची भाजी			पाण्यात शिजवून घेणे. त्यात लसूण, हिरवी मिरची मिक्स करुन तेलात फोडणी देणे. मिरची पाट्यावर वाटून फोडणी देवून तयार करणे.
५	तरुट्याची भाजी	पानकळ्यात		शिजवून पाणी काढणे. त्यात मिठ, कांदा, लसूण, मिरची मिक्स करणे. अर्धी कच्ची शिजवून तयार करणे.

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
६	पाथरीची भाजी	पानकळ्यात	Launaea procumbens 	शिजवून घेणे मिठ, लसूण, मिरचीत परतून घेणे. कांदा कापून मिठ मिरचीत परतून घेणे. शिजवून पाणी काढणे व गरम करून तयार करणे.
७	तांदूळकुंद्रा	पानकळ्यात	mranthus viridis 	शिजवून घेणे मिठ, लसूण, मिरची, एकत्र घेणे. कांदा कापून तयार करणे.
८	कुंदराची भाजी	पानकळ्यात		शिजवून मिठ, मिरची, एकत्र करून शिजवून मिठ, मिरची, लसूण पाट्यावर वाटून तयार करणे.
९	चंदनबटवा	बारमाही	lriplex hortensis	शिजवून घेणे घाटून बेसन, लसूण, मिरची गोडतेल एकत्र करणे. शिजवून घेवून घोटून
१०	शेवग्याच्या फुलाची भाजी		Moringa oleifera 	शिजवून निपळून घेणे व कांदा भाजून काळी भाजी (कोरड्यास) करणे. कांदा कापून मिठ, मिरची, लसूण पाट्यावर वाटून सुकी भाजी तयार करणे.
१२	शेंदाड माकडाची भाजी	पावसाळ्यात		शिंदळ माकडाची भाजी ठेचून, शिजवून घेवून कांदा, शेंगदाण्याचा कूट, मिठ, मिरची, लसूण पाट्यावर वाटून तयार करतात.
१३	अंबाडी	जून–जुलै	Hibiscus Sabdariffa 	शिजवून पिळून मिठ, मिरची, लसूण, खेकडा ठेचून गरम करून तयार करतात. किंवा घोटून बाजरीचे पिठ टाकून तयार करतात.

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
१४	उंबराची भाजी	सहामाही		बारीक छोटे फळ शिजवून वाळलेली मिरची ठेचून, लसूण घेऊन मिक्स करणे, उंबर शिजवून पिळायचे व बारीक, बारीक तुकडे करून मिठ, मिरची, लसूण यात परतून भाजी तयार करतात. औषधी उपयोग: संडास होत असल्यास गुणकारी औषध.
१५	सौंदडच्या शेंगांची भाजी	जानेवारी		शेंगांचे तुकडे करून शिजवून, पिळून घेणे. कांदा चुलीत भाजून मिठ, मिरची, धने, हरबऱ्याची दाळ, मिरे, खस खस, दगड फूल, मसाला परतून पाट्यावर वाटून भाजी तयार
१६	अभईच्या शेंगांची भाजी	पावसाळ्यात		शेंगा शिजवून पाणी फेकून, चुलीत कांदा भाजून शेंगांचे आंतील टरफल काढून मिठ, मिरची, धणे, हरभऱ्याची दाळ भाजून किंवा बाजरीचे पिठ भाजून, काळा मसाला परतून, पाट्यावर वाटून शेंगांची भाजी तयार करतात.
१६	चिगूरची भाजी	चैत्र	Corchorus trilocularis / Tamarindus Indica	शिजवून, पिळून कांदा कापून मिठ, मिरची, लसूण पाट्यावर वाटून परतून चिगूरची भाजी तयार करतात.
१७	कुसमोडा	आषाढ – श्रावण		शिजवून घेऊन निपळून, कांदा, मिरची, लसुण एकत्र करणे. घोटून किंवा सुकी करतात.
१८	कुरुडुच्या फुलांची भाजी	आषाढ – श्रावण		शिजून पिळून कांदा, मिठ, मिरची, लसूण पाट्यावर वाटून कुरडूची भाजी तयार करतात.

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
१९	केकताच्या फुलांची भाजी			शिजवून घेऊन निसून, कांदा, मिस्क करूण चटणी करून खाणे. शिजवून घेऊन निसून, पिळून कांदा, मिठ, मिरची, लसूण पाट्यावर वाटून चटणी करतात.
२०	आपट्याच्या कवळ्या बाराची भाजी	चैत्र		शिजवून घेणे. निपळून कांदा, मिरची व लसूण एकत्र करून परतुन घेणे. शिजवून, पिळून कांदा, मिठ, मिरची, लसूण, पाट्यावर वाटून गरम करून तयार करतात.
२१	कटूरल्याची भाजी	पावसाळ्यात	Momordica 	काळी भाजी होते. शिजवून, पाणी काढून, मिठ, मिरची, लसूण, कांदा परतून गरम करतात.
२२	कवठाची चटणी	जानेवारी		लाल तिखट, लसूण, मिठ लावून एकत्र करणे. मिठ, मिरची, लसूण पाट्यावर वाटून गोडेतेल एकत्र करून कच्चीच खायची.
२३	बांबूच्या कोंबाची भाजी		Bambusa arundinacea Roxb.	कोंबांना खूप शिजवावे. निपळून, कांदा, लसूण, मिरची एकत्र करून घेणे.
२४	हादगा फुले		Sesbania grandiflora 	शिजवून कांदा घालून, मिठ, मिरची एकत्र करून घेणे. शिजवून वाफेवर कांदा, मिठ, मिरची, लसूण जरम करून तयार करतात.
२६	रान रताळीची भाजी	जून ते ऑगस्ट		शिजवून, पिळून मिठ, मिरची, लसूण वाटून गरम करून भाजी तयार करतात.

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
२७	करवंदाची चटणी	एप्रिल ते जून		शिजवून, पिळून कांदा, मिठ, मिरची वाटून गरम करून तयार करतात.
२८	किरळीच्या बोंडाची भाजी	ऑक्टोबर ते जानेवारी		शिजवून, पिळून कांदा, मिठ, मिरची वाटून चटणी तयार करतात.
२८	चिंचेच्या फुलांची भाजी	मार्च		शिजवून, पिळून कांदा, मिठ, मिरची वाटून भाजी तयार करतात.
२९	मोहरीच्या पानांची भाजी		Brassica juncea	शिजवून, पिळून कांदा, मिठ, मिरची, लसूण पाट्यावर वाटून भाजी तयार करतात.
३०	भोकराच्या फुलांची भाजी		Cordia dichotoma	शिजवून कोरडे, कांदा, मिठ, मिरची, लसूण एकत्र करून गरम करतात.
३१	रान अळंबी (भुईपोड)	श्रावण महिन्यात		शिजवून काळा मसाल्यात तयार करतात.
३२	कुयरीच्या शेंगांची भाजी			शिजवून, सोलून काळ्या मसाल्यात बनवायची.

क्र.	स्थानिक नाव	कालखंड	Scientific Name	रानभाजी बनविण्याची पध्दत
३३	शेवयाची भाजी			शिजवून पिळून मिठ, मिरची, लसूण एकत्र करूनगरम करतात.
३४	कडू शेरन्या			चिरून, वाळवून मिठ लावून तळून खावे किंवा मिठ, मिरची, लसूणात तळून खावे.
३५	कोरपडीच्या फुलांची चटणी			फुल कापून, शिजवून, पिळून कांदा, मिठ, मिरची, लसूण पाट्यावर सुकी मिरची टाकून चटणी तयार करतात. हरण दोडीच्या फुलाची भाजीफुल शिजवून, पिळून, कोरडी मिरची, मिठ, लसूण पाट्यावर वाटून गरम करून भाजी करतात.
३६	समिंद्र शोकाच्या पानाच्या वड्या		rgyreia nervosa 	पानाला मिठ, मिरची, लसूण वाटून बेसन पिठात वड्या तयार करून झाल्यावर गरम करून वड्या तयार करतात.

Annexure 5

Bio-Diversity & Eco restoration on Individual Agro-Forest Farm from Lokparyay Project Area in Vaijapur & Soygaon Taluka (Survey form)

Lokparyay								
	Period - 2015-19							
		Village	Total Land	TREES	SHRUB	GRASS (Bhare-Bundle)	CLIMB ERS	RANBHAJI (Judi-Bundle)
No.	Farmer's Name (Wife/Husband)		Ha /Aar					

Date:
Name of the Karyakarta
Phone:

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Report

6.3

Eco- restoration of Community Forest Resources Lands

KHOJ, Dist. Amaravati

Background

This thematic team envisioned restoration of the lost biodiversity and protection and conservation of those that exist through engagement and empowerment of communities. For us, in and around Melghat it meant in true sense restoring the barren forest land with the species that pre-existed through our dialogue with the community elders and our work with the community as well as with the forest department in two villages of Payvihir and Nayakheda and helping conserve and enrich the existing flora in that of Lawada and Nawalgon. It was also important that the forests were not only meant to support the ecological processes, but it was also important that it supported the livelihoods of the local communities. Hence, we had to strive to get this judicious mix in our efforts.

Four villages from Achalpur and Chikhaldara block of Amravati district with Community Forest Rights were identified to be a part of the Eco Forest Restoration programme. These villages had rights to manage their forests recognized under Forest Rights Act through their Gram Sabha. These villages were identified to understand the impact of CFR in three different types of forests- open, medium and dense forests. Two villages of Payvihir and Nayakheda with a forest area of 192.89 ha and 631 ha respectively had a forest area that was not very productive and open, Lawada with rights over 177 ha of and had a medium quality of forests with some resources. In contrast, Nawalgaon with a 284 ha of land had a good forest but with predominance of teak and is part of the buffer of the Melghat Wildlife Sanctuary

Figure 1: ICCT work done in payvihir village under NREGA

During the last six years of the programme, the intervention under the programme used the following strategies in the two villages of Payvihir and Nayakheda-

1. Protection of the forests by the local Gram Sabha
2. Ban on open grazing and felling
3. Planned Soil Moisture Conservation Efforts
4. Plantation of 30 native species that existed before in the forests and few other species that are of importance
5. Natural Regeneration of forests
6. Ensuring the availability of water
7. Sustainable use of existing resources
8. The convergence of other resources to enrich the biodiversity and forest restoration efforts

And protection of existing biodiversity, minimal addition through plantations, sustainable use of existing resources and wherever necessary undertake plantations, Convergence of other resources to enrich the biodiversity and forest restoration efforts

In all the above efforts use of laws for enriching biodiversity was our focus and hence our convergence with NREGA, FRA, PESA and BDA became our approach of intervention in the process of restoring our forests and biodiversity/

Journey with MGBP

Key issues: Restoration of forests and habitats of wildlife and livelihoods of the local communities, Governance of the Gram Sabha's and Convergence of resources

Objectives

i) To promote participatory forest management and management of wildlife

ii) To promote regeneration of herbal medicines and other biodiversity

iii) To promote local crops and seeds through the seed banks

iv) To promote natural farming and other low cost and sustainable farm development

v) To promote environmental education in the younger generation

Figure 1: ICCT work done in payvihir village under NREGA

vi) To promote the establishment of biodiversity corners in villages

vii) To promote convergence of programmes for nurturing ecology and livelihoods

viii) To promote the implementation of NREGA for livelihoods development and through other watershed management works and improve Governance

We were able to cover a lot of the planned areas of work in the last six years; however due to scantly rains in the last two years, our herbal medicine plantation did not succeed much. We have been able to create a process of ecological conservation, better livelihoods and effective Governance using the convergence of laws, programmes and institution in a cluster of 5 villages covering an area of 1200 ha of land at the foothills of Melghat Tiger Reserve.

Sampling methods: The maps of the forest area were divided into quadrants of 1ha each on a graph paper, of which we had to identify 2% of the area for sampling. This 2 per cent area is identified through systematic sampling from the total CFR area. The total CFR area is divided into quadrant of 1ha each and then selecting samples of 1 ha at proportionate intervals for collecting the data to understand the stock in the forests and address the gaps. The trees of girth 15cms or more at breast height and the species were recorded and also marked with colour to keep the identification mark. Also, shrubs, grasses, medicinal plants and creepers in that 1 ha were recorded along with any signs of birds, animals to give an understanding of the existing flora and fauna in the region. All such quadrants were aggregated to get a consolidated picture of the area, and the planning was then done with the inputs from the local people and the gaps identified from the stock.

Major work done under MGBP

• Regeneration of lost forests in over 1200 ha of land and restoration of habitats

The forests of Payvihir and Nayakheda together of around 820 ha of forest land that was degraded. With CFR recognized, communities were wondering how to restore the forest land. The first principle was the protection of the forests from illegal grazing, cutting and theft and second was proactive efforts to plant trees. Consciously we spoke to the local elders to understand what species existed in the forests before and in the last four to five years, over 30 native species have been reintroduced in the forests (list attached as Annexure 1). Many have naturally regrown with the protection offered by the villagers. Moreover, when people began protecting forests, this spirit and work was not limited to just these villages but soon spread to other villages and a cluster of five villages today protect over 1200 ha of their forest land, enrich their biodiversity by natural and added regeneration efforts.

Eco Forest Restoration Results
Transition images from the cluster of Payvihir and Nayakheda villages and their journey since 2012 with MGB and KHOJ)

• Restoration of native species through plantations under NREGA

The biggest challenge in regenerating the forests was how to ask people to spend their time protecting and planting their forests when they had no means of livelihoods and people migrated for over eight months in search of a source of income. It was at this time that our experience and confidence in using yet another legal framework that bestowed people with a right to earn a dignified wage came to our help. NREGA provided us with unbound resources and aimed at creating sustainable assets, and we found a new way of converging laws empowering people to protect and conserve their biodiversity.

The community members identified the species that existed in the forests before and that were lost, eg. Arjun, Salai, Biba, Hilda, Behada, Sitafal, Bamboo, Mango, Neem, Tamarind, Jamun, Ber, Amla and these were included in the plantation. In contrast, many others like Behrya, Khair, Amaltas, Palash, Teak etc. grew with the protection offered by the local communities.

• Community ownership of forest resources

Communities that once had a very symbiotic relationship with the forests today think forest is not theirs, but that of forest departments and hence tend to keep away from any intervention. However, forests and

tribal communities have always coexisted. This fact was recognized and accepted by the Forest Rights Act, and it provided for recognition of this right by law and empowered communities to not only use the forest resources it traditionally did but also endowed them with the responsibility to protect and conserve it for future generations. These rights were transferred to the Gram Sabha through a process of claims that were filed with the Sub Divisional Level Committee along with details of the nature of their claim, the list of claimants and the evidence of their rights that were sought under FRA. Once the SDLC examined and approved the claims, these were to be finally approved by the District Level Committee. It took a minimum of 2 years for the villages to get these rights recognized with series of meetings internally with neighbouring Gram Sabha's who were allotted their common areas under JFM to the other villages, filling evidence and then following up to explain the law to the officials. However, the process of negotiations and discussion only empowered the local communities to understand both their rights and responsibilities. It was a big concern that the traditional area sought under FRA was barely a forest; in reality, it was more a scrub forest.

With CFR, now the forests belonged to the community and nothing could be done without their consent. The ownership of the people over the processes thus increased.

- Effective management of forest resources by local communities- Since the communities have taken over the management of forest resources under the Forest Rights Act, they have framed their own rules to manage and conserve them. Open grazing is restricted to some area near the village while over 160 ha of forest are closed. There is no cutting of trees for fuelwood, and only the remains of the thinning processes are allowed to be taken away by the workers. There is a planned effort at soil moisture conservation with water absorption trenches and CCT being dug across the hills from top to bottom to prevent any soil moisture erosion. Every year there is a plantation of native species in specific patches of forest areas.
- Moreover, there is water in the forests so that in case of emergency plants do not die, and there can be some plant saving measures either through drip or through emergency supplies. The effort is to ensure that every sapling planted turns into a tree. The community also manages a little yield of custard apple and tendu and markets it very sustainably.

Facilitation of soil moisture conservation works- The forests were barren land with not many trees. Being an undulating terrain, without any proper treatment, there

was also colossal soil water runoff. The first few months we talked about the plantation, about regenerating the lost livelihoods, we were laughed at because of the situation on the ground. However, together with the communities, we were convinced that we had to change this. Hence with the protection and conservation of forests, we also decided to work on prevention of soil moisture runoff. So, every year people undertake works that are essential to conserve soil and water, e.g. Water Absorption trenches, CCT, DCT, Talav, Stone bunds, Gabian Bandhara's, Desilting etc. All these activities are carried out through NREGA.

- **Plantation of over 200000 saplings including plantation of the identified 30 to 50 species that existed in the region before**

The plantation exercise in these villages ensured that there were no exotic variety of trees being introduced, but rather all native species that once thrived in the forests were reintroduced through plantations. As a result of this Arjun, Dhawda, Salai, Sitafal, amla, Bamboo, Tamarind, Bor, Neem, Mahua, etchave been planted in the region

- **Ripple effect created on other adjoining villages**

Initially, the process began in Payvihir and Nayakheda village, but slowly the other nearby villages in the same panchayat also joined in the process of conservation and livelihoods. Today five villages in the cluster are protecting a forest area of 1200 ha. It has resulted in not only regeneration of the lost forests but also helped in restoring the lost habitats of the wild animals and birds.

Payvihir and Upatkheda villages were first amongst the 18 villages in the country to initiate the management of tendu leaves under FRA. With a turnover of two lakhs, today 40 villages are working together bringing about 1.40 crores to the villages for livelihoods. During this process, they also conserve the forests, prevent it from fire and thus help in the sustainable management of its resources.

Details of sampling methods

Sampling was carried out in the area under Community Forest Rights. The whole forests were mapped into quadrants of 1 ha, and every plot was plotted through a Systematic Stratified Sampling methodology. Trees, shrubs, herbs, grasses and any signs of birds and animals in that area was documented to give us a brief picture of the forests.

Database

It is in the process of being updated.

Unintended outcomes

- The work in the villages of Payvihir and Nayakheda became models of Governance of commons and the impact of convergence
- It also had ripple effects amongst neighbouring villages

Qualitative impact: restoration of the forest species in over 800 ha of the forest area and restoration of the habitats of birds and also wildlife

Quantitative impact

We are in the process of collecting data after four years of intervention that will give us a picture of the pre-post scenario. It will take another one month to compile the data

Community participation

The community was at the Core of the intervention, without their engagement with the process, it would not have been possible to see the results on the ground. They owned up failures, and they also owned up the success.

Initiation

The process began with the filing of claims and the struggle to get the claims recognized by the District Level Community. Post recognition of rights the communities organized themselves for management of their community forest resources. They created a micro plan and then a comprehensive CFR Conservation and Management plan with technical support of KHOJ for a long term and short -term management of the forest resources. The whole process is planned and owned by the Gram Sabha. The villages today have set an example of how commons can be governed by the most marginalized and the poorest of the poor

Management of common (shared) resources

The communities have a process of decision making through the Gram Sabha, which is the highest decision-making body and the implementation of the decisions is done through various committees. There are decisions regarding harvest, and use of resources and these are taken in the Gram Sabha.

There are specific resources which are not merely used for community benefit but benefit the community and society at large. Such resources like forests, rivers etc. cannot be merely the domain of the individuals but mostly need to work on principles of the larger common good.

While managing CFR's, we have worked with communities to demonstrate how individual vs collective benefits the society at large. However, there have to be certain principles and rules for the behaviour related to the common resources, and also mechanisms to address those who digress from this expected norm.

Elinor Ostrom's principle of management of commons was one such learning paradigm that we use in the management strategy. If the rules and its management are appropriately implemented the results have a significant impact on the collective. The efforts have been so planned that most of the individuals get individual benefits like wages or individual schemes that can best fit in the developmental paradigms.

If managed collectively and regularly through proper systems in place, it can benefit the individual and the collective, and the village of Payvihir is the best example.

Most of the individual benefit programmes and norms are decided in the village Gram Sabha, and hence this tends to become the expected behaviour. If there are grievances, there are mechanisms of redressal within the Gram Sabha, with institutions who are engaged in the process and ultimately the laws that apply to the people at large.

Social conflicts

Initially, there was a lot of conflict around grazing by people from neighbouring villages that was resolved by giving them due to notice or levying fines if they did not adhere, there were severe conflicts, but the Gram Sabha's managed it through their collective action. It was not just one village that stood together in times of difficulty, but all the four villages stood together if the challenge was more substantial.

The rules set out by the community was initially of appraising the trespassers with their rights of management and requesting them not to interfere, if on second occasion people were found to be violating the rules, they would be summoned before the Gram Sabha and penalized based on the destruction they had caused or based on the cattle that had entered the area. Last but not the least once decided the Gram Sabha did not budge from the penalty come whatsoever. If things would not be resolved at their level, the communities also sought the intervention of KHOJ, Forest Department, Revenue Department or Police as required to help them exercise their lawful rights.

Real Test of Forest Ownership

There was a tussle in Nayakheda between the local villagers and the Dhangar community. The members of the Dhangar community have been trying to enter the forest for grazing their livestock for some time. Members of Nayakheda have protected the forests from grazing and theft. They have stopped them from entering their forest area. They were always asked to file their CFR claim in their village of residence. However, rather than filling their legal claim, they wanted to enter the protected forests of Nayakheda.

One night in the dark, around 40 to 50 people entered the village forest with all preparedness to construct houses. They had a tractor full of materials. Suddenly some of the youths saw some activity and reported to the others. They then went and saw what was going on. However, the Shepherds were also prepared to attack these people. They called us for help. It was around 11.30 in the night. We spoke to forest and revenue officials from the Collector, SDO and Tahsildar and the CCF, DCF to the RFO, all were informed. Even the police were informed. They were evicted by the next day morning. They did some damage to the Palash trees, but more considerable destruction was saved.

They made a second attempt to enter and divide the village by putting up houses on an individual tribal's farmland. This tribal was not a resident of the village. They continued to make houses while the villagers opposed. We got the villagers to locate the type of land and its ownership status. It was found that this was a non-transferable government land. The Gram Sabha informed the SDO and Tahsildar, and after enquiry, a notice was sent to the farmer for reclaiming the Government land if the purpose was violated. This shook the farmer, and he finally asked the Shepherds to move out of the farmland. Since then, there has been some peace in the forests. However, they still try and enter the area wherever there is a lack of vigil.

This was a live example of how communities if they decide can manage their forests very well and protect it from all kinds of threat and theft and ensure better management of forest resources. However, till the time the issues were resolved, this kept up the heartbeats.

Conservation of social fabric

The programme and processes certainly helped weave through the caste differences and social barriers were broken in uniting the village Gram Sabha's that once divided the villages very strongly. Youth is now a key to the whole process, and they are the leaders of the change. The differences between Balai and Korku community have been to a great extent now left behind when it comes to the development of the village or its commons. Initially, these differences and their aspirations were a hurdle for the common action. However, as the processes unfolded, efforts were made to sort out the differences and ensure that everyone had an opportunity to participate and raise their issues and find solutions. Now people also realize that it is easier to find alternatives to question through collective efforts rather than fighting alone. Individual needs for development, for access to government programmes, have also been addressed through the process of convergence. However, the role of youths in sorting these issues on the ground stands out.

- How do local and global factors influence conservation-related behaviour of communities?

The villages are also impacted by the fluctuating monsoon that impacts their whole lifecycle. Hence, they are associated with the global phenomenon of climate change, their efforts at soil moisture conservation and plantations are driven to help mitigate some of the challenges. Every year there is a change in the pattern of seasons and that not only affects the farmers but also the forests as the heat in the summer increases and the chances of mortality of the new sapling is on rising, fruiting of trees is reduced or delayed, water levels go deep, and there is lesser water availability for any activity in the forests.

While the systems outside the region here are caught in the consumerist world, the people here are still surviving on the bare minimum requirements. The effort is to make the best use of technological enhancement to achieve our local needs. In the process, however, people are careful to conserve their cultural practices and ethos, modifying a bit, if required in the changing environmental scenario. For example, Holi, the biggest festival of tribals, does not burn timber in the Puja but instead all sorts of waste from agricultural fields and forests.

While trying to work inwards within the village, the need is to create assets and infrastructure which will connect people to the benefits of the globalization process especially on information sharing, learnings while helping them become self-reliant locally.

We think that this is the golden mix that can empower tribal and rural India to a great extent. The aspirations of the globalised world need to be given a local context, with rights over their local resources, while building capacities to manage them and providing support to exercise the rights by the local communities

Managing The Commons- Not Easy But Not Impossible

For a long period, management of the common resources is challenged by the phrase TRAGEDY OF THE COMMONS and the fact that any resource that has open and uncontrolled access is likely to be destroyed rather than conserved.

Conserving and protecting the commons requires rules and processes that allow it to be collectively used by the stakeholders while simultaneously ensuring that there are rules also for those who are violating these.

The villages engaged in the process have set these up with some degree of enforcement and revision as they proceed.

While our initial processes, Elinor Ostrom's principles served as a guiding tool, yet it may be worth to revisit these in our context one by one with relevant examples –

1. Define clear group boundaries – the villagers worked with the forest department to identify their boundaries, removed encroachments on their common lands and planted trees so that no one in future can trespass again and protection becomes more meaningful. However, the question of boundaries on several occasions get very technical and political, and the pressure on communities is very high if the encroachment on the common land is of politically economically stronger communities who exert un required interference and it is impressive to know that sometimes even the forest department is not interested in resolving this dispute or rather takes the side of the encroacher rather than the communities that protect their commons

2. Match rules governing the use of common goods to local needs and conditions

Communities are the stakeholders of the CFR process and hence the responsibility to frame rules and amending them lies with their Gram Sabhas. Since Gram Sabha also has the responsibility to meet the needs of the people that are related to the commons like firewood or livelihoods, their needs are a part of how and what of the rules. For instance, people have banned open grazing in the forests; however, since dairy is promoted as an alternate source of livelihoods, people are allowed to cut grasses and bring them for stalk feeding. Thus, ensuring that the forest is protected while people's needs also met.

3. Ensure that those affected by the rules can participate in modifying the rules.

It is the people who collectively own the resources need to have the rights in amending the rules. The Gram Sabha of the two villages worked on these in terms of fixing the penalty, deciding the grazing area etc. If the people do not have the powers to amend the rules, it is likely that it will not reflect the learning from the management processes and it also reduces their participation.

4. Make sure outside authorities respect the rule-making rights of community members.

The fact that communities can make their rules to protect their commons is not acceptable on many occasions to the Government and to those who are impacted by their decisions. However, it depends on how strongly the communities defend their decisions and rules, how they can justify their rules, their documentation and records and also sensitivity in handling these matters, understanding of the legal provisions that it gets the acceptance or

respect from people from outside. It is also equally important that the communities also respect these rules themselves before they expect that outsiders respect these rules. As a first step, the communities inform their neighbours about any trespass and let them know that they are managing their area, and any further violation shall be penalized. If the violation persists, they are penalized by the Gram Sabha in forms of fines.

5. Develop a system carried out by community members, for monitoring members' behaviour.

This is also a crucial part of the governance of commons. It is always easier to restrict or deal with an outsider, but it is most important to enforce rules for the fellow beings who sometimes may think that they are the makers of law and hence have all the rights with them and no one would question if a few rules are twisted or violated. However, it is incredibly challenging to hold the members of the collective accountable to rules. Comparatively, it is easier to hold outsiders accountable. If the collective can work on this, half of their efforts are already successful and in the right direction.

6. Use graduated sanctions for rule violators.

Yes. This is followed by the communities- first warning, then a penalty, third filing of Criminal cases if the first two do not work.

7. Provide accessible, low-cost means for dispute resolution

Disputes are mostly resolved at the village levels, and hence they do not incur costs per se, but it does need people's time and energy and involvement to enable the resolution. This is the benefit of the community's ownership that the authority to resolve CFR related disputes rests with the Gram Sabha.

8. Build responsibility for governing the common resource in nested tiers from the lowest level up to the entire interconnected system.

The responsibility of managing the commons is not just of an individual or a village collective it is the need and responsibility of all of us a society that these commons get protected, conserved and regenerated for the future existence of our next generations. Hence for governing the commons, you always need a system at various levels that will come together or help address the challenges and build each other's capacities in return. In the villages we work with not just one village Gram Sabha is working to protect their common forest areabut together a collective of 5 villages are protecting an area of 1200 ha, so whenever the issue needs more community engagement and pressure, the villagers from all the villages jointly work to resolve the problem. They seek support from organisations who work with them for legal and technical guidance which is most of the time available to them. If the problem requires any State intervention, that is also sought collectively. Itt has helped resolve many issues.

The standard feature of the process in the villages was that they were never isolated cases of managing the commons; it was more significant than one specific village or one specific community. It was a cluster. Whenever there was an attack on the rights of the communities over commons, not just one but all the villagers came together and ensured that the challenges were thwarted and rights respected. This built a broader community together.

Challenges

The balance between individual pursuit for the fulfillment of one's dreams and aspirations in today's consumeristic world and the ever-growing need to protect the common natural resources or to harness them scientifically and sustainably is the crucial balance that needs to be achieved in the process. In this case of village, we have been able to meet these through ensuring that there are enough resources to meet these individual primary goals through various government schemes and programmes like money through NREGA, livelihoods through dairy or improved agriculture, improving yield of the farmland through NREGA or agriculture convergence Fuelwood through LPG and thinning. We are trying to build peoples capacities to be able to only sustainably rely on the commons so that both individual and collective needs are fulfilled and the collective resources thrive

Traditional conservation and harvest practices

1. It had been a practice for a long time, that the villagers in the rural tribal areas conserved their seeds for sowing; however, the force of the market was so strong that this tradition was interrupted in many villages across the country and also the villages where we work. During the last few years, we have been working on the efforts to revive the local crops through seed sharing. We collect the seeds from farmers and give it those who are willing to sow them in their farms and return the seeds to be used by some other farmer.

2. Post FRA people are now harvesting tendu leaves from the CFR areas, however, they as a principle neither pruning or bush cutting of the trees is allowed to permit the natural growth of the trees, and also its fruiting and communities take care to prevent any fire during the period, as a result, tendu trees are flowering and forests and biodiversity that gets lost, in the fire that was permitted earlier to allow the collection of only the fresh leaves to be collected, also secured. There has been no decrease in collection noted, and hence it is evident that these practices promote sustainable management of the tendu and also the forests

Innovations and technology development by people

While plantation has been undertaken to promote the forests in the villages, the more significant challenge was to ensure that each sapling planted was converted into a tree. People made all the efforts to ensure that the survival did not drastically dropdown. From using bottles and earthen pots to water the plant, they moved to solar-based drip in the forests to ensure that plants survived the hottest condition.

Relevance of history in conservation practices

The tribals, forests and wildlife have always mutually coexisted for generations. However, with the advent of the British rule and its production-based commercial forestry intervention led not just to the destruction of the local biodiversity but also this great relationship. The forest ownership that lay with those who conserved slowly moved to that of the government and people became intruders, encroachers and also poachers. At the same time, the British regime slowly led to the decline of the rich biodiversity. It replaced that with commercial teak plantations, which was harvested periodically for various purposes in the name of production forestry. Villages closer to the commercial centres and access to roads then brought head loads of firewood for the restaurants or the city dwellers, while those in the interior forests were logged to bring in financial revenue to the forest department. The forests near the markets became open and barren as people's dependence also shifted from forests to markets and cash economy. In contrast, for those villages in the deeper forests, they continued to stay in the symbiotic relationship using and planting sustainably. Even if look at the management prescriptions under working plans of the forest department, the forests closer to the towns and cities, sought to have lost all value and even the prescriptions went for a toss as communities chose to move away from the subjugating and exploitative forest regime to being small farmers and wage labourers, thus creating a vast expanse of open forest area without much floral and faunal biodiversity.

Beneficiaries

Demography

People of Payvihir, Nayakheda, Lawada Van and Nawalgaon are the direct beneficiaries of our intervention. The details of the villages as per the 2011 Census are as below-

Name of village	Block	Gram Panchayat	Households	Population	Male	Female	SC	ST
Payvihir	Achalpur	Upatkheda	110	490	255	235	96	382
Nayakheda	Achalpur	Upatkheda	98	435	225	210	48	229
Lawada Van	Chikhaldara	Bhulori	46	273	132	141	0	273
Nawagaon	Chikhaldara	Khadimal	90	400	207	193	0	400

Benefits

Through convergence with MGNREGA, villagers can get livelihood support. These activities also helped achieve the dual objective of conservation and livelihoods, ensured the protection of the commons. They mobilized the community not just around forest resources but also worked upon their issues of rationing, schools, animal husbandry and other issues concerning the community. From a 100 per cent migrant village, the village of Payvihir today has round the year work within the village forests.

The villagers have learnt to work with the Government and create a space for themselves through the process. They have learnt to use convergence as a tool for converting their rights into resources for their future generations

Type of benefits

Round the year employment means that the people at least earn Rs 12000 per family if two people from the family are working at the minimum rate of NREGA of Rs 201 for the entire month. Apart from this, many families have an additional source of income from milk production.

Measures to continue benefits post-MGBP

The whole decision-making process has been ingrained in the village, and hence there are more chances that much work initiated shall continue. Also, since people have fought for their rights, they are aware that only their collective action can help them sustain what they have earned. In this process, people have also realized the Do's and Don'ts of the management of the common resources. CFR binds the people collectively with their rights and other legal provisions, and government programmes help them turn a lot of these into actual resources that can be meaningful for their livelihoods and the future of their commons.

People's preference for livelihood species

People preferred plantation and regeneration of the native species and have denied the exotic variety of plants.

CFR experience

People are planting a mix of the species wherever plantations are being undertaken. The priority is to focus on those trees that existed in the forests for decades before the forests turned barren. So discussions with the elderly in the village give an understanding of what would grow well in this area, and those were prioritized in the plantation. Any exotic species was sent back to the nurseries. Secondly, species that would add value to the livelihoods of the people, the birds and the wildlife in the region. Fruit-bearing species Jamun, Mango, Badam, Bamboo, Sitafal, Ber etc. became part of the package.

In at least two villages, there are Natural Biodiversity Hotspots- these are untouched areas and un intervened. One patch of the forests was left untouched to see what happened if the area was without any external intervention. None of us has taken any stock of the region but has neither done any intervention in these areas.

In the year 2018, we felt the need to create AAMRAI and hence in 2 villages of Payvihir and Nayakheda, 500 trees were planted of which 400 were mango trees with a mix of both hybrids, and native varieties and 100 trees were again the ones that were useful for food and shelter of the birds.

How sustenance of forest-based communities is achieved by non-monitory engagement with the forest?

This is not possible as these communities have minimal land and the forest has to be regenerated in a way that it will help the livelihoods even with sustainable use of its resources. We have though clubbed other interventions like dairy to reduce forest dependency

Conservation strategies

Community Management and Control over resources. Rules for management are framed by the Gram Sabha on a regular basis and also based on their need. Some of the strategies have already found mention earlier in the document.

Non-monetary engagement with the forest

Protection and Conservation by the Communities, Nature Education for Children, Ecological services for the society and hence the need for conservation and protection.

List of Publications and presentations

https://www.youtube.com/watch?v=Tt0pej9AA-Q

http://www.khojmelghat.org/videos/undpkhojvideo.mp4

https://www.cseindia.org/people-s-forests-8540

Networking

Most of our collaborative work was on Environment Education with CEE as they have guided the whole process of environmental education that is being carried on by the ground teams.

The evaluator became our mentoring partners in the process, and that was a wonderful association with Prof K C Malhotra.

We are also part of Vidarbha Livelihood Network – an organization of likeminded organizations working on similar issues and FRA Collective at the State level.

Outreach

People were never beneficiaries; they were always partnering in the process. Many more villages, many organizations used our work in Payvihir and Nayakheda as learning models and youths from areas in Thane, Yavatmal took the lead in their work, on returning home children got involved in the whole process very naturally, and they are our future ambassadors. They participate in the plantation processes, in raising of the nursery by seed collection, they also go on nature trails and observe birds in their vicinity as well in the neighbouring villages as well as join the community in any village-level collective action.

Policy level interventions

- The process of convergence emerged from the initial exercise at Payvihir village wherein all government officers came together to discuss the possible interventions to facilitate conservation and livelihoods, and then it went on in other districts, and as a result, the Convergence GR came into effect
- The implementation of NREGA by the community engagement process became a motivation for organizations and communities in Marathwada to address the drought using NREGA funds
- KHOJ led the process of creating Conservation and Management Plans in post CFR scenario with UNDP support and that gave a direction to the efforts of the village
- The JFM was appointed as agency for NREGA based on the work in the Payvihir village that required a local agency to facilitate the plantation activities
- Provision of solar pumps and drips for forest plantation was never an acceptable activity, however, with the results in Payvihir and Nayakheda forests, this is now being more accepted and used by the Forest Departments in practice.
- The process of collective management of tendu leaves was initiated collectively by villages of KHOJ along with other organizations in Vidarbha in 2012-13 and today five years down the line; it has set an example of how this market-driven MFP can be well managed by the collective of Gram Sabhas. Today several Gram Sabha's across the state and also in other parts of the country are following this model

National/ international outreach

These efforts have been shared and acknowledged at National level meetings on FRA. These also find mention in the reports of Centre for Science and Environment on Community Forest Rights and have been filmed by UNDP for one long and one short-duration film that have been shared widely on social media.

Knowledge-related outcome

The management of CFR areas has been demonstrated from this effort

The Forest Eco restoration and its possibility demonstrated

Management of Commons is possible, stands justified

Interesting facts

With the regeneration of the lost forests in the villages of Payvihir and Nayakheda, birds have arrived and with birds are arriving seeds of various species. Jute is one of the examples of species that are not found in the villages before.

The process contributed to the bridging of the social divide to a great extent in Payvihir and Nayakheda village where heterogeneous population existed. Before the programme, there were animosities between groups in the villages, however as the Gram Sabha processes started gaining roots, groups also mostly resolved their difference and emerged as collective that worked for the conservation and development of the village.

The process evolved basic principles that became a premise of our further work-

a. The convergence of village-level institutions working on natural resource management into one group of action committee that shall act on the decisions taken in the Gram Sabha

b. The convergence of all government programmes of different departments in post CFR scenario

c. The convergence of the legal provisions that work towards conservation and livelihoods

Stories emerged

The traditional knowledge and wisdom of the people were useful in understanding what trees existed in the forests during the time it was denser, and this gave us the input as to what would survive in this region.

Accordingly, these were included in the plantation plan of the villages.

The villagers also have traditional wisdom about where a borewell is most likely to yield water, for, eg. The Acqa or the Rui plant is a source of water as this tree never dies, and its roots are always moist. This turned to be useful information when the borewell was dug in the forests in Payvihir.

Knowledge of medicinal plants and its usage also exists in the communities, and it gets documented in the village biodiversity registers.

The tradition and culture of the people, especially that of Payvihir, which was getting lost in the development and race for survival. During this process of revival of the forests, people realized the need to protect and conserve their own culture and tradition and hence the process of celebration of their festivals is being revived.

Realizations about human nature/ human-nature relationship

Tribals and forests had a very symbiotic relationship, however with the advent of the Britisher's production-driven forestry; people became encroachers and poachers in their land. The life systems of the tribals always had an element of the conservation, for example, tribal's never burnt their dead but rather buried them, their needs were always limited, and they worshipped nature and barely overexploited them. Through the processes of Community Forest Rights, these are being reinstated.

In such situations, CFR gave a new direction to the people and has helped restore this relationship between nature and people. Today we can see how this interlinking is serving as a model for many other villages to conserve and sustainably use their natural resources.

Observations about ecology- regeneration/ depletion/ conservation

Conservation of the forests and biodiversity can be very meaningful only if the communities in the vicinity are engaged and participate in the process at all levels. Only then this can be sustained and give accurate results.

New understandings/ philosophy/ realizations emerged

Most of the forests co-exist with the habitations of the tribal people. Even though tribal's are themselves living at the margins with bare resources, their lives still are largely in sync with nature and its processes. Communities, where forests have been destroyed, have been at the brink of marginalisation and impoverishment. Forests and people can mutually benefit each other if communities decide the norms for their coexistence and work towards their implementation.

Species lists/inventory

अ.क्र	कोरकू नाव (Korku Name)	मराठी नाव (Marathi Name)	शास्त्रिय नाव (Scientific Name)
1	खैर्रा	खैर (Khair)	*Acacia catechu*
2	सलाई	सालई (Salai)	*Boswellia serrate*
3	शिंदो	शिंदी (Shindi)	*Phoenix sylvestris*
4	पळसा	पळस (Palas)	*Butea monosperma*
5	टेंम्ब्रु	तेंदू (Tendu)	*Diospyros melanoxylon*
6	आगोट्या	वाघाटी (Waghati)	*Cpparis horrida*
7	काटलूच	कर्टुले (Kartule)	*Momordica dioica*
8	चायपत्ती ईली	खोबरवेल (khbarwel)	*Tylophora indica*
9	सिताफल	सिताफळ (Sitafal)	*Annona squamosa*
10	लावा	उंबर (Umber)	*Ficus racemosa*
11	जांबू	जामुन (Jamun)	*Syzigium cumini*
12	काटकुम झारा	कंबरमोळी गवत (Kambarmoli Gawat)	*Tridax procumbens*
13	बानाकु घुंगरू	अमलतास (Amaltas)	*Cassia fistula*

अ.क्र	कोरकू नाव (Korku Name)	मराठी नाव (Marathi Name)	शास्त्रिय नाव (Scientific Name)
14	भेर्या	भिवरीया (Bhiwrya)	*Chloroxylon swietenia*
15	सांभलू	संभालु (निर्गुडी) (Nirgudi)	*Vitex negundo*
16	धावळा	धावडा (Dhawda)	*Anogelssus latifolia*
17	भुईकू चिलाटी	शतावरी (Shatawari)	*Asparagus racemosusa*
18	सागा झारा	पवन्या गवत (Pawnya Gawat)	*Sehima sucatum*
19	कऊ	अर्जुन (Arjun)	*Terminalia arjuna*
20	मुसली	मुसळी (Musali)	*Chlorophytum*
21	आसन ईली	वासन वेल (Wasanwel)	*Cocculus hirstus*
22	माट	बाम्बू (Bamboo)	*Dendrocalamus strictus*
23	तिनसा	तिवस (Tiwas)	*Ougenia dalbergiodes*
24	बारू	कुसुम (Kusum)	*Schleichera oleosa*
25	तारोप	चारोळी (Charoli)	*Buchananina latifolia*
26	सोसो	बिबा (Biba)	*Semeracarpus anacardium*
27	मूं	मोहा (Moha)	*Madhuca longifolia*
28	बेला	बेला (Bela)	*Aegle marmelos*
29	माहूल ईली	माहुलवेल (Mahulwel)	*Bauhinia vahlli*
30	तिळाळी	तिळाळी (Tikhadi)	*Cymbopogon martini*

Database

Impact

Ecological

Restoration of forest and wildlife habitats in the two villages of Jambhlala Nayakheda and Payvihir has created a very positive impact in the region. It has created a model of local governance of forests that others can come and see and learn and try and use some of the principles that led to the success of Payvihir like that of Institutional Convergence, Programmatic Convergence and its impact on the forests and biodiversity.

The processes have led to the regeneration of lost forests in the villages not just of Payvihir and Nayakheda but in adjoining villages of Khatijapur, Upatkheda, Kumbhi Wagholi as well.

One of the studies by Researchers on the availability of floral and faunal diversity (insect diversity as a proxy and indicator of overall faunal diversity) was carried out in five CFR and five non-CFR forests, and the preliminary findings point to some interesting observation that reveals that the CFR areas could be richer in terms of the floral and faunal biodiversity than the non-CFR areas indicating that the hard efforts of the communities are bringing about changes on the ground. This dataset is being analysed and written up as a scientific paper, and the findings will be reported in the final report.

Community

Communities earn their livelihoods through protection and conservation of their natural resources like forest, land and water. Earlier the entire village used to migrate in search of livelihoods and work in ginning factories or on brick kilns or did odd jobs to make ends meet. However, today they have round the year employment available to the people in the forests predominantly and also in the village. Distress migration has been curtailed completely. Most of the employment comes from the work in forestry through NREGA. On the other side, it has contributed to rejuvenating the forests and helping them earn their livelihoods as well. The management of custard apple and tendu also contributed to the income of the community.

The process has a huge impact on the village level Governance process as this has activated the Gram Sabha convenings that are now becoming the decision-making bodies.

Since families now stayed together at the village, other issues of entitlements like ration card, bank accounts, caste certificates, pension schemes etc. all became a matter of priority. These were dealt with by organizing

Rajaswa Abhiyan or Revenue Department Camps, wherein the administration reaches out to the village and resolves these issues.

Similarly, the issues of education and health also started gaining attention as children now attended the village school around the year. The School Management became stronger, and the performance of students improved eventually. Health and sanitation measures improved. Dustbins dotted houses in the village, and a culture of collective community action took roots.

The Ration Shop

The women in the village started gathering for the meetings organized during the presence of officials- like Talathi, Tahsildar, District Collector, Guardian Secretary and shared their drudgery for bringing ration from the fair price shop that was almost 8 to 10 km away.

It was resolved that women's group could take over the ration shop. There was no functional group. We spoke to women and helped them formed a group not to take loans but for self-help in the village; instead we had decided that we would never take a loan.

The group thus formed applied for Ration shop and got the orders. The first few months, the youths accompany the women to the taluka headquarters to complete the processes, but it took not more than six months for the women to be completely independent in managing all the affairs of the shop from filling challan to delivery and managing losses, they effectively made decisions. They partnered effectively in the governance of the village.

Academia

Convergence has primarily been a matter of discussion; how this was to be implemented on the ground always remained a puzzle. In the villages we worked with, we were able to mainly crack this down to the rules of the game that helped us move beyond just one or two villages to many more villages in Melghat. We basically evolved three principles- first, integration of all-natural resource-based community-based committees or groups, second; converging all the legal frameworks governing natural resources and biodiversity and thirdly converged government programmes for villages that achieved the first two principles.

Failures

The community biogas was set up in two villages after a lot of follow up and dissenting opinions that had finally agreed to stand by the demand of the community.

It was a great alternative technology that fitted into what community wanted to do to manage their fuelwood and move towards conserving nature.

However, the technology provider UP Bioenergy Mission did not want to enter into any agreement for implementation, it provided technical people (who were experienced in working but had no technical qualifications), instruments and equipment but there was nothing to bind all into one accountable agency.

There were technical issues, and the project was inefficiently budgeted, and it overshot the estimation.

The owners of the model could not resolve implementation issues and slowly it started slipping down in performance, and there were technical failures, which beyond a point community could not address despite all the best intentions. All efforts were made to activate the process, but it could not take off after a brief trial period of a few months.

One of the learnings, also was not all people had contributed to the building of the plant that was expected from the community and hence giving in was easy.

MEDA, the alternate energy department, was barely able to resolve any challenges and the support that we had anticipated never came, we had an external consultant of a great repute, but he could not dialogue with the community and practical things did not work over long-distance communications.

We failed in our dream project, and this was a pain that we continue to carry deep in us, for the loss of faith in the right technology and a great loss of public funds, we had put in all our energy, made investments of time and money, there could be better processes to take these pilots through.

Policy

1. Issuance of the Convergence GR by TDD was an outcome of the work we did in Amravati on the convergence of other schemes and government programmes to augment the gains of CFR and the Governance of Gram sabha. This led to the formation of District level Convergence committee across the State

2. Issuance of guidelines for the functioning of the CFRMC committees in the State

3. Issuance of JFMC as an agency under NREGA

Way forward

The community will continue the work and we shall support them wherever needed in taking their plans forward. Most of the forest regeneration, Gram Sabha hand-holding will have to continue in 3 villages.

We do have human resources for some time to take it forward but will have to raise the programme component for the work on the ground.

The principle of convergence of various government programmes has been institutionalized through a government GR in the State of Maharashtra. We are hoping to see the results in the next couple of years with more villages willing to take to the Payvihir route, and the models of plantation and convergence that we used in the Achalpur cluster is widely acceptable to the communities and also the government and hence the chances of it being used by others is better.

Dependence on forests for livelihoods also creates people's relationship with the forests. Although a forest may not be yielding great financial turnouts but the fact that there is something to look forward to, something that allows the community to relate to forests helps in effective conservation and management. Even then, the area may be small and returns little, it is helpful to build a connection. A big area of forests with no returns may be a very good biodiversity hotspot, but till the time it yields some returns, people find it difficult to relate. Also, the relationship between forest and tribals plays a critical role. Tribals have been living in a symbiotic relationship with nature and hence for them managing something they know and which also becomes a source of livelihoods is more likely to bring in people's participation than non-tribal forest-dwelling communities who may be dependent on forests for things like grazing.

The leadership and mobilization of the village give direction to the village processes. Management of Commons requires a facilitating leadership and the presence of these helps in shaping the village.

The processes are already taken up by neighbouring villages so the principles of biodiversity conservation shall be used in our activities with other three villages in the neighbourhood

Post CFR, processes have been institutionalized in these villages and are now being upscaled in the region.

Staff

Sr. No.	Name	Designation	Introduction	Tenure with MGBP
1	Purnima Upadhyay	Principle Investigator	Works with KHOJ as founder trustee and key areas of interest includes turning rights into resources	
2	Mahadeo Gillurkar	Co- Principle Investigator	Keen facilitator of community processes with youths with a sound understanding of biodiversity	
3	Shahdev Dahikar	Field Assistant	Very effective in the mapping of resources and a patient learner and educator	
4	Prashant Kasdekar	Environment Education Facilitator	Active and sincere efforts in taking biodiversity conservation to children and community	

Annexure 1

The Story of Eco Forest Restoration as it unfolded on the ground....

It wasn't long before that the forests at the foothills of the Melghat Tiger Reserve stood barren and treeless but the realisation of the fact that forest was of no use without trees soon came to the people of the villages inhabiting this forest area. Those who realised this early were the villagers of Payvihir, who were meeting to discuss the community forest rights under FRA. While the community had traditional and customary relationship with this forest, the lack of livelihood sources and easy and uninterrupted access to the trees in earlier decades had led to the people of all the surrounding villages including payvihir to chop the trees of khair, dhawda, arjun, salai, tiwas etc against the money that they would get for head loads....there was barely any restrictions from the forest department.

With the Community rights claim over, the people realised the need to afforest their area in order to be really able to exercise their rights. This is when they sat together and started thinking of the possibilities. However, the challenge was how? With a village full of migrants, who were struggling to put their two meals together, but with a commitment and dream to re- green the forests, our only hope was MGNREGA.

It was around this time that Maharashtra also got a passionate and committed Forest Secretary in Mr Praveen Pardeshi, who was invited to explore how to take this challenging dream forward. A Commitment to recognise the rights of the communities under FRA was the first step decided. On june 8th 2012, 7 villages including payvihir, nayakheda, khatijapur, Lawada Van, Bhavai got their CFR recognised. This was a morale booster.

Since 2012, the people have barely looked back. There have been several challenges but they were never stronger than the people's resolve.

In the first year, they planted 2000saplings to commemorate their rights. Then they struggled to protect and save each of their saplings. The forest was now protected from theft, grazing and trespass. Second small step was exercising their rights over a small patch of Custard Apple which was earlier auctioned for Rs 500 to Rs 600 but now brought thousands to the Gram Sabha both for wages and also savings for collective action. When all of us talked about plantation we became a laughing stock as FD staff would say that no tree could survive as there was no soil to retain water.

It was then decided to undertake works like Water Absorption Trenches and Continuous Contour Trenches to ensure that each drop was stored. NREGA provided the resources that slowly helped us retain the villagers who otherwise fled to nearby towns in search of livelihoods working two to three shifts at a stretch. While the whole district complained of delayed wages, they set a system where funds would flow every 15 days and hence NREGA became the most popular people's programme.

Every year people undertake WAT and CCT works in 25 to 35 ha of forest area and plant trees. In the last five years, since 2012, they have treated an area of over 100 ha of their 192 ha land, constructed Van bandhara, stone bunds, Jali Bandhare, low cost CNB that now ensure maximum water retention.

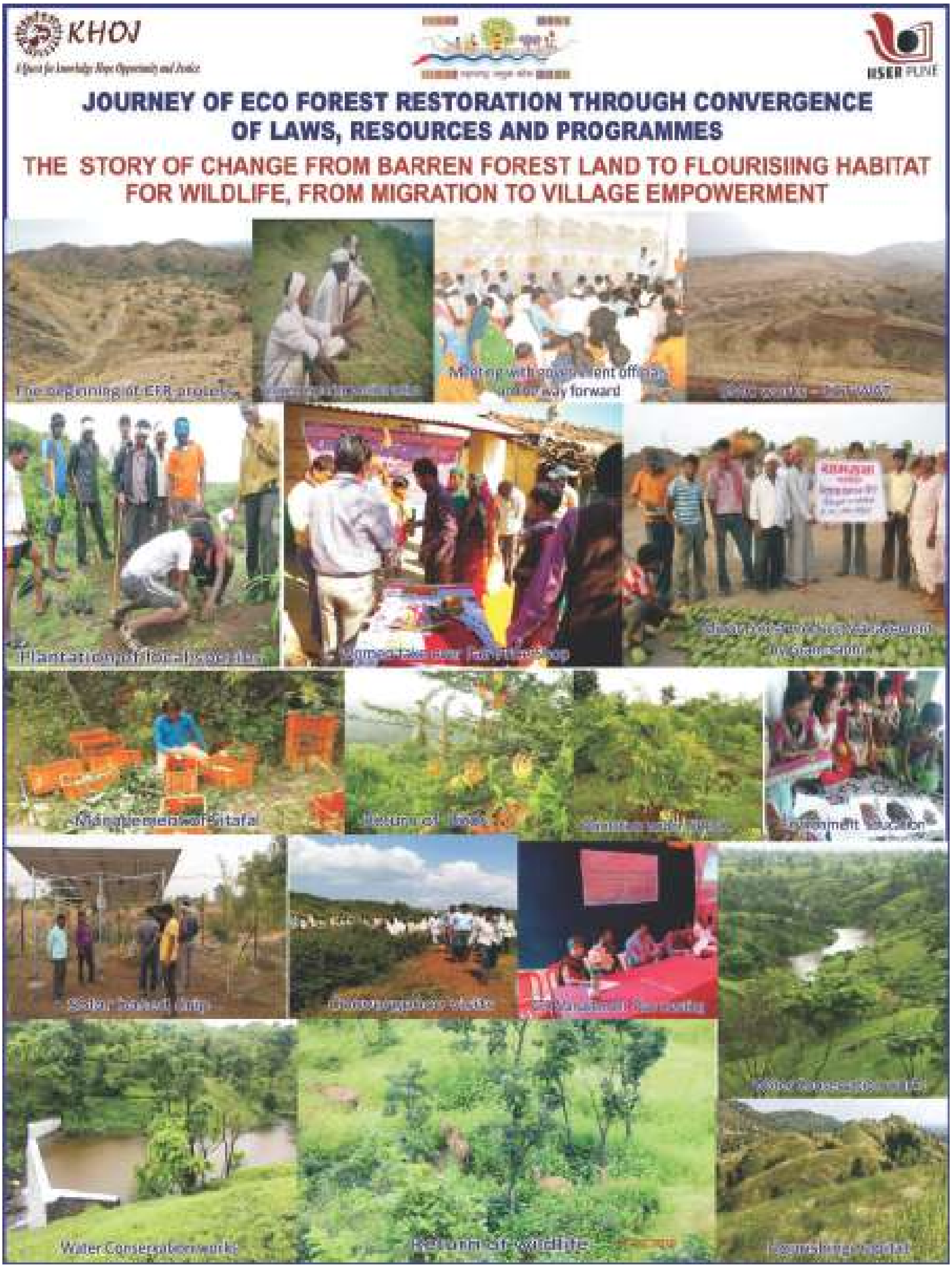
Over 284000 trees have been planted. Villagers worked hard to ensure survival of each sapling throughout the summer, water plants initially manually, then through drip. Thus demonstrating how committed communities can be towards forest protection and re generation. There are no exotic species of plants but only those which existed prior on these forests and seen by the village adults, and those of medicinal or nutritional value or that of food and fodder for the animals and birds have been planted in the forests.

The Solar system developed through the funds of Vidarbha Development Board, set a new example to boost survival of forest plantations. Today not only Payvihir but the other villages are conserving and protecting their forest area of around 1200 ha. A patch of wasteland today is seen with contour based water harvesting structures, plantation pits and patches of greens in the striking hot summer are soothing to eyes and a great contentment to the heart that the energy of youths is invested back in such community building processes.

Nothing can be a better certificate for the biodiversity conservation, other than the return of the wildlife in the forests of Payvihir, Upatkheda, Nayakheda and Khatijapur. The sight of Chital and Nilgai, Sloth Bear and leopard, अस्वल, मोर, सायल *the presence of large number of chirping birds and butterflies in the forests brought a smile on the faces of youths and children, who never saw any signs of these in the forests before.*

Annexure 2

Activities	Department
CCT/DCT/WAT	MGNREGA
Plantation	MGNREGA
Van Talav and Ponds	Forest Department Funds
Solar Pump with Drip line for plants and waterhole	Vidarbha Development Board
Natural Regeneration	Forest Department Funds
Lantana Removal from Sitafal forests	Forest Department Funds and Voluntary Contribution of Gram Sabha
Biodiversity Park and Roadside plantation	Social Forestry
Diversion Drain	KHOJ
Nala Deepening	KHOJ
Repair of Existing Cement Bandhara	KHOJ
Removal of excess water from agricultural area through farm drains	KHOJ
Farm Ponds	Agriculture
Introduction of medicinal plants	KHOJ
Construction of biogas/Supply of LPG	TDD/Social Welfare/Campa funds
Replacement of unyielding cattle	Forest Dept Funds
Fruit sapling distribution	KHOJ
Milchy Animals	Forest Department and Contribution of pepole
Nursery	Forest Department


KHOJ
JOURNEY OF ECO FOREST RESTORATION THROUGH CONVERGENCE OF LAWS, RESOURCES AND PROGRAMMES
THE STORY OF CHANGE FROM BARREN FOREST LAND TO FLOURISIING HABITAT FOR WILDLIFE, FROM MIGRATION TO VILLAGE EMPOWERMENT
way forward
Return of wildlife

Result-based Management output: Biodiversity enhancement and Eco restoration of community forest resource lands employing a diversity of life sustaining and economic plant species

Output /S	Indicators	Baseline (at the start of the project)	Target (set for the reporting period)	Achievements during reporting period	Achievements cumulative till date
Eco restoration of community forest resource lands	Established BMCs	4	0	0	4
	Documentation of traditional knowledge of associated communities on NTFP species	30	30	Khair, Bhivriya, Shindi, Dhawada, Salai, Biba, Charoli, Sitafal, Amaltas, Palas, Tiwas, Tendu, Kusum, Nirgudi, Umber, Bel, Jamun, Moha, Arjun, Waghati, Mahulvel, Vasanvel, Khobarvel, Shatavari, Katvel, Musali, Pawanya, Gawat, Tikhadi, kambarmolee gawat	30
	Listing of RET and Economically important tree species (No.)	30	30	30	30
	Regenerative plantation (Ha/ Number of seedlings)	150000	25000	2084	329738
	Community's participation in management and conservation of forest resources (No of Events + type)	60	12	10	65
	Scouting of seedlings from other sources (RET+ Economically important) for plantation	150000	25000	3460	71263
	Activities initiated for soil and water conservation (Area in Hec. Number of treatments)	Total forest area 1385 ha under CFR. Target for MGB programme – 450 ha	50 ha CCT and WAT	10 ha WAT 20 ha. DCT 25 ha. Dhali bhand 25 ha.	468 ha.
	Schemes/ Programs tapped from Government				· MGNREGA for SMC and plantation in Payvihir, Nayakheda, Lawada, and Nawalgaon · Social Forestry for plantation · Jalyukta Shivar · Forest department resources
	Scientific harvesting and collection (No Of Events)	2	2	2	Collection and management of Tendu leaves every year is done by the Gram Sabha

Output /S	Indicators	Baseline (at the start of the project)	Target (set for the reporting period)	Achievements during reporting period	Achievements cumulative till date
	Marketing / processing and value addition details (Event/ Quantity details)	1	1	1	Collection and sale of tendu leaves are done by Gram Sabha Payvihir and Nawalgaon through collective of the Group Gram Sabha under FRA
	Use of NTFP by communities themselves				Mahua flowers used for consumption, Mahua seeds used for extraction of edible oil, Katvel,Matalu,Nirgudi stems are used for fencing, Waghati fruits for vegetable and fodder, Tembhru fruits for consumption
	Participation of women / gains by women				Protection of forests and use of alternate energy, Women also work in forest area. They participate in tendu collection.Women are also key decision makers as part of the CFR committees Women run 2 fair price shops established during the process thus addressing the food security issue as well
	Mobilization of Schools/ Groups/ Students around biodiversity (No. Of Events)	6	6	4 (school)	2
	School PBRs (No) and Biodiversity corners	6	6	2	2
Novel/Unexpected Observations					Impact of climatic changes on the production of the minor forest produce especially Sitaphal
New questions raised/discussed					निलगाय, सांबर, हरीण, डुकरांन पासून पिकांना हानी होऊ लागली
Unforeseen problems encountered					***Forest Fire due to growth of grass***

नवीनप्रश्न

कोविडच्या काळात लोकांना अनेक समस्या जाणवल्या जसे कि, रोजगाराचा प्रश्न, राशन, किराणा, यासारख्या मुलभूत समस्यांनातोंड द्याव लागला पोटासाठी खूप मोठा संघर्ष करावा लागला.त्यामुळे अनेक ठिकाणी उपासमारीची पाळी येवू लागली.

म्हणून manrega अंतर्गत जितक्या गावात काम उपलब्ध करून देता येईल तितक्या प्रमाणत करून देण्याचा प्रयत्न केला गेला. कोणत्या गावात किती रोजगार आहे? किती लोक कामावर हजर आहेत? आणि किती लोक बेरोजगार आहेत? हे समजून घेण्याचा प्रयत्न करण्यात आला. अख्या मेळघाट मध्ये फक्त 600 च्या जवळपास लोकांना रोजगार होता. तशीच परिस्थिती राज्याची सुद्धा होती. मोठ्या प्रमाणत लोक घरी असल्याने रोजगार मिळणे गरजेचे होते. कारण राशन, किराणा अश्या मुलभूत अडचणीमुळे गावातील लोकांचे बेहाल होत होते. कार्यकर्त्यांनी गावात जावून रोजगार, राशन ची काय परिस्थिती आहे कसे जगत आहेत हे समजून घेण्याचा प्रयत्न केला गेला. वेळोवेळी तहसीलदार, जिल्हाधिकार्यांलयाकडे निवेदन देत पाठपुरावा करण्यात आला. हळूहळू का होईना लोकांना रोजगार उपलब्ध झाला. महाराष्ट्र राज्याच्या नरेगाच्या सचिवांना हि माहिती देऊन संपूर्ण राज्यात मनरेगाची कामे मोठ्या प्रमाणावर सुरु केल्यास ग्रामीण आदिवासी भागात मोठ्या प्रमाणात रोजगार मिळवून देता येईल. व त्यांना त्यातून आर्थिक सहाय्य होईल. त्यात मा. सचिवांनी सकारत्मक पाऊल उचलले. लोकांना त्याचा फायदा झाला. आणि प्रती दिवस 30 हजार ते 41 हजार लोकांना काम मिळत गेले.

observation

नयाखेडा जंगलात आता वन्यजीवनाचे बर्याच प्रमाणात वाढ होतांना दिसत आहे. त्यात विशेष करून वेगवेगळ्या प्रजातीचे पक्षी पाहायला मिळत आहे हे आमच्या साठी विशेष बाब आहे त्या सर्व पक्ष्यांचे स्वागत ग्रामसाभाच्या वतीने आही करत आहे Common name:- Eurasian eagle Scientifice name:-Bubo Bengalesis या सारखे पक्षी आता दिसून येतात. Spotbilled duck, littlecormorant, indian pondheron, black drongo, white brested kingfisher, bluecheeked bee eater, indian roller, redrented bulbul, oriental magpie robin, purpul sunbird, common myna निलगाय, सांबर, हरीण यासारखे प्राणी नवीन रोप वनाचे पान आणि शेंडे खाताना दिसून येते. त्यामुळे नवीन रोपवन वाढतांना पान दिसत नाही.

नवीन बाब

खोज संस्था आणि कृषी विभागाच्या सयुंक्त विद्यमानाने परतवाडा येथे रानभाजी महोत्सव साजरा करण्यात आला.त्यात विशेष करून रानभाज्यांचे महत्व सांगण्यात आले.खर तर अनेक शहरी लोकांना रान भाज्यांची माहिती नाही. कस बनवायच्या कोणत्या रान भाज्या खातात त्यामुळे अनेक लोकांनमध्ये रान भाज्यान विषयी जाणीव जागृती व्हावी त्या हेतूने हा कार्यक्रम पार पाडण्यात आला. प्रथमच कृषी विभागाने हा महोत्सव घेण्यास सहकार्य केले. सहभागी महिलांना प्रमाणपत्र देऊन गौरविण्यात आले.

नयाखेडा व पायविहीरच्या सामुहिक जंगलात निलगाय व हरणाच्या टोळ्यात वाढ झाली. त्यांना लोकांकडून अभय मिळाले. परंतू आता दोन्ही गावाच्या वनात बिबट्या व वाघाचे आगमन झाले असून वाघाने शिकार केली आहे.

बिबट्याच्या पायांचे ठसे

निलगायीची बिबट्याने केलेली शिकार

मेळघाट व्याघ्र प्रकल्प सोडून इतर कोणत्याही ठिकाणावर मुसळी वनस्पती पाहायला मिळत नाही पण गेल्या आठ वर्षाच्या संवर्धनामुळे आम्हाला आज नयाखेडा सामुहिक जंगलात मुसळी पाहायला मिळली आहे. येणाऱ्या भविष्यात अश्याच प्रकारची विविधता पाहायला मिळणार आहे छोट्या–छोट्या स्वरुपात का होईना पण ग्रामसभाचे प्रयत्न सुरु आहेत.

मजको अंतर्गत कोविडच्या काळातही ग्रामसभाना त्यांच्या मागणी प्रमाणे फळझाडांचे वाटप करण्यात आले. नयाखेडा (जांभळा), पायविहीर, लवादा (वन) लॉकडाऊन मुळे लोकांना अनेक समस्याना तोंड द्यावा लागला. त्यात

मुलभूत गरज भागविनेही कठीण झाले होते. त्यामुळे गावात जावून लोकांच्या अडचणी समजून घेतल्या किराणा राशन मिळत आहे कि नाही ते पाहण्यात आले. तर असे लक्ष्यात आले कि लोकांजवळ धान्य तर आहेच मात्र तेल, चटणी, कांदा, मसाले, मीठ या सारख्या गोष्टी नव्हत्याच. कारण गावातल्या किराणा दुकानात सुद्धा किराणा मिळत नसे, पूर्ण स्टोक संपलेला होता. नियोजन करून गावा गावात जावून किराणा खोज संस्थेच्या माध्यमातून वाटप करण्यात आला. काही दिवस लोकांना याची मदत झाली.

नावीन्यपूर्ण उपक्रम

ग्रामसभा पायविहीर, नयाखेडाने सामुहिक जंगलात मियावाकी पद्धती सारखे 1 x 1 मीटरच्या अंतरावर 1666 मिश्र रोपवन लागवड करण्यात आली. भविष्यात अनेक प्रकारची विविधता पाहण्यात मिळेल. त्या हेतूने हा छोटासा उपक्रम राबविण्यात आला आहे.

संवर्धनामुळे हळुहळु आता वणांची घनता वाढू लागली आणि त्याला फुल, फळ येणे सुरु झाले असून नयाखेडा येथील जंगलात भेराया वनस्पतीला आलेल्या शेंगा.

कोविडच्या काळात महाराष्ट्रातल्या सर्व शाळा सरकारने बंद केल्या होत्या. पण यातही online शिक्षण पद्धती सुरु होती. मात्र गावाकडे हि online शिक्षण घेणे शक्य नव्हते. मूलं शिक्षणा पासून वंचित राहत होते म्हणून पायविहीर गावाच्या पालकांनी विचार केला कि, आमच्या मुलांचे शिक्षण सुरु राहावे, यासाठी शालेय शिक्षण समितीने गावातील लोकांशी चर्चा केली व लोकांनी सुचविल्या प्रमाणे शाळा सुरु ठेवण्याचे ठरले.ही माहिती शाळेच्या शिक्षकांना देण्यात आली. परंतु दोन्ही शिक्षकांनी ''तुम्ही शाळा सुरु ठेवू नये'' असे सांगितले. मात्र हि बाब मुलांच्या शिक्षणाची अडचण लक्ष्यात घेता. समितीने मान्य केली नाही. जेंव्हा सरकारने शाळा सुरु करण्यास सांगितले व शिक्षकांना मुख्यालयी राहण्यास सांगितले. तेव्हा शिक्षक राहण्यास तयार नव्हते कारण कोविड ची भीती होती. म्हणुन पायविहीर गावाच्या ग्रामसभेने शिक्षण समितीच्या मार्गदर्शनात शाळा सुरु केली.

पायविहीर ग्रामसभेनी त्यांच्याच गावातल्या 3 शिकलेल्या मुलांची निवड करून शाळा सुरु केली. विशेष म्हणजे पायविहीर गावात शाळा सुरु ठेवण्यासारखे सभागृह किवां समाज मंदिर नाही म्हणून इम्पथी फाऊडेशनने बांधून दिलेल्या 2 वर्गखोल्या व जि. प. च्या निधीतून 1 वर्ग खोली तयार आहे. त्याच ठिकाणी मुलांना शिकविल्या जावू लागले. कोविड च्या दृष्टीने सर्व निकष शाळे मध्ये पाळले जातात.

परंतु अमरावती जिल्ह्या मधे कुठेही शाळा सुरु नसतांना फक्त आपण ज्या शाळेत शिकवितो त्या गावामध्ये जिल्हा परिषदच्या शाळेमध्ये शाळा सुरु असणे हि गोष्ट शिक्षिकांना आवडली नाही व आपण सांगितलेले ऐकत नाही. त्यामुळे त्यांनी शाळा सुरु असल्याची तक्रार जिल्हा शिक्षण अधिकाऱ्याकडे केली त्यानुसार तहसीलदार अचलपूर आपत्ती व्यवस्थापन प्रमुख म्हणून समितीच्या लोकांना तालुका कार्यालयात बोलावून शाळा. बंद करण्यास सांगितले. परंतु समिती व ग्रामसभेच्या लोकांनी शाळा सुरु राहिल असे सांगितले. त्यामुळे तहसीलदार यांनी तुम्ही जर शाळा बंद केली नाहीतर आताच्या आता गुन्हा दाखल करण्यात येईल अशी धमकी दिली. तरी सुद्धा तहसीलदार यांना लोकांनी शाळेविषयी, गावात सुरु असलेल्या सर्व विकास कामांची व वनविकासाची माहिती दिली. तेव्हा ते म्हणाले, मी आपत्ती व्यवस्थापनाचा प्रमुख आहे. आपण मुख्यकार्यकारी अधिकारी व जिल्हाधिकारी यांची परवानगी घेतली तर त्यांची शाळा सुरु ठेवण्यास काही हरकत राहणार नाही. असे तहसीलदार अचलपूर म्हणाले.

खरतर शाळा सुरु केल्या याविषयाची माहिती मा. जिल्हाधिकारी अमरावती, मा. मुख्यकार्यकारी अधिकारी, अमरावती व तहसीलदार अचलपूर यांना पूर्वीच इमेलद्वारे माहिती दिली होती. मा. जिल्हाधिकारी यांनी 'ओके' म्हणून उत्तर दिले होते. परंतु तहसीलदारानी तो इमेल पाहिला सुद्धा नव्हता. जेंव्हा ग्राम सभेच्या लोकांनी शाळे विषयी पूर्ण माहिती दिली आणि कोविडची सर्व दक्षता पाळून शाळा सुरु ठेवले असल्याचे सांगितले. तेंव्हा तहसीलदार म्हणाले, कि तुम्ही एवढी काळजी घेवून चांगल्या पद्धतिने शाळा सुरु ठेवली हि बाब इतर शाळांना मार्गदर्शक ठरू शकली असती. त्यानंतर तहसीलदार यांना आमच्या गावातल्या शाळेला भेट देवून कोविड च्या अनुषंघाने अधिक मार्गदर्शन मागण्यासाठी बोलावण्यात आले. या चर्चे नंतर मा. मुख्यकार्यकारी अधिकारी जि. प. अमरावती यांना ग्रामसभेने पुन्हा माहिती दिली. व शाळा सुरु ठेवली. यात शिक्षिकांनी स्वत: मुख्यालयी न राहता व वर्ग सुरु न करता ग्रामीण भागातील विद्यार्थ्यांना शिक्षणापासून वंचित ठेवण्यासाठी इरादा दिसून येतो. शिक्षकांच्या प्रयत्नाला पायविहीरच्या शालेय समितीने ग्रामसभेच्या सहमतीने दूर सारले. व शिक्षण सुरु ठेवले. गावातील शिक्षक मुलांना मानधन सुद्धा ग्रामसभेने वर्गणी, देणगी व ग्रामसभेच्या उत्पादनातून दिले आहे.

आनंदशाळा शिबिरानंतर शाळेतील जैवविविधता शिक्षण प्रकल्प उपक्रम अहवाल २०१८

पर्यावरण शिक्षण मित्र :- सहदेव दहीकर संस्थेचे नाव : खोज संस्था गौरखेडा (कुंभी) जि.अम.

शाळेचे नाव	शाळा भेटीचा तपशील किती,कधी कशासाठी	शाळेत करण्यासाठी निवडलेल्या प्रकल्प सद्यस्थिती	शाळेत केले गेलेले उपक्रमाची माहिती
जि.प शाळा पायविहीर	फोन वर संपर्क १ वेळा झाला प्रकल्प अभ्यासाची माहिती देण्याकरिता गेलो त्यानंतर दुसर्या दिवशी दि.१२/३/१८ रोजी शाळेला भेट देऊन आनंदशाळा शिबिरात झालेल्या प्रकल्प अभ्यास बद्दल म्याडम व विध्यार्थ्यांना सविस्तर माहिती दिले आणि पुरस्कारासाठी पाठविण्यास माहिती सांगितले.	शाळेला प्रकल्प सद्य दिले आहेत आणि प्रकल्प अभ्यास करण्यास व पुरस्कारासाठी पाठविन्या बाबत समजावून सांगितले व शाळा पातळी,जिल्हा पातळी,व राज्यस्तरीयवर असे एकूण ५ प्रकल्पाची निवड शाळेमधून करायची आहे व सी.ई.ई.ला फेब्रु ते मार्च पर्यंत ५ पैकी ३ प्रकल्प जिल्हास्तरीयवर पाठवावे व प्रत्यक्ष प्रकल्प करून त्याचे फोटो पूर्ण प्रक्रिया लिहून प.शि.मि यांच्या कडे पाठवून द्यायचे आहेत व एप्रिल ते मे या कालावधीत ५ प्रकल्पा पैकी ३ प्रकल्प राज्यस्तरीय वर प्रकल्प अभ्यास करून प.शि.मि.यांच्या कडे पाठवायचे आहेत आणि प्रकल्प मुल्यांकन संस्थेचे पी.आय,समन्यवक,प.शि.मी,शिक्षण क्षेत्रातील अभ्यासक व्यक्ती व शिक्षक यांनी मिळून प्रकल्प अभ्यास व मुल्यांकन करायचं आहे.आणि प्रकल्पाला लागणारा खर्च सर्व शिक्षा अभियान च्या निधीतून,देणगीदारव्यक्ती ,मजको बजेट मधून खर्च करावयाचा आहे या पद्धतीने पाचही शाळेत चर्चा झाली.	१) दि. ५ ऑक्टो २०१७ रोजी वन्यजीव सप्ताह अंतर्गत गावात प्रभातफेरी करून पर्यावरणावर आधारित जनजागृती करण्यात आले. **दि.२५/३/२०१८ रोजी पायविहीर येथे शिवारफेरी केली असता जंगलात मालटेकडी डोंगरावर जाऊन विद्यार्थ्यांनी पिटारा साहित्याच्या माद्यमातून दुर्बिने निरीक्षण करतांना तेंव्हा त्यांना रानडुक्कर,नीलगाय,हरण दिसले तसेच जंगलामध्ये फिरतांना झाडावर लावलेली नावांची पाटी दिसली खैर, बोर , अमलतास,पळस आणि त्या झाडाचे शास्त्रीय नाव वाचण्यात आले आणि ज्या झाडावर नावाची पाटी नव्हती त्या झाडांची नावे विद्यार्थ्यांनी शोधून सांगितले. सागा गवत , फुली गवत आणि ग्रामसभाने जंगलात केलेली कामे पाहिण्यात आले cct,wat,वन तळे ,पाणवठा,तलाव,आव ळ्याची लागवड केलेली नर्सरी,तसेच ५० हजाराची रोपवाटिका नर्सरी पाहून तेथील काम करणाऱ्या महिलांनी बी पेरण्यापासून ते झाड उगवे पर्यंतची सविस्तर माहिती दिली मार्गदर्शन केले.**

			ग्रामसचिवालय ऑफीस मध्ये येऊन विद्यार्थ्यांचा शिवारफेरी आढावा घेतला असता पक्षी,प्राणी,गवत,झाड,पहिले असे त्यानी सांगितले.
जि.प.शाळा खतीजापूर	भेटीचे दि.२६/१२/१७ पाणी तपासणी उपक्रम घेण्यासाठी व आनंद शाळेत झालेल्या प्रकल्प अभ्यासाची माहिती शाळेत दिले. दि.७/३/२०१८ प्रकल्प अभ्यास पुरस्कारासाठी पाठविण्याबाबत शाळेत चर्चा व माहिती शिक्षिका व विद्यार्थ्यांना दिली	दि. रोजी झाड नावाचे गाव प्रकल्प घेण्यात आला त्यामध्ये दोन गट पाडून पहिला गटाने कडूनिंबाच्या झाडांचे निरीक्षण केले तेंव्हा त्यांना कडूनिंबाच्या झाडावर खार,पक्षी मैना,पोपट,कबुतर,पक्ष्यांचे घरटे दिसले नंतर दुसऱ्या गटाने वडाच्या झाडाचे निरीक्षण करून चिमणी,कावळा,भारद्वाज,व कावळ्याचे घरटे दिसले नंतर निरीक्षण करून आल्यावर एका गटाला वर्गात झाडाचे जीवनचक्र व दुसऱ्या गटाला झाडावर कोणकोणते घटक अवलंबून राहतात त्याबद्दल चित्र काढून अवलंबून असणार्या घटकांची माहिती सेन्चुरी पेपर वर लिहिण्यात आली आणि जीवनचक्रबाबत बी पासून ते फुलापर्यंतचे अवस्था आहे ती चित्राद्वारे दाखविण्यात आले आणि झाडावरचे निरीक्षणात जे घटक आढळे त्यांची माहिती लिहण्यात आले.	दि.२६/१२/१७ रोजी खतीजापूर शाळेत पाणी तपासणी उपक्रम मुलांच्या माध्यमातून राबविला गेला.पाण्यातील असलेल्या विविध घटकांची माहिती व मुलांद्वारे प्रत्यक्ष पाणी परीक्षण करण्यात आले.आणि मार्गदर्शिका म्हणून रसे म्याडम उपस्थित होते.
जि.प.शाळा उपातखेडा	संपर्क २ वेळा १)दिसेम्बर महिन्याच्या तिसर्या आठवड्यात प्रकल्प अभ्यास उपक्रम विद्यार्थ्यानि कडून करून घेण्यासाठी शिक्षका सोबत फोन वर चर्चा झाली होती. २) प्रकल्प अभ्यास पुरस्कारासाठी पाठविन्या बाबत चर्चा झाली आणि प्रकल्प अभ्यास करण्यास सांगितले.	प्रकल्प अभ्यास १)आई-बाबा दिवस भर काय-काय करतात हा प्रकल्प निवडण्यात आला व स्वताच्या घरी जाऊन आई बाबाचे निरीषण करण्यात आले. २) माझ्या थाटात काय-काय आहे प्रथम तीन गट पाडून ज्या घरात तीन पिढी आहे अश्या लोकांची नावे निवडण्यात आले नंतर प्रत्येकी एक विद्यार्थी एकाच व्यक्ती कडून माहिती घेईल असे ठरले.व नोंदवही मध्ये थाळी उपक्रम विषयी फोरमेट बनवून माहिती नोंद करण्यास वरील सर्व नियोजन ठरवून निवड केलेल्या घरांना भेट देऊन माहिती विचारले. ३)आमचे गाव आमचे नियम हा प्रकल्प निवड केला आहे	**दि.१३/११/१७ रोजी जि .प .प्राथ.मराठी शाळा उपातखेडा येथे शिवारफेरी करण्यात आले त्यात ४२ विद्यार्थी सहभागी होते आणि मार्गदर्शक म्हणून श्री रसे सर,श्री बोंडे सर,श्री नेवारे सर शिवाफेरीत उपस्थित होते तसेच त्या दरम्यान विद्यार्थ्यांनी घटकांची नावे नोंदवले** **कडूनिंब, पळस, हिवर, सिताफळ, बदाम, बॉटल ब्रश, सांभालु, दुधारी, रायमोनिया, काशी, सप्तपर्णी, बॉटल ब्रश, सागा गवत , तीखाळी, फुली गवत, वासन वेल, खोबरवेल अश्या विविध वनस्पतींचे निरीक्षणे करून शिवारफेरी पूर्ण करण्यात आले.**

जि.प.शाळा नयाखेडा(जांभळा)	भेटीचे दि.२१/२/२०१८ प्रकल्प अभ्यास करण्याबाबत व पुरस्कारसाठी पाठविण्या बाबत शिक्षक व विद्यार्त्यां सोबत प्रत्यक्ष चर्चा झाली. दि.७/३/२०१८ रोजी प्रकल्प अभ्यास फॉर्मट देण्यास गेलो असता पुन्हा चर्चा झाली.	१) आमच्या गावाचे जंगल हा प्रकल्प निवडून शिवारफेरी केले व जंगलात जाऊन निरीक्षण करून रानडुक्कर,अस्वल यांचे विष्ठा दिसले.आणि १ मोर व अमलतास,पळस,भेर्या, वासनवेल, वाघाटी, बांबू, रानतुळस,निर्गुडी, आघाळया चिल्लर,रायमोनिया,कडूनिंब,सागवन,कुटकी गवत यासारखे वनस्पती आढळे त्याची नोंद करून जंगलातील CFR मध्ये मिळालेल्या जंगलाचा नकाशा दाखविण्यात आला.कोणकोणते कंपार्टमेंट आहे व किती हेक्टर वनक्षेत्र आहे त्या संदर्भात सविस्तर माहिती गोळा करून वर्गात आल्यावर चर्चा करून प्रकल्प अभ्यास सेन्चुरी पेपर वर लिहण्यात आले. २) विकतचा खाऊ अभ्यास हा प्रकल्पासाठी पहिले ज्या घरी लहान मुल-मुली आहेत.त्या घरांची निवड करून त्या घरांना भेटी देऊन विकतचा खाऊ काय-काय खातात ते त्यांच्या पालकांना व विद्यार्थांना विचारून माहिती नोंदविण्यात आले असता एकूण पाच घराला भेट दिली आणि विकतच्या खाऊ बद्दलची माहिती गावातील दुकानात जाऊन पडताळणी केली नंतर वर्गात येऊन सेन्चुरी पेपरवर खाऊचे नाव व किमती लिहिण्यात आले.	प्रशांत यांनी दगडांचे ९ प्रकारचे नमुने जमा केले आहे जि.प.शाळेतील विद्यार्थ्यांना घेऊन पळस फुलांचा रंग तयार होळी निमित्याने तयार केला . **दि. १३/१०/१७ रोजी शिवारफेरी करतांना १३ विद्यार्थी सहभागी होऊन शिवारफेरी करण्यात आले त्यात विविध घटक आढळले** **झाड वनस्पती सीताफळ, पळस, कडूनिंब, अमलतास, पापळा, बोर, सागवान, खैर, हिवर, राय मोनिया, सांभालु, आवळा, भिवरीया, तेंदु, पक्षी पोपट, मैना, फुलपाखरू पायरीडी ,गवत सागा, तिखाळी, फुली, रानभाजी फांगी आरा व आम्लेट यासारखे वनस्पतीचे निरीक्षण करून नोंद करण्यात आले.आणि जाणकार व्यक्ती श्री क्रिष्णा परसराम शेळके व मार्गदर्शक श्री मदनलाल उमक सरांनी विद्यार्थ्याना मार्गदर्शन केले.**
जि.प.शाळा कुंभी वाघोली	दि.१४/१२/१७ रोजी मुलांचे प्रकल्प अभ्यास उपक्रम घेतला व तीन गट पडून प्रत्येकी एका गटाला एक-एक प्रकल्प करण्यास दिले आणि त्यांनी दि.१९/१२/१८ प्रकल्प करून त्याचे सादरीकरण शाळेत केले दिलेल्या प्रकल्प गवत,पत्ते,कडधान्य,दगड,यांचा संग्रह करणे.	दि.१२./३/१८ रोजी पुरस्कारासाठी प्रकल्प अभ्यास करण्यासाठी शिक्षिकांना सांगितले व पहिले दोन प्रकल्प संस्था क्लस्टर व जिल्हा पातळी वर पाठविण्यास सांगितले व ते प्रकल्प प.शि.मि.यांच्या कडे लिहून पाठवावे.	दि.१९/१२/१७ रोजी प्रकल्प अभ्यास करतांना विद्यार्त्यानी संग्रह केलेले नमुने १)गवत ४ प्रकारचे २) ७ प्रकारचे झाडाचे पान ३) दगड ५ प्रकारचे ४) धान्य ५ प्रकारचे या पद्धतीने प्रकल्प अभ्यास करण्यात आले. आणि अमोल वाट सरांनी त्याबाबत मार्गदर्शन केले. **दि.१४ /१०/१७ रोजी जि.प.प्राथ.मराठी शाळा कुंभी वाघोली येथे शिवारफेरी करण्यात आले त्यात १० विद्यार्थी सहभागी होते. पळस, अमलतास,**

			हिवर, बाभूळ, सागवन, उंबर, सीताफळ, कडूनिंब, जामून, बांबू, काट उंबर, शिंदी, बारतोंडी, दुधारी गवत सागा, तिखाळी, फुली, शंक पुष्पी व पक्ष्यांचे अंडी आणि पक्षी मध्ये कावळा, पोपट,मैना भुरी, आणि फुलपाखरू कॉमन क्रो, लेमन फ्यंशी, फुलपाखरू कोश,वाघाटी वेल,वासन वेल, अश्या महत्वाचे घटक शिवारफेरी करतांना मिळाले आणि विद्यार्थ्यांनी नोंदी घेतले तसेच मार्गदर्शन अमोल वाट सर आणि जाणकार व्यक्ती श्री राहुल उईके,सुखराम गंगाराम धान्डेकर भाऊ उपस्थित होते.
जि.प.शाळा लवादा (वन)	१) प्रकल्प अभ्यास करण्यासाठी गेलो असता आनंदशाळेतील झालेल्या प्रकल्प विषयी शिक्षकांशी चर्चा झाली व प्रकल्प करण्यास सांगितले. संपर्क २ वेळा प्रकल्प अभ्यास करण्यासाठी व पर्यावरण उपक्रम राबविण्याबद्दल.		दि.७/११/१७ रोजी शिवारफेरी करण्यात आले त्यामध्ये २९ विद्यार्थी सहभागी होते आणि श्री वासनकर सर उपस्थित राहून स्वता मुलांना मार्गदर्शन करीत होते मोहा, चारोळी, बेल, बिबा, चिंच, तिवस, उंबर, अर्जुन, सागवान, बारू, सांभालु, बास, चेकरेज, तेंदू, जामून, धावडा, पिंपळ, दुधारी, सालई, सागा गवत, तीखाळी, सेईणार गवत, अस्वलाचे विष्ठा,सस्याचे विष्ठा हरणाचे विष्ठा यासारखे महत्वाचे नोंदी विद्यार्थ्यांनी केल्या आणि शाळेत जाऊन आढावा घेण्यात आले.शिवाफेरीत काय-काय बघितले तर विद्यार्थ्यांनी झाड,गवत व प्राण्याचे विष्ठा पहिले असे सांगून वासनकर सरांनी यावर मार्गदर्शन केले.

जैवविविधता संवर्धनात योगदान देणारे उपक्रम व त्यांचे निर्देशक*

१. आपल्या क्लस्टर अंतर्गत निवडलेल्या शाळेच्या विद्यार्थ्यांनी गोळा केलेल्या बियांबद्दल सांगा:

अ. कोणकोणत्या झाडांचे बिया गोळा केले? बियांचे प्रकार व संख्या अशी माहिती लिहा:(**पिकांचे वाण इथे लिहू नये**)

उदा: पळस-१००, बहावा- ५००

एकूण बी प्रकार: १०	**एकूण बी संख्या:६०३६**

बी प्रकार	बी संख्या	बी प्रकार	बी संख्या	बी प्रकार	बी संख्या
अमलतास	८७	बिबा	७		
सिताफळ	१५४४	सागवान	५०७		
पळस	२३	चारोळी	४८३		
रामफळ	१८				
पिंपळ					
भिंगरी	३६७				
सावरा	३०००				

ब. बिया गोळा करण्याच्या उपक्रमांत कोणकोणत्या शाळेतील किती विद्यार्थ्यांनी सहभाग घेतला?

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या
	जि.प.प्राथमिक मराठी शाळा कुंभी वाघोली	८
	जि.प.प्राथमिक मराठी शाळा लवादा (वन)	१३
	जि.प.प्राथमिक मराठी शाळा खतिजापूर	२

क. गोळा केलेल्या बियांचा संग्रह कुठे व कसा केला? या बियांचे काय करणार आहात? शाळानिहाय वेगवेगळे नियोजन असेल तर थोडक्यात माहिती द्या :- गोळा केलेले बिया विद्यार्थ्यांनी श्री सुखराम गंगाराम धान्डेकर यांच्या जवळ जमा केले. कारण ते JFM समितीचे अध्यक्ष आहेत. त्यामुळे त्यांना बिया ठेवण्यास सांगितले असता नंतर पावसाळ्यात बिया लावू असे सांगून दिले. त्यांच्या जवळ बिया दिले आहे. लवादा वन च्या विद्यार्थ्यांनी शाळेत बिया प्रदर्शनी करिता जमा केले होते. तसेच खतीजापूर येथील विद्यार्थ्यांनी पिंपळाचे बिया जमा करून वनविभागच्या नर्सरीला दिले.

२. आपल्या क्लस्टर अंतर्गत निवडलेल्या शाळेच्या विद्यार्थ्यांनी रोपं तयार केली असतील तर त्याबद्दल सांगा. मोहा व शेवगा च्या झाडाचे रोप तयार केलेत.

अ. कोणकोणत्या झाडाच्या बियापांसून रोपे तयार केली? किती संख्येत रोपे तयार केली?

झाडाचे नाव	रोपांची संख्या	झाडाचे नाव	रोपांची संख्या	झाडाचे नाव	रोपांची संख्या

मोहा	७०						
शेवगा	८९						

ब. रोपं तयार करण्याच्या प्रक्रियेत सहभागी विद्यार्थ्यांचा तपशील

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या
	जि.प.प्राथमिक मराठी शाळा पायविहीर	२६

क. तयार केलेली रोपं कुठे ठेवली आहेत? त्याची काळजी कशी घेतली जाते? त्यांचे पुढे काय करणार? याचे शाळानिहाय वेगळे नियोजन असेल तर तपशीलात सांगा :- सामुहिक जंगलाच्या नर्सरी मध्ये झाडे ठेवलेली आहे. त्याची देखरेख ची जबाबदारी ग्रामसभा करीत आहे. त्या झाडाला पाणी देण्यासाठी स्वतंत्र बोअरवेल खोदलेले आहे. तेथून नर्सरीला पाणी पुरवठा केला जातो. नर्सरीतील रोप मोठे झाल्यावर गावाच्या जंगलावरच लावतील.

३. आपल्या क्लस्टर अंतर्गत निवडलेल्या शाळेच्या विद्यार्थ्यांनी लावलेल्या झाडांचा तपशील सांगा:

अ. रोप/झाडांचे प्रकार/नावे	लावलेली संख्या	जगवलेल्या झाडांची संख्या

ब. झाडं लावण्याच्या उपक्रमात सहभागी विद्यार्थ्यांचे शाळानिहाय तपशील सांगा

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या
	जि.प.प्राथमिक मराठी शाळा पायविहीर	२६

क. झाडे कुठे लावली आहेत? लावलेल्या झाडांची निगा कशी राखली जाते? याबद्दल थोडक्यात सांगा :-

विद्यार्थ्यांनी झाडांची लागवड नर्सरी मध्ये केली आहे आणि त्याची निगा राखण्यासाठी गावातील चौकीदार व कामगार व्यक्ती आहेत.

४. आपल्या क्लस्टर अंतर्गत निवडलेल्या शाळेच्या किती विद्यार्थ्यांनी रोपवाटिका तंत्रात कुशलता प्राप्त केली?

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या

ब. रोपवाटिका कशी करावयाची याचे किती शाळांमध्ये किती विद्यार्थ्यांना प्रशिक्षण देण्यात आले?
प्रशिक्षण दिले नाही .

५. वणव्यापासून/ इतर स्थानिक धोक्यापासून वाचवलेले कुरण क्षेत्र/ वन क्षेत्र किती?

अ. हेक्टर मध्ये लिहा-

ब. कोणत्या धोक्यापासून वाचविले याचे तपशील, त्यात विद्यार्थी सहभाग कसा होता?

६. आपल्या क्लस्टर अंतर्गत निवडलेल्या शाळेच्या विद्यार्थ्यांच्या मदतीने/सहभागाने माती आणि पाणी संवर्धनासाठी वेगवेगळ्या रचना बांधल्या असतील तर याबद्दल थोडी माहिती सांगा? (जसे की बांध, सीसीटी)

अ. कोणत्या प्रकारची रचना बांधली?

ब. यामध्ये कोणकोणत्या शाळांमधून किती विद्यार्थ्यांचा सहभाग होता?
क. माती आणि पाणी संवर्धन रचनांचा उपयोक आणि व्यवस्थापन कसे होते आहे?

७. तुमच्या क्लस्टरमधील विद्यार्थ्यांनी सेंद्रिय खते आणि कीटकनाशके तयार केली असल्यास त्याचा तपशील सांगा.

अ. कोणकोणते खते व कीटकनाशके किती प्रमाणात तयार केली?

खते/कीटकनाशक नावे	किती तयार केले/ प्रमाण/वजन

ब. त्याचा वापर व परिणामकारकता अभ्यास करण्यात आला आहे काय? असल्यास थोडक्यात माहिती लिहा.
क. या उपक्रमामध्ये कोणत्या शाळेतील किती विद्यार्थ्यांनी कशा स्वरूपाचा सहभाग घेतला?

ड. सेंद्रिय खते आणि कीटकनाशके तयार करण्यात कुशल बनलेल्या विद्यार्थ्यांची नावे

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या

८. तुमच्या क्लस्टरमधील विद्यार्थ्यांनी स्थानिक संसाधनापासून इको प्रोडक्ट्स तयार केली आहेत का?

अ. कोणती प्रोडक्ट/वस्तू	किती संख्येत / प्रमाण / वजन
पळस फुलाचा रंग	१० लिटर

ब. इको प्रोडक्टचे काय केले? विक्री केली का? प्रोडक्टबद्दल लोकांच्या काही प्रतिक्रिया काय होत्या?
होळी सणा निमित्य गावातील विद्यार्थ्यांना घेऊन पळस पुलाचा रंग तयार करण्यात आले आणि तो रंग धुलीवंदन च्या दिवसी विद्यार्थ्यांनी रंग म्हणून वापरला असता हा प्रयोग त्यांच्या आई-वडिलांना सांगितला तर त्यांनी पळस फुलाचा रंग येणाऱ्या वर्षाला वापरतील आणि रंग बनविण्याची प्रक्रिया करतील करण नैसर्गिक रंग असल्याने केमिकल चा वापर यात होत नाही व शरीराला कोणत्याही प्रकारची हानी होत नाही असे विद्यार्थानच्या पालकांचे प्रतिक्रिया होते.

क. इको प्रोडक्ट/वस्तू बनविण्याच्या प्रक्रियेत सहभागी शाळांनुसार विद्यार्थ्यांची संख्या सांगा.
जि .प .प्राथ .शाळा नयाखेडा जांभळा येथील विध्यार्थी ३ होते. जनता हायस्कूल परसापूर चे ३विधार्थी व श्री. गु. तु. काळे महाविद्यालय तेलखार १ आणि २ मुली.एकुण ९ विधार्थी नयाखेडा (जांभळा) होते.
ड. स्थानिक संसाधनापासून इको प्रोडक्ट्स तयार करण्यात कुशल विद्यार्थ्यांची यादी द्या.

अ.क्र.	शाळेचे नाव	विद्यार्थी संख्या
	जि.प.प्राथमिक शाळा नयाखेडा (जांभळा)	९

९. अ. विद्यार्थी/शिक्षक/पर्यावरण शिक्षण मित्र आणि संस्था यांनी मिळून आपल्या क्लस्टर मध्ये जैवविविधता संदेश पोहचविण्यासाठी शिबीर/मेळा/प्रदर्शन/व्याख्यान/सहल/चर्चा/बैठक यांचे आयोजन केले असेल तर त्याची थोडक्यात माहिती द्या.

कार्यक्रमाचे स्वरूप	कधी घेतला?	उपस्थित/भेट दिलेले लोक
जैवविविधता दिवस	२२ मे	गावकरी लोक व सहभागी विद्यार्थी तसेच पर्यावरण शिक्षण मित्र
वन्यजीव सप्ताह कार्यक्रम	१ ते ७ ऑक्टोंबर	गावकरी लोक,विद्यार्थी वनविभाग चे कर्मचारी व

		पर्यावरण शिक्षण मित्र
मोहन झां स्मृती वन उदघाटन	१७ मे	ग्रामस्थ,वनविभाग,शाळेचे विद्यार्थी,खोज कार्यकर्ता
जागतिक वन दिवस	२१ मार्च	ग्रामस्थ,वनविभाग,शाळेचे विद्यार्थी व पर्यावरण शिक्षण मित्र

ब. जैवविविधता संवर्धनाचे संदेश पोहोचलेल्या व्यक्तीची कुटुंबाची संख्या - (व्यक्तींची संख्या लिहिताना कुटुंबातील व्यक्तींची संख्या ध्यानात घेऊन व त्याशिवाय इतर काही व्यक्तींना संपर्क केले असेल तर त्यांची एकत्रित लिहावी)

कुटुंबांची संख्या: ६९८	व्यक्तींची संख्या: २०९४

—.**जैविविधता संदेश लोकांपर्यंत पोह्चाविण्यासाठीच्या या कार्यक्रमात शाळेच्या मुलांचा सहभाग कोणकोणत्या कामात कशा कशा स्वरूपाचा होता**? वन्यजीव सप्ताह कार्यक्रमांतर्गत विद्यार्थ्यांनी झाडे लावा झाडे जगवा, पाणी अडवा पाणी जिरवा, स्वच्छता करा अश्या प्रकारचे संदेश गावात प्रभात फेरी करून घोषणा करण्यात आले. गाव स्वच्छता व कचरा जमा करून कचर्याचे व्यवस्थापन करण्यात आले. प्रजाकसत्ताच्या दिवशी पर्यावरणावरणावर आधारित जनजागृती कार्यक्रम घेण्यात आला. जंगल, वन्यजीवांचे संरक्षण, पाणी वाचविणे, जंगलाला आगी पासून वाचविणे अश्या विविध विषयावर गीत व पटनाथ्याच्या स्वरुपात विद्यार्थ्यांनी लोकांपर्यंत संदेश पोहचविला. तसेच पायविहीर येथे सत्यपाल महाराजांचा कीर्तन कार्यक्रम आयोजित करून जैवविविधतेवर जनजागृती संदेश त्यामाद्यमातून देण्यात आले.

१०. शिवारफेरी

१)शिवारफेरी हा उपक्रम केलेल्या शाळेचे तपशील खालील मुद्याला अनुसरून लिहावे:

१. शाळेचे नाव :- जि .प .प्राथ.शाळा नयाखेडा(जांभळा)

२. शिवारफेरीची तारीख :- १३/१०/१७

३. सहभागी विद्यार्थ्यांची संख्या :-१३

४. सहभागी शिक्षकांचे पूर्ण नावे :- श्री .मदनलाल उमक सर

५. शिवारफेरीसाठी गावातील कोणत्या जाणकार व्यक्तींची मदत झाली त्यांचे पूर्ण नावे :- क्रिष्णा परसराम शेळके

६. शिवारफेरीत आढळेलेल्या घटकांची संख्या :-

अ. झाडे १)सीताफळ २)पळस ३)कडूनिंब ४)अमलतास ५)पापळा ६)बोर ७)सागवान ८)खैर ९) हिवर १०)राय मोनिया ११) सांभालु १२)आवळा १३) भिवरीया १४) तेंदु **ब. पक्षी**,१)भुरी २) पोपट ३) मैना **क. फुलपाखरे**,१)पायरीडी **ड. गवत**, १) सागा गवत २) तिखाळी ३) फुली ४) बास ५) **इ. पिके व किडे**, **ई. पाली**, **सरडे**, **बेडूक**, **उ. रानभाज्या** १) फांगी आरा व **अळंबी**,आम्लेट **ऊ. इतर घटक**

७. शिवारफेरीत केलेले मोजमाप/अभ्यास पद्धती बद्दल थोड-(बिंदू, रेषा, चौरस पद्धत)

८. शिवारफेरीतून आढळेलेल्या गोष्टींचे तपशीलवार नोंदी जैवविविधता नोंदवहीमध्ये केले असेल तर त्याबद्दल थोडी माहिती लिहा- नोंदीची पद्धत, माहिती कोणी नोंदविली, त्याचे वापर कशासाठी केले जाते, इत्यादी.

९. शिवारफेरीत कसं वाटलं? काय शिकायला मिळालं? हे सांगणारं दोन विद्यार्थ्यांचे मत १)मोनिका मनोहर चव्हाण शिवाफेरीत आम्हाला खूप मजा आली.त्यात आम्ही विविध पक्षी झाड,गवत,पहिले आणि किट मधून छत्री (आम्लेट) रानभाजी शोधली होती

२) कुलदीप राजू शनवारे यांचे मत शिवारफेरी करणे आम्हाला खूप आवडतो कारण शिवारफेरी पासून बर्याच झाडाची ओळख आम्हाला झाली आहे आणि हा उपक्रम उत्साही आहे. ३)शिक्षकाचे थोडक्यात मत.श्री मदनलाल उमक सरांचे मत शिवारफेरी उपक्रम हा क्लस्टर मधील सर्व शाळांमध्ये घ्यायला पाहिजे करण यामधून शिकायला भरपूर काही मिळते शिवाफेरीच्या शिक्षणातून प्रत्यक्ष अनुभव घेत विद्यार्थी उत्साहपूर्वक शिकतात त्यामुळे हा अभ्यासाचा सोपा मार्ग होऊ शकतो.

१०. शिवारफेरीचे फोटो

शिवारफेरी कीट/साहित्य याचे मुलांकडून वापर करत असतानाचे, मोजमापे करीत असतानाचे व परिसर दिसेल असे सर्व मिळून फक्त पाच फोटो पाठवावे.

२) शिवारफेरी हा उपक्रम केलेल्या शाळेचे तपशील खालील मुद्याला अनुसरून लिहावे:

१. शाळेचे नाव:- जि .प .प्राथ.शाळा कुंभी वाघोली

२. शिवारफेरीची तारीख :- १४ / १०/ १७

३. सहभागी विद्यार्थ्यांची संख्या :- १०

४. सहभागी शिक्षकांचे पूर्ण नावे :- श्री अमोल वाट सर

५. शिवारफेरीसाठी गावातील कोणत्या जाणकार व्यक्तींची मदत झाली त्यांचे पूर्ण नावे:-

६. शिवारफेरीत अढळेलेल्या घटकांची संख्या

अ. झाडे १)पळस २)अमलतास ३)हिवर ४)बाभूळ ५)सागवन ६)उंबर ७)सीताफळ ८)कडूनिंब ९)जामून १०)बांबू ११)काट उंबर १२)शिंदी १३)बारतोंडी १४)दुधारी **ब. पक्षी**, **क. फुलपाखरे**,१)कॉमन क्रो २)लेमन फ्यंशी **ड.** सागा गवत २) तीखाळी ३)फुली गवत ४)शंक पुष्पी **इ. पिके व किडे,उदय किड ई. पाली, सरडे, बेडूक**, **उ. रानभाज्या अळंबी, ऊ. इतर घटक** पक्ष्यांचे अंडी,फुलपाखरू कोश,वाघाटी वेल,वासन वेल,

७. शिवारफेरीत केप/अभ्यास पद्धती बद्दल थोड-(बिंदू, रेषा, चौरस पद्धत)

८. शिवारफेरीतून आढळेलेल्या गोष्टींचे तपशीलवार नोंदी जैवविविधता नोंदवहीमध्ये केले असेल तर त्याबद्दल थोडी माहिती लिहा- नोंदीची पद्धत, माहिती कोणी नोंदविली, त्याचे वापर कशासाठी केले जाते, इत्यादी.

९. **शिवारफेरीत कसं वाटलं? काय शिकायला मिळालं?** हे सांगणारं दोन विद्यार्थी व एका शिक्षकाचे थोडक्यात मत.श्री अमोल वाट सर शिवारफेरी उपक्रमातून निरनिराळ्या वनस्पतींची माहिती जसे कि झाड,गवत,वेल औषधी वनस्पतींचे उपयोगाबद्दल महत्वाची माहिती मिळाली.

१०. **शिवारफेरीचे फोटो**

शिवारफेरी कीट/साहित्य याचे मुलांकडून वापर करत असतानाचे, मोजमापे करीत असतानाचे व परिसर दिसेल असे सर्व मिळून फक्त पाच फोटो पाठवावे

३) शिवारफेरी हा उपक्रम केलेल्या शाळेचे तपशील खालील मुद्याला अनुसरून लिहावे:

१. शाळेचे नाव :- जि .प .प्राथ.शाळा लवादा (वन)

२. शिवारफेरीची तारीख :- ७ / ११/ १७

३. सहभागी विद्यार्थ्यांची संख्या :- २९

४. सहभागी शिक्षकांचे पूर्ण नावे :- श्री वासनकर सर

५. शिवारफेरीसाठी गावातील कोणत्या जाणकार व्यक्तींची मदत झाली त्यांचे पूर्ण नावे:-

६. शिवारफेरीत अढळेलेल्या घटकांची संख्या

अ. झाडे १)मोहा २)चारोळी ३)बेल ४)बिबा ५)चिंच ६)तिवस ७)उंबर ८)कऊ (अर्जुन) ९) सागवान १०)बारू ११) सांभालु १२)बास (बांबू) १३) चेकरेज १४) टेम्ब्रू (तेंदू) १५) जामून १६) धावडा १७) पिंपळ १८) दुधारी १९)सालई **ब. पक्षी**, **क. फुलपाखरे**,१) **ड.** सागा गवत २) तीखाळी ३)सेईणार गवत **इ. पिके व किडे,उदय किड ई. पाली, सरडे, बेडूक**, **उ. रानभाज्या अळंबी, ऊ. इतर घटक** अस्वलाचे विष्ठा,सस्याचे विष्ठा,हरणाचे विष्ठा.

७. शिवारफेरीत केलेले मोजमाप/अभ्यास पद्धती बद्दल थोड-(बिंदू, रेषा, चौरस पद्धत)
८. शिवारफेरीतून आढळेलेल्या गोष्टींचे तपशीलवार नोंदी जैवविविधता नोंदवहीमध्ये केले असेल तर त्याबद्दल थोडी माहिती लिहा- नोंदीची पद्धत, माहिती कोणी नोंदविली, त्याचे वापर कशासाठी केले जाते, इत्यादी.
९. शिवारफेरीत कसं वाटलं? काय शिकायला मिळालं? विद्यार्थ्यांचे मत १)रामू भूसुम. शाळेपेक्षा जंगलात जाऊन शिकणे चांगले वाटते. क्यामेरा व दुर्बिणीतून दूरच्या पक्षी,प्राणी झाड मोठे दिसतात. त्यामुळे शिवारफेरी करणे आम्हाला आवडतो श्री.वासनकर सर शिक्षकाचे थोडक्यात मत शिवारफेरी करताना विद्यार्थ्यांना घटकांचा स्पर्श जाणीव झाला. त्यामुळे शैक्षणिक क्षेत्रातील प्रकल्प अभ्यास या माद्यमातून मुलांना शिकविता येणे सोपे होईल.
१०. शिवारफेरीचे फोटो
शिवारफेरी कीट/साहित्य याचे मुलांकडून वापर करत असतानाचे, मोजमापे करीत असतानाचे व परिसर दिसेल असे सर्व मिळून फक्त पाच फोटो पाठवावे.

४) शिवारफेरी हा उपक्रम केलेल्या शाळेचे तपशील खालील मुद्याला अनुसरून लिहावे:
१.**शाळेचे नाव :-** जि .प .प्राथ.शाळा उपातखेडा
२. शिवारफेरीची तारीख :- १३/११/१७
३. सहभागी विद्यार्थ्यांची संख्या :- ४२
४. सहभागी शिक्षकांचे पूर्ण नावे :- श्री रसे सर,श्री बोंडे सर,श्री नेवारे सर
५. शिवारफेरीसाठी गावातील कोणत्या जाणकार व्यक्तींची मदत झाली त्यांचे पूर्ण नावे :-
६. शिवारफेरीत अढळेलेल्या घटकांची संख्या
अ. झाडे १)कडूनिंब २)पळस ३)हिवर ४)सिताफळ ५)बदाम ६)बॉटल ब्रश ७) ८)सांभालु ९)दुधारी १०)रायमोनिया ११)काशी १२)सप्तपर्णी १३)बॉटल ब्रश **ब. पक्षी**, **क. फुलपाखरे**,१) **ड**. सागा गवत २) तीखाळी ३)फुली गवत ४) **इ. पिके व किडे**, **ई. पाली, सरडे, बेडूक, उ. रानभाज्या अळंबी, ऊ. इतर घटक** वासन वेल,खोबरवेल,
७. शिवारफेरीत केलेले मोजमाप/अभ्यास पद्धती बद्दल थोड-(बिंदू, रेषा, चौरस पद्धत)
८. शिवारफेरीतून आढळेलेल्या गोष्टींचे तपशीलवार नोंदी जैवविविधता नोंदवहीमध्ये केले असेल तर त्याबद्दल थोडी माहिती लिहा- नोंदीची पद्धत, माहिती कोणी नोंदविली, त्याचे वापर कशासाठी केले जाते, इत्यादी.
९. शिवारफेरीत कसं वाटलं? काय शिकायला मिळालं? हे सांगणारं दोन विद्यार्थी व एका श्री नेवारे सर यांचे थोडक्यात मत.झाड,गवत,वेली पक्षी प्राणी,फुलपाखरू ची माहिती मिळविण्यासाठी विद्यार्थ्यांनी प्रत्यक्ष शिवारफेरीत प्रयत्न केले आणि जास्तीत-जास्त घटक शोधण्याचा प्रयत्न केला आणि पिटारा किटच्या मदतीने निरनिराळ्या रानभाज्या फुलपाखरे ओळखता आले.शिवारफेरी उपक्रमात मुलांना व आम्हाला देखील शिकण्यास आनंद आला.आणि असा उपक्रम कधीच झाला नाही महत्वाचे म्हणजे यात आवश्यक व महत्वाच्या वनस्पतीचे माहिती मिळाली.
१०. शिवारफेरीचे फोटो
शिवारफेरी कीट/साहित्य याचे मुलांकडून वापर करत असतानाचे, मोजमापे करीत असतानाचे व परिसर दिसेल असे सर्व मिळून फक्त पाच फोटो पाठवावे.

५)शिवारफेरी हा उपक्रम केलेल्या शाळेचे तपशील खालील मुद्याला अनुसरून लिहावे:
१. शाळेचे नाव :- जि .प .प्राथ.शाळा पायविहीर
२. शिवारफेरीची तारीख :- २५/११/१७
३. सहभागी विद्यार्थ्यांची संख्या :- ४४
४. सहभागी शिक्षकांचे पूर्ण नावे :-
५. शिवारफेरीसाठी गावातील कोणत्या जाणकार व्यक्तींची मदत झाली त्यांचे पूर्ण नावे :-

६. शिवारफेरीत अढळेलेल्या घटकांची संख्या

अ. झाडे १)खैर २)बोर ३)पळस ४) अमलतास **ब.** पक्षी,शिकारा **क.** फुलपाखरे, **ड.** सागा गवत ३)फुली गवत ४) **इ. पिके व किडे, ई. पाली, सरडे, बेडूक, उ. रानभाज्या अळंबी, ऊ. इतर घटक** ग्रामसभाने जंगलात केलेली कामे पाहिण्यात आले cct,wat,वन तळे ,पाणवठा,तलाव,आवळ्याची लागवड केलेली नर्सरी,तसेच ५० हजाराची रोपवाटिका,नील गाय,रानडुक्कर,हरण

७. शिवारफेरीत केलेले मोजमाप/अभ्यास पद्धती बद्दल थोड-(बिंदू, रेषा, चौरस पद्धत)

८. शिवारफेरीतून आढळेलेल्या गोष्टींचे तपशीलवार नोंदी जैवविविधता नोंदवहीमध्ये केले असेल तर त्याबद्दल थोडी माहिती लिहा- नोंदीची पद्धत, माहिती कोणी नोंदविली, त्याचे वापर कशासाठी केले जाते, इत्यादी.

९. शिवारफेरीत कसं वाटलं? काय शिकायला मिळालं? हे सांगणारं दोन विद्यार्थी व एका शिक्षकाचे थोडक्यात मत.शिवारफेरी नंतर विद्यार्थ्यांचा आढावा घेतला असता त्यांनी सांगितले कि शिवाफेरीतून आम्हाला वन्यप्राणी व नवनवीन झाड पाहायला मिळाले आहे व काही झाडांची ओळख झाली आहे.आणि शास्त्रीय नावे देखील नवीन प्राणी,पक्षी,झाड पाहणे जंगलात जाने आम्हाला खूप आवडतो.

१०. शिवारफेरीचे फोटो

शिवारफेरी कीट/ साहित्य याचे मुलांकडून वापर करत असतानाचे, मोजमापे करीत असतानाचे व परिसर दिसेल असे सर्व मिळून फक्त पाच फोटो पाठवावे.

११. विद्यार्थ्यांनी बेंरियम

	हर्बेरियम बनविलेल्या शाळांची संख्या	**सर्व शाळा मिळून हर्बेरीअम बनविलेल्या गवतांची संख्या**

हर्बेरीअम केलेल्या गवताची यादी

हर्बेरीअम बनविण्याची प्रक्रिया किती विद्यार्थी करू शकतात?

अ.क्र.	**शाळेचे नाव**	**हर्बेरीअम बनवू शकतील अशा विद्यार्थ्यांची संख्या**	**हर्बेरीअम बनवू शकतील अशा विद्यार्थ्यांची यादी**
	जि.प.प्राथमिक मराठी शाळा नयाखेडा (जांभळा)	५	मोनिका मनोहर चव्हाण राधिका संजू माकोडे निलेश जवाहरलाल काळे कुलदीप राजू शनवारे राज रामराव बेलसरे
	जि.प.प्राथमिक मराठी शाळा उपातखेडा	३७	अनामिका बालाजी काळे वर्ग ७ वा शारदा संजू भागेकर

			निकिता सज्जुलाल तोटे नंदनी गोविंदराव शनवारे राजश्री ओम जावरकर पूनम राजाराम जामुन्कर सागर गंगाराम काळे आकाश अनिल काळे राजेंद्र नामदेव बेलसरे राजकुमार संजय भाकरे निकेश बजरंग धन्डेकर शुभम सुकलाल जामकर माणिकराव काळे अशोक सावलकर मंगल काळे प्रकाश काळे पतीराम जामुन्कर गोपाल खडके राजू बेलसरे अमित मावस्कर निलेश बुसूम अमोल काळे प्रणव मावस्कर अनिकेत खडके साहिल काळे मनिषा काळे जमुना मावस्कर वैष्णवी खडके

			शीतल येवले गायत्री जावरकर राज शनवारे विक्की मोरे गिरीधर गायन लखान शेळके विजय बेलसरे तुषार शनवारे विजय काळे
	जि.प.प्राथमिक मराठी शाळा खतीजापूर	१०	नंदनी नामदेव शनवारे प्रीतेश बंडू काळे कुलदीप संतोष आठवले रोषण दीपक गाठे उदय विनोद पंडोले ओम गाजू बराहे सोनक्षी सुरेश मावस्कर कोमल गजानन चावंडे नितीन प्रदीप आठवले शिवम रामकिसन बारस्कर
	जि.प.प्राथमिक मराठी शाळा लवादा वन	९	बबली मावस्कर रजनी सावलकर गायत्री तोटे सरिता कस्देकर अंजली कासदेकर रवींद्र कासदेकर पंकज कासदेकर

			शिवानी भूसूम रोषण बेलसरे
	जि.प.प्राथमिक शाळा पायविहीर		प्रेरणा रामू काळे रविना रमेश तोटे शिवम भालचंद्र बलोदे चांदणी भांगु झारेकर रीना बळीराम जांबू सुहानी गणेश जांबेकर शाम दादाराव बेलसरे नितीन हिरामण मावस्कर दीपक दिलीप लोखंडे राजेंद्र रतन भूसुम अमित शंकर तोटे
	जि.प.प्राथमिक मराठी शाळा कुंभी वाघोली	६	देविका बिसंदरे उषा जामुन्कर अंकुश धुर्वे राजू उईके महेश शेंडे सुधीर धन्डेकर

१२. दोन वर्षापूर्वी तुम्ही आपल्या भागातील स्थानिक आंब्याच्या प्रकारांचा अभ्यास केला होता, या अभ्यासाचे फोटो व तपशील पाठवावे.

बियाणे उगवण क्षमता अभ्यास

दि: २३/ ६/ २०१८

शाळा : जि.प.प्राथमिक मराठी शाळा उपातखेडा

शिक्षकांचे नाव :

सहभागी एकूण संख्या : २५

अ क्र.	कोणत्या पिकाच बियाण	पारंपारिक/ सुधारित	बियाण आणणार्यांच नाव नाव	उगवायला लागलेल्या कालावधी	उगवण क्षमता (%)
१	ज्वारी	पारंपारिक	हरिचंद्र हरी मावस्कर	५ दिवसानंतर	९१%
२	बाजरी	पारंपारिक	सीताराम पुनाजी कासदेकर	५ दिवसानंतर	१००%

पारंपारिक पद्धतीने राखलेले बियाणे : पारंपारिक पद्धतीचे बियाणे उगवण क्षमता तपासणी साठी नमुने घेतले होते.

सुधारित कृषी कढून आणलेले बियाणे :

लोकांचे प्रतिक्रिया :- या अगोदर आमच्या गावात कुठल्याही प्रकारचे बी उगवण क्षमता तपासणी झाली नाही त्यामुळे हा प्रयोग पहिल्यांदा आपल्या कडून होत आहे. आणि हा उपक्रम आमच्या साठी खूप महत्वाचा आहे. आतापर्यंत आम्ही समजत होतो कि पाणी न आल्याने किंवा पाणी जास्त पडल्याने बियांची उगवण कमी होते परंतु हे माहित नव्हतच कि बियांची उगवण क्षमता तपासणी केल्याने बीयांची गुणवत्ता माहित पडतो. आणि आम्ही पाण्याला व हवामानाला दोष देत राहतो. त्यामुळे अनेकदा गैरसमज होत असल्यामुळे आता तपासणी मुळे लोकांची गैरसमज दूर झाली तसेच उपस्थित असलेल्या लोकांनपैकी एका व्यक्तीला जर्मीनेशन तपासणी संदर्भात थोडी फार माहिती होती परंतु त्यांनी प्रत्यक्ष करतांना पहिले नाही आणि आता मात्र प्रत्यक्ष पाहिल्यामुळे अनुभव आला त्यामुळे गावातील इतर शेतकरी लोकांना या उपक्रमाबद्दल सांगणार आहे असे आम्हाला त्यांनी म्हटले.तसेच येणाऱ्या हंगामाला आम्ही बियांची उगवण क्षमता तुमच्या कडून पेरणी पूर्वी तपासून घेवू .

चर्चा झालेले मुद्दे :- : बी उगवण क्षमता तपासणी करण्या पूर्वी गावात फोन वर संपर्क करून चार शेतकऱ्यांना कळविण्यात आले कि आपल्याला बियांची उगवण क्षमता करायची आहे तरी आपण बियांची तपासणी करायला गावातील इतर शेतकऱ्यांना सांगा म्हणजे बियाणांची असलेली गुणवत्ता शक्ती किती आहे हे समजून येईल आणि त्यामध्ये शेतकऱ्यांची फसवणूक होणार नाही. त्यामुळे बी तपासणी करणे अत्यंत महत्वाचे आहे. असे सांगितल्यावर शेतकऱ्यांनी हो म्हणून आम्ही त्यांना पुढील दिवसाला सकाळी ८ वाजता येणार असे सांगितले त्यामुळे आपल्याला ज्या बीयांची तपासणी करायची आहे त्या बियांचे वेगवेगळे नमुने घेवून ग्लास भर पाण्यात मुठ भर म्हणजे शंभर दाण्या एवढे नमुने तपासणीच्या तीन तास अगोदर ग्लास भर पाण्यात भिजू घालावेत कारण त्याशिवाय बियांची तपासणी होणार नाही रात्री फोन करून सांगितले कि आपण बिया उदयाला भिजू घालावेत आम्ही येणार आहे नंतर दुसऱ्या दिवशी जाऊन विद्यार्थ्यांना जमा करून घेतले व गावातील असलेल्या लोकांना सोबत घेवून बी उगवण क्षमता तपासणी पाहण्या करिता व प्रक्रिया समजून घेण्याकरिता आले होते कोणाकोणाला बी उगवण क्षमता तपासायची आहे. असे उपस्थित लोकांना प्रश्न विचारला तर उपस्थितांपैकी २ व्यक्तींनी बी उगवण तपासणी करण्यास हो म्हटले तेथे गावातील २५ विद्यार्थी – विद्यार्थींनी उपस्थित होते. त्यापैकी तीन मुलीनी हात वर करून मी करणार असे म्हटले असता त्या तीन मुलींना घेऊन तपासणी करण्यास सांगितले प्रथम पारंपारिक ज्वारीचे नमुने घेतले जर्मिनेशन पेपर घेऊन बकेट मध्ये एक पेपर पूर्णपणे बुडवून घेतले एकूण शंभर बियाणे विद्यार्थ्यांनी मोजून ठेवले आणि भिजवलेल्या बियांचे नमुने जर्मिनेशन पेपर वर एक इंच या

अंतरावर असे दहा बाय दहा पर्यंत ठेवून स्केलने मोजून ठेवण्यात आले. सर्व बियाणे ठेवून झाल्यावर चारही बाजूने फोल्ड करून जर्मिनेशन पेपर ला गुंडाळून त्यावर विद्यार्थिनीचे नाव दिनांक लिहून गोल करून वरून दोरीने बांधण्यात आले. आणि सर्वांना सांगण्यात आले कि तीन दिवसाने हि बिया किती टक्के उगवेल हे समजू येईल. पाचव्या दिवशी गावात जावून शाळेत उगवण क्षमता पाहण्यात आले तेंव्हा बाजरी चे उगवण क्षमता १०० % तर ज्वारीचे ९१ % टक्के दिसून आले. तसेच या दरम्यान तेथे असलेल्या लोकांना व शाळेतील चिमुकल्यांना सांगण्यात आले कि रासायनिक शेती करणे सोडा व सेंद्रिय शेती करा कारण रासायनिक शेतीमुळे जमिनीत असलेले पोषक तत्व देणारे जीवजंतू नष्ठ होतात. आणि आपल्या आई-वडिलांना समजावून सांगा कि आमचा पुढच भविष्य तुम्ही का धोक्यात टाकतात कारण या किटक नाशका मुळे आमचे पुढील जीवनमान धोक्यात येत आहे. त्यामुळे पक्षी, कीटक, वन्यजीव, सरपटणारे प्राणी, यांची पण शिकार करू नका कारण यांच्या मुळे आपण आहे. आणि आपण एकमेकांवर अवलंबून आहोत हे विसरायला नकोत.

प्रश्न उत्तर :-

१) विद्यार्थांनी विचारलेले प्रश्न :- हे काय आहे ?

उत्तर :- हा जर्मिनेशन पेपर आहे आणि या पेपर द्वारे आपण बियांची उगवण क्षमता तपासणी करू शकतो.

२) हा पेपर तुम्ही कुठून आणला ?

उत्तर :- हा पेपर आम्ही पर्यावरण शिक्षण केंद्र पुणे येथून आणला आहे आणि हा पेपर कृषी विभागा मध्ये सुद्धा आपल्याला मिळू शकतो.

३) हा पेपर किती रुपयाला मिळतो ?

उत्तर :- २५० रुपये प्रती किलो

थोडक्यात मार्गदर्शन :- जर्मीनेशन पेपर हा बियांची उगवण क्षमता तपासणी करिता वापरतात म्हणून बाजारातून किंवा घरी साठवून ठेवलेले बियांची तुलनात्मक अभ्यास जर्मीनेशन पेपरद्वारे आपण करू शकतो तसेच बि यांच्या बाबतीत शेतकऱ्याचा बाजारात जी फसवणूक होते ते आपण याद्वारे टाळू शकतो. जर्मिनेशन तपासणी केल्यामुळे शेतकऱ्याला आर्थिक नुकसान पासून वाचवू शकतो त्यामुळे शेतकरी मजबूत व सक्षम बनवू शकतो या मध्यामातून त्याचा चांगला विकास होवू शकतो. आणि अश्या छोट्या-छोट्या उपक्रमातून एक चांगला शेतकरी तयार होऊ शकतो. जर्मीनेशन सारखे आणखीण काही पारंपारिक पध्दती आहेत त्यामाध्यमातून बीयांची उगवण क्षमता तपासणी केली जाते उदा. १) कापसाचे बोळे काढून घ्या आणि त्यात शंभर बियाणे मावेल इतके कापसाचे कापड सारखे बनवा आणि ते ओले करून बियांचे नमुने घेवून कापसाच्या बोळ्यात ठेवा आणि तीन दिवस पर्यंत जमिनीत फुटभर मातीत गाडून ठेवा लगेच तीन दिवस झाल्यावर जमिनीतून काढा आणि पहा बियांची उगवण क्षमता किती टक्के आहे हे समजू येईल त्याच बरोबर सुतळीचे बारदाण्याने सुद्धा बी उगवण क्षमता तपासता येते तुमच्या पैकी काही लोक करून पहा किंवा जर्मीनेशन पेपरने हि प्रक्रिया करून पहा.

जि. प. प्राथमिक मराठी शाळा लवादा (वन)

बियाणे उगवण क्षमता अभ्यास

दि: २३/ ६/ २०१८

शाळा : जि. प. प्राथमिक मराठी शाळा उपातखेडा

शिक्षकांचे नाव :
सहभागी एकूण संख्या : १५

अ क्र.	कोणत्या पिकाच बियाण	पारंपारिक/ सुधारित	बियाण आणणार्यांच नाव नाव	उगवायला लागलेल्या कालावधी	उगवण क्षमता (%)
१	जगणी	पारंपारिक	पतीराम मनिराम कास्देकर	३ दिवसानंतर	१००%
२	ज्वारी	पारंपारिक	प्रवीण कास्देकर	३ दिवसानंतर	९७%

पारंपारिक पद्धतीने राखलेले बियाणे : पारंपारिक पद्धतीचे बियाणे उगवण क्षमता तपासणी साठी

नमुने घेतले होते.

सुधारित कृषी कढून आणलेले बियाणे :-

प्रतिक्रिया :- लवादा वन येथे जर्मी नेशन पेपर ची तपासणी केली असता तपासणी च्या वेळेला गावतील महिला शाळेचे विद्यार्थ्यांना उपस्थित होते. त्यामुळे त्यांना विचारण्यात आले कि आपल्याला या जर्मीनेशन तपासणी केल्या बद्दल काय वाटते ? काय प्रश्न आहेत ? सांगा तर त्यांना याविषयी काहीच माहिती नव्हती त्यामुळे त्यांनी अस म्हटले बी उगवण क्षमता आताच पाहायला मिळेल का? तर आम्ही म्हटले कि याचा रिझल्ट तीन दिवसाने पाहायला मिळेल मग बी उगवण क्षमता कधी पाहायला मिळेल व कश्या वरून बी उगवण क्षमता ओळखता येईल तर तेंव्हा आम्ही म्हटले कि जेंव्हा आपण बी जर्मीनेशन पेपर मध्ये गुंडाळतो त्या वेळेला तीन दिवस नंतर किती अंकुर फुटलेली आहे हे पेपर उघडल्यावर माहिती पडेल त्यात किती टक्के बियांची उगवण झालेली आहे हे दिसून येईल. आणि आपल्याला या माध्यमातून शेतकऱ्यांची बाजार पेठेतील बीयांची फसवणुकी पासून बचाव करता येईल.व एक चांगला शेतकरी निर्माण करण्यास मदत मिळेल. त्यानुषंगाने आपल्याला बाजारातील विविध बियांची आणि घरच्या बियांच्या उगवण क्षमतेबद्दल माहिती होईल कि कोणत्या बियान मध्ये किती उगवण क्षमता आहे आणि कोणते बी दर्जेदार वापराचे आहे तसेच आपण मार्केट मध्ये जावून जी बियाणे खरेदी करून आणतो ती बियाणे खरच चांगले असतात का ? पेरण्या लाईकीच्या घरचे बिया चांगल्या आहेत कि मार्केट मधले बिया चांगले असतात याबाबत समज तयार होईल आणि उगवण क्षमता कळल्यावर घरीच बियाणे साठवणूक केल्या जाईल

चर्चा :- गावातील उपस्थित महिलांना व विद्यार्थ्यांना समजावून सांगण्यात आले कि बी उगवण क्षमता तपासणी केल्या वर आपल्या बरीच काही माहिती मिळते करण मार्केट बाजार मध्ये नेहमी काय होते.जे बिया आपल्या कडून मार्केट, बाजारात विकत घेतल्या जातो तेच बियाणे व्यापारी लोक मशीन द्वारे किंवा महिलांना घेवून त्यांना मजुरी देवून लहान मोठे आणि सर्वात निकृष्ठ दर्जाचे लहान बियां निवडून काढल्या जाते. आणि तेच बिया पुन्हा आपल्याला विकत देतात व जास्त किमतीत देत राहतात. त्यामुळे जे पारंपारिक पद्धतीने जे बियाणे घरी साठवून ठेवले जातात तेच बियानाची उगवण क्षमता चांगल्या पद्धतीने होऊ शकतो. म्हणून आपण घरचे बियाणे वापरायला पाहिजे बिया घरीच साठवणूक करून ठेवायला पाहिजे. कारण यामुळे आपण आपली शेतकरी बाजू चांगली ठेवू शकतो.

प्रश्न :- विद्यार्थांना जर्मीनेशन पेपर बाबत विचारले काय वाटते तुम्हाला याबाबत काही प्रश्न असतील तर सांगा आणि आम्हाला काही विचारायचं असेल तर विचारू शकता.

थाळी उपक्रम

थाळी उपक्रम हा एक अभ्यासाचा भाग आहे उपक्रमाच्या माध्यमातून 3 पिढ्यांमध्ये खाण्यात कोणकोणते बदल झाले हे समजून घेता आले.यावरून असे लक्ष्यात आले कि ज्यांनी रानभाज्या, फळे, कंदमुळे व मास मच्छी चा आहारामध्ये वापर केला त्याची शरीररचना धष्ट पुष्ट आणि निरोगिमय दिसून आले आहे. तसेच वयोमान सुद्धा जास्त कालावधीचा दिसून आला. हा उपक्रम 108 कुटुंबा सोबत करण्यात आला आणि समाजातील विविध घटकांना घेवून अभ्यास केला गेला. पहिल्या पिढीत काय बदल झाले. ते पाहण्यात आले तर या गोष्टी लक्ष्यात आल्या त्याच बरोबर दुसऱ्या पिढीच्या बद्दल सांगायचे झाले तर दुसर्या पिढीनेही बऱ्याच रानभाज्या व अंडी मास यांचा वापर केल्यामुळे त्याचं आयुर्मान ठीक आहे जैविक व सेंद्रीय पद्धतीचे आहार असल्याने साधारणपणे आहार चांगलाच होता तिसऱ्या पिढीच्या बाबतीत खूप मोठी तफावत दिसून आली त्यांच्या आहारामधून जंगलातील रानभाज्या नाहीसा झाल्या व नवीन पद्धतीचे फास्टफूड खाण्यात आल्याने शरीरावर होणारा परिणाम खूप मोठ्या संकटाकडे घेवून जाणारा विचित्र आहे.र

प्रकल्प करतानाची कृती व निवड–

थाळी उपक्रम राबविताना मुलांच्या माध्यमातून उपक्रम राबविण्यात आले सर्व प्रथम त्यांच्या स्वताच्याच थाळ्या भरण्यास सांगितले आठवडा भर चा वेळ देवून विध्यार्थी जे–जे खातात ते लिहून आणायला सांगितले त्यानंतर काही मोजक्याच विध्यार्थ्यानी प्रयत्न केले कारण सर्व मुल प्राथमिकचेच आहेत. गावात जावून श्रीमंत/मध्यम/गरीब अश्या तीन प्रकारच्या कुटुंबाची निवड करण्यात आली. त्यात पहिल्या पिढीत मुलगा /मुलगी,आई/बाबा, आजी/आजोबा अश्या तीन पैकी एका–एका ची निवड प्रत्येक पिढीतून करून थाळी उपक्रम घेण्यात आले काय काय पदार्थ आहारामध्ये खाल्ल्या जाते त्याब्बदल सविस्तर माहिती घेण्यात आली. असे एकूण 108 थाळ्या भरण्यात आल्या त्यात काही म्हाताऱ्या लोकांच्या खाण्यात नवनवीन वनस्पती दिसून आल्या जसे कि उदा/ चुरणी फळ खातात, माहूरवेलीच्या बिया भाजून खाल्ल्या जाते या प्रकारे अनेक गोष्टी थाळी उपक्रमातून ऐकण्यास व माहित पडल्या.

Report

6.4

Eco- restoration of Community Forest Resources Lands

Part A: Vrikshamitra, Gadchiroli

Background

Gadchiroli District was carved out on the 26th of August 1982 by the division of erstwhile Chandrapur District which is the part of the Vidarbha region of Maharashtra. In ancient times the region was ruled by the Rashtrakutas, the Chalukyas, the Yadavas of Devgiri and later the Gonds. In the 13th century Khandkya Ballal Shah founded Chandrapur as capital. He shifted his capital from Ballarsha to Chandrapur. Chandrapur subsequently came under Maratha rule. In 1853, Berar of which Chandrapur (then called Chanda until 1964) was part, was ceded to British East India Company in 1854. Chandrapur become an independent district of Berar. in 1905, the British created the tahasil of Gadchiroli by transfer of Zamidari Estate from Chandrapur and Brahmapuri within Chandrapur district. It was part of the Central Provinces till 1956, when with the reorganization of the states, Cha ndrapur was transferred to Bombay state. In 1960, when the new state of Maharashtra was created, Chandrapur became a district of the state.

Gadchiroli district is situated on the North-Eastern side of Maharashtra state & have state borders of Telangana and Chhattisgarh. Naxalisum is highly prevalent in Gadchiroli district and subsequently has been highlighted as part of the Red Corridor, used to describe areas in India that are plagued by Naxalites. As per Census 2011, total population of district is 10,72,942. Male & female population is 5,41,328 and

Foot note: as per decision taken in the EC meeting of 25-02-2019 and subsequent meeting with Mr. Mohan HH of Vrikshamitra, the project with Vrikshamitra was terminated as on 31-03-2019.
Further work was conducted under the guidance of Dr. Madhav Gadgil from 01-04-2019 and directly implemented by IISER coordination team.

5,31,614 respectively. SC & ST population in the district is 1,20,754 and 4,15,306. The ST population that resides in the district is 38.17 %.

The district is categorized as Tribal and Underdeveloped district and most of the land is covered with forest and hills. Forests cover is 78.62% of the geographical area of the district. The district is famous for Bamboo and Tendu leaves. The main profession of people is farming. People are more dependent on forest for their livelihood. The then Madhya Pradesh Govt. has revoked Nistar Rights and included in land Revenue manual and gave legal rights and enabled forest department to manage the rights.

Nistar Rights

People's sentiments about Nistar rights is very aggressive. Nistar Rights mean people's traditional right to harvest produce from water, land and forest around the village for living.

These rights have been given to local people even before the British Era. However, by 1900 the English Government destroyed these rights in all places, except Adivasi area. Severe resistance from locals did not allow Nistar rights to be snatched from these people. They had to resort to appointment of "jamindars" from among the adivasis. This continued till the independence of India. After the independence, an enactment was done to abolish Jamindari system. In 1960, all these villages came into Maharashtra state along with their Nistar rights. The Maharashtra Govt. had to approve Nistar rights under the Maharashtra Land Revenue Code 1961 section 160 to 167. But management as defined in section 161, Nistar area management plan was never prepared. Government of India have reinforced Nistar rights in the Indian Forest Policy, by stating " Adivasi and other people living near or within the forest are dependent on the forest produce. Their rights and concessions will be fully protected. The first preference of forest produce will be for the fuel, fodder, and wood for construction etc.

Joint Forest Management programme was intiated in 1992. This was implemented as "forest management through village participation. The village Mendha (Lekha) has fought for the right even in good forest area. This was a pathbreaking development which helped similar people across the country. Although the proceeds of 50% of forest produce was to go to villages as per government orders, this was never implemented resulting in distrust among the adivasis.

PESA Act was implemented by Govt of India in 1996. The right of Gramsabha on the scheduled areas was recognized in this act, but at the ground level this did not happen. In 2002, India adopted the Biodiversity Act. The provision to have Biodiversity Management Committees in villages was one of the pathbreaking decisions in this Act. However, even this could not be implemented properly. Forest Rights Act 2006 was enacted to remove the injustice done to tribals and other traditional forest dwellers. Implementation of this Act started from January 1, 2008, The first two villages which approved Community Forest Rights are Mendha (Lekha) and Marada both of which are in Gadchiroli District. The peaceful fight of villagers of Mendha (Lekha) to acquire rights over bamboo utilization for livelihood set a model for the rest of the country. A survey done after 10 years of implementation of the Forest Rights Act showed that the act could be implemented in only 3% of the area. On the other hand, Maharashtra had a success of 16%. Gadchiroli is leading in this regard with 77% implementation.

Journey with MGBP

Area of operation of the organization (districts): Tahsil : Dhanora , Dist. Gadchiroli

Key issues addressed Empowering people, people's participation, FRA process, CFR Management Plan, Bamboo management, People's Knowledge - Flora known to people, Concept of Tapu, Mapping based on Tapu, Sampling. (Tapu: These are the patches of landscapes or waterscapes which people recognize traditionally because of many reasons like a folklore associated with the patch, some event in the past, animal habitats etc.)

Objectives

- Establishment of BMCs
- Documentation of traditional knowledge of associated communities on plant species
- Listing of RET and Economically Important Tree Species (ITS)
- Regenerative plantation
- Community's participation in management and conservation of forest resources
- Scouting of seedlings from other sources (RET+ Economically important) for plantation
- Soil and water conservation
- Schemes/ Programs to be tapped from Government
- Scientific harvesting and collection
- Marketing / processing and value addition
- Study of use of NTFP by communities themselves
- Study of Participation of women / gains by women
- Mobilization of Schools/ Groups/ Students around biodiversity
- School PBRs and Biodiversity corners

Objectives fulfilled

· All the 11 villages got CFR titles.

· Gramsabhas of these villages should therefore prepare the Forest working and management plan for their community forest. Even though we are working with them to build their capacity for preparing the plan, they have applied to the Tribal department for getting financial support for the same.

· As a part of the preparation they have completed following tasks:

· mapping: tapu list, *najari nakashe* (map drawn by visual observation), GPS training, demarcation of boundaries by GPS, Google maps on flex for 10 CFR gramsabhas,

· Survey of plant species: listing of flora and fauna known to the people. Identification of important species for 10 gramsabhas. Qualitative survey for abundance of plant species on all tapus of 2 gramsabhas completed. Computerization of qualitative survey data for Mendha. Selection of tapu-sample for Mendha CFR for quantitative studies. A special computer program was developed for the purpose. Quantitative measurements by Point Centered Quarter Method in Mendha and estimation of stock for important tree species in Mendha.

Methodology and data with results are attached in the files as below:

1. Note on stock mapping
2. Abundance_flora_tapu_area
3. Mendha_Sp_All_ Estimation
4. Detail Bamboo Estimate 14_15

Establishment of BMCs: 5 Villages viz. Sinsur, Mendha, Chavela, Sode, Kakdeli

Documentation of traditional knowledge of associated communities on plant species: List have been prepared in 11 Villages and work of documentation is going on.

Listing of RET: Nil

Economically Important Tree Species (ITS): List of Important Tree Species (ITS) have been prepared in 11 Villages.

Regenerative plantation:

1. Nursery sanctioned under MGNREGA in one Village: Mendha (Lekha)

Nursery Details:

S. No.	Fruit tree	No. of seedlings raised	No. of saplings planted			Balance saplings
			2016-17	2018-19	Total	
1	Custard Apple	7048	1700	1150	2850	4198
2	Tamarind	1726	620	-	620	1096
3	Amla	17128	2020	930	2950	14178
4	Kusum	2284	-	-	-	2284
5	Gulmohar	-	-	-	218	218
6	Rela	4692	-	-	4692	4692
7	Jambhul	2966	1700	-	1700	1266
8	Bel	195	-	-	-	195
9	Bamboo	13644	2400	50	2450	11194
10	Mango	30	-	-	-	30
11	Neem	256	-	-	-	256
12	Garanji	1358	500	-	500	858
		51535	8940	2130	11070	40465

Plantation donein CFR area: Actual counting of survival rate was not done. However, by qualitative observation the survival rate is "good".

Community's participation in management and conservation of forest resources :

- One day training on Preparation of Working Plan was conducted for 11 Villages at Gadchiroli on 20/08/2016, regarding guiding principles and General outline. Divisional Commissioner inaugurated the workshop.
- The Gramasbhas have approached Tribal Dept., Maharashtra Government for funds to prepare Forest Working Plan or Community Forest Conservation and Management Plan. The Gramasbhas followed the matter with Tribal Dept., Maharashtra Government for funds to prepare Forest Working Plan or Community Forest Conservation and Management Plan. Vrikshamitra has also followed up the matter with TD. TD invited for a workshop on this subject on 1st and 2nd of Sept.2018 at Mumbai. Vrikshamitra made a presentation on the need of giving funding directly to Gramsabha (will be mentioned as GS hereafter) and how they will execute it.Vrikshamitra pursued the matter in the state level steering committee meeting. As a result of these efforts, GR was issued by TD, GoM to give the funding directly to Gramsabhas for which a tripartite Agreement between TD, GS and Vrikshamitra was be done.

Soil and water conservation: Following staggered trenches and Bamboo clumps & covering roots by soil management work was done under MGNREGA on following tapus: We consider this as the most important task as it helps in arresting degradation and restores the natural processes.

Names of the Tapus:

1. Pekor Pen (20.5ha)
2. Niral Hukke – 2(56 ha)
3. Darrona Gohadum (34.7 ha)
4. Nend Konta (3 ha)
5. On other different tapu (10 ha.)

Total -124.2 ha

Sustainable harvesting and collection:

1. Estimation of bamboo by Point Centered Quadrate Method at village Mendha (Lekha)

2. Detailed observation for stock estimation of standing bamboo stock by above method. This includes observing number of bamboos in different phenological stages and the damages. (Given in Annexure "Detail Bamboo Estimate 14_15" in "Mendha_data"zip file) of bamboo clumps before harvesting

3. Computerisation of data by local village youths

4. a. Harvesting of bamboo as per scientific norms which are followed by the Forest department as a standard practice. Gradation of harvested bamboo and on spot sale for 2 years

b. Bamboo was chemically treated with Boric acid / Borax.

c. Following articles were made from the treated bamboo: i. Trusses ii. Pillars for construction

iii. Bamboo work shed with bamboo panels iv. Bamboo sofa v. chair for relax posture.

The articles were made by artisans in Mendha (Lekha) as demonstration article. They are used in Mendha Gramsabha and not sold. Economics is not done as it was for demonstration purpose.

5. Initiative was taken to form *Mahasangh* (Federation) of neighboring CFR villages for sale of Tendu leaves which is an economically important minor forest produce.

Study of use of NTFP by communities themselves:

1. Development of format

2. Data collection for sampled families

Study of Participation of women / gains by women: 6 Villages. But not satisfactory. More work necessary

Mobilization of Schools/ Groups/ Students around biodiversity:

1. Rapport with teachers (11 Schools)

2. Identification of local Mango varieties (11 schools)

3. Two *Anand Shala Shibir* of teachers and studentswith the collaboration of CEE

4. *Anand Shala Shibir* of teachers and studentswith the collaboration of Jagrut Mahila Samaj, Ballarpur and Rashtra Sewa Dal (Pune) were held at two *ashramshalas* at Gogalwahi and Sode

School PBRs and Biodiversity corners:School SPBRs at govt. Asramshalas at Sode was prepared and for Ashramshala at Godalwahi is in progress.

Sampling methods: For stock mapping

Our sample is a set of tapus which are areas identified by people traditionally and are named. Tree species in the tapu are given abundance ranking on a scale of 4 (namely 0, 1, 2, 3 signifying absent, rare, medium, abundant) for each tapu. For each species weighted abundance for all tapus is computed, and it is normalized.

Using Monte Carlo simulation thousands of candidate sample-sets are generated from amongst all the tapus. Using the same method as above weighted abundance for each species is computed for each candidate sample-set which is again normalized. For a given sample-set the difference in abundance level in the sample-set and the same for entire area gives the error in estimation of

abundance from the sample-set for any species. We rank the errors in all species and find the median error. The most efficient sample is the one which gives minimum median error and is considered for further quantitative studies.

Sacred grove in Mendha (Lekha) Pengeda devrai has been declared as a biodiversity protected area by the Gramsabha of Mendha (Lekha). The belief of the people was that without any human intereference, whatever changes are taking place in nature, they can be observed in the Devrai. So, 10% of forest is declared as biodiversity conservation site. The criteria of choosing the protected area are: 1) representation of dense, medium and sparce forest and grasslands (2) use of Tapu by people, high or low; (3) availability of water '(4) habitation of wild life, and (6) availability of patrolling.

Based on these criteria the area was selected and it came to 12.82% of the total area. Nine tapu's were selected out of 87.

Table 2 a:

S.No.	Name of tapu	Area	% area	Forest density
1	Saaheban Matta	28.8	1.32	Dense
2	Saaheban Gudra1 1	37.66	1.72	Medium
3	Padahur Palla	46.45	2.12	Medium
4	Padahur	16.45	0.75	Medium
5	Pen Matta	41.29	1.89	Medium
6	Thalaj Panja	51.45	2.35	Sparse
7	Kutan Kal	12.5	0.57	Sparse
8	Kutan Pal er	11.36	0.52	Sparse
9	Ponad Kadya	34.45	1.58	Dense
	Total	280.41	12.82%	

Bamboo Management

Gram sabha, Mendha (Lekha) Tal. Dhanori, Dist. Gadchiroli

The first village in the country to get Community Forest Rights

Rs. 450 per day for 50 bamboos; for 15 days work – 6750 per person

-No cutting of bamboo Only bamboo management

मनरेगा में १५०रु . प्रतिदिन के हिसाब से ९६ दिन काम के १४४००रु.

Table 2 b:

Sector No.	Total sale including tax	Labour charges	Tax remitted to Govt.	Village development fund	Tapus selected for Pengeda	Type of forest
471	2196274	808938	131649	1255687	Saaheban Metta	Dense
470	7877766	2903427	558125	4416214	Ponad Kadya	Dense
468	1453324	851781	102966	498577	Pen Metta	medium
Total	11527364	4564146	792740	6170478		

Work done in Bamboo management: Each clump is numbered and the bamboos are counted as per age of the bamboo like 1,2, or 3 years

Dried and those not growing straight are removed and the clump is cleaned

Prepare a trench and put soil around the base of the clump

Remove the bamboos above 3 years age and transport to the depot.

The bamboo management work has been completed in 114.2 hectares

Table 2 c:

Tapu number	Duration of management	No. of clumps	Bamboos above 3 years age	Total Bamboo	No. of Bamboos harvested	बांबू शिल्लक	बंडल	चर
4	09/02/2016 to 14/03/2016	1065	7675	12790	3361	9401	943	926

Details of sampling methods used, diversity indices used : as mentioned earlier

Unintended outcome

It was only Mendha (Lekha) who have applied for funding for preparing a Forest Management Plan, but now as many as 39 gramasabhas have asked for funding for making their own Forest Management Plans.

Qualitative impact of the work: Awareness regarding sustainable use, conservation and management plan for conservation and sustainable use,

Quantitative impact of the work: (Give data on relevant parameters before and after the intervention, or in the intervention area and control area)

Staggered trenches – 10 He. +

1. Pekor Pen (20.5ha) 2.Niral Hukke – 2(56 ha)

3. Darrona Gohadum (34.7 ha)

4. Nend Konta (3 ha)

Approx. Total (114 ha)

Estimation of important species (IS) by Pt. Cent. Quadrate Method (3 Villages)

5. Staggered trenches for above clumps & covering roots for soil and water conservation:

In 4 *Tapu* –

1. Pekor Pen

2. Niral Hukke - 2

3. Darrona Gohadum

4. Nend Konta

Approx. Total (114 ha)

Tapu list (11 Villages)

3. *Nazari Nakashe*

Of *Tapus* (4 Villages)

3. Demarcation of CFR (9 Villages)

4. GPS Training (11 Villages)

5. Demarcation by GPS (11 Villages)

6. Google Maps (10 villages)

7. Estimation of important species (IS) by Pt. Cent. Quadrate Method (3 Villages)

Community participation in MGBP process

Forest Rights for Livelihood – seminar- The responsibility for management is of the gramsabha and on the condition that there will be no remuneration from the project.

Community's role in designing or reshaping the work

Considering Tapu instead of compartment as the basis for preparing maps, and participation in the same, Finalizing the biodiversity protected area in Pengeda, its implementation, protection, and management was given to gramsabha.

Bamboo Management: In 2012-13, Mendha (Lekha) was the first gramsabha which established rights of bamboo harvesting and sale which they did successfully. This story is available on YouTube as "Gajab Kahani Mendha (Lekha) ki". In subsequent years the rights were obtained by other villages. However, the forest contractors tried to take disadvantage of the ignorance of these gramsabhas by offering them poor prices which the people of Mendha (Lekha) resisted. This led to boycotting of Mendha (Lekha) by these contractors. This hampered the sale of Bamboo of Mendha (Lekha). This prompted the youths of Mendha to undertake study of Bamboo harvesting for the contractors as against Bamboo management under MNREGA.

- How do communities manage common resources (forest, water, and other common resources) which do not have individual ownership? If the Community Forest Rights or PESA rights are granted to the community the resources will be managed better.

Are common resources more liable for over-exploitation? If the rights are not given to locals and if the government manages these resources, the community will not own any responsibility.

If people have written/spoken rules for sustainable use of common resources, give examples. In Mendha (Lekha) Community have prepared their own rules and others are in the process of doing so.

- Social conflicts around conservation– conflicts with neighboring villagers – There are two types of conflicts. 1. The conflict between Mendha and Lekha villages over collection of forest produce, and 2. The conflict in Kakadyeli over the forest boundary.

People are conducting several meetings with patience to reach consensus.

Common resources over which community rights are granted under CFR or PESA are protected by the communities by establishing their own rules of management and use. Some villages have already formed such rules and for others process is going on. So there is little possibility of over exploitation.

For Common resources which are under FD control, people don't take any responsibility.

This is a most general observation.

- Conservation and weaving of social fabric (For example, social changes accompanying conservation efforts, village/Tribal governance and rights over resources, return of youth, work with minority communities and bringing them to mainstream, etc.)

Theoretically, it is not difficult to grasp but arguments of the critics and lack of actual experience raises doubts in the mind. On the other hand, it is crystal-clear that the way of violence and majoritarianism is taking us deeper in the mire. Mendha (Lekha), a tiny village, has done historical work—without being aware of it—of showing a way out of this impasse. It has shown that a village community can work on the basis of consensus, and that violence can be successfully resisted by non-violence.

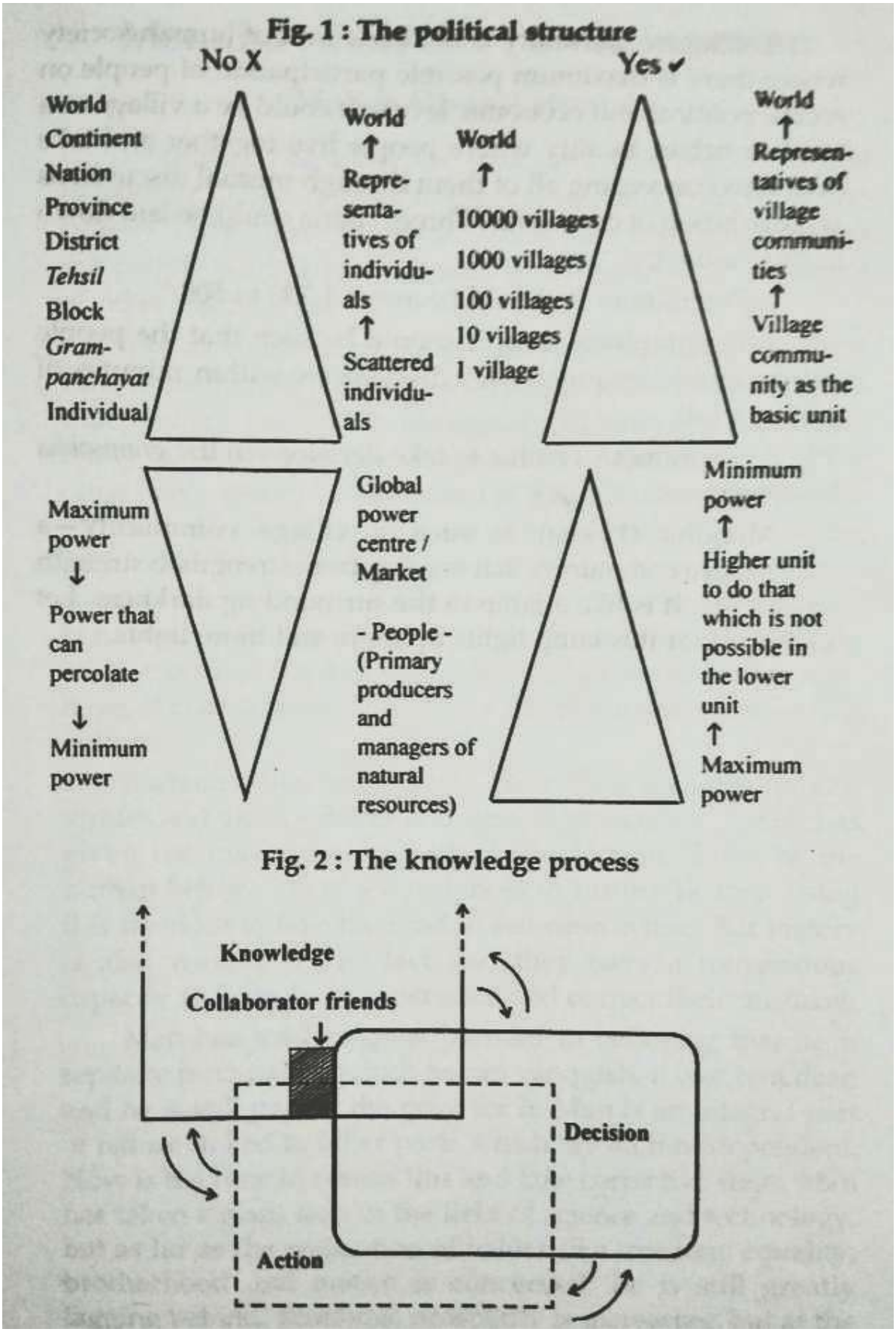
To enable the evolution of people's power, two things are necessary from village level to the global level.

1. The political structure: See fig. 1

2. The knowledge process that is free from the tensions

Of decision-making: See fig. 2 (Reproduced from "Mendh (Lekha)" written by Dewaji Navlu Tofa and Mohan Hirabai Hiralal with permission to reproduce)

Introduction



A village community is the basic unit of human society where there is maximum possible participation of people on social, political and economic levels. It could be a village or a rural or urban locality where people live together and take decisions concerning all of them through mutual discussions and evolution of consensus. Three criteria could be laid down in this context:

1. Population: It should be around 300 to 500.

2. Geographical area: It should be such that the people can assemble frequently for discussions within minutes of giving a call.

3. Unanimous resolve to take decisions in the *gramsabha* by consensus.

Mendha (Lekha) is such a village community—a progressive community that is going from strength to strength since 1987. It is like a lamp in the surrounding darkness. Let us hope that this lamp lights up more and more lights.

Beneficiaries

Village Name	Area of Village (in hectares)	Number of Households	Total population-Persons	Total population-Males	Total population-Females	Scheduled Castes population-Persons	Scheduled Tribes population-Persons
Chavela	1153.00	124	590	288	302	2	576
Markagaon	696.00	30	159	81	78	0	159
Kak adyeli	819.00	77	376	180	196	0	376
Mahawada	764.00	62	338	149	189	0	334
Malanda	649.00	81	408	207	201	0	388
Mendha	1930.00	105	490	139	148	0	287
Navargaon	1320.00	57	271	140	131	0	244
Yerandi	618.00	50	267	136	131	0	267
Sode	410.00	95	612	217	395	26	571
Waghbhumi	518.00	45	236	116	120	0	236
Sinsur	632.00	14	88	41	47	0	39

What benefits they have received?

How were they benefitted- long term/ short term? Duration? Monitory benefits? Right based benefits? Measures to reassure that benefits to the community continue even after conclusion of MGBP?

a) People's preference for livelihood species Moha, tendu, bamboo, gum, hira behada, avala, palas roots & leaf

b) CFR experience

c) Plantation strategies, creation of biodiversity parks, devrai experience**: Pengeda: People can do such things for conservation even at the loss of income. Please see Sec II.2 above for details.**

d) How sustenance of forest based communities is achieved by non-monitory engagement with forest? It can not be achieved by only non-monitoring. Both are necessary

e) Policy level interventions:

a. Gram Panchayat is the primary implementation agency of MANREGA. Community Forest Rights are not given to Grampanchayat. It is given to the Gramsabha elected by the villagers, but they have no right to implement MNREGA. On an experimental basis, Gramsabha of Mendha (Lekha) was awarded this responsibility by Govt. of Maharashtra. The results have been good. Efforts were made to extend this to other areas, but it has not been successful so far.

b. 11 gramsabhas in the project area have started forest activities in their area. This was shared with other agencies workin in the area of CFR. Through this interaction another 72 gramsabhas have joined this program, 83 CFR gramsabhas from 4 talukas of Gadchiroli District have approached Tribal department for direct financial assistance for forest protection and for making forest management plan. This has been

approved by the Government. This can be considered as success of advocacy done through Maharashtra Gene Bank Project.

National/ international outreach Active participation in CFR LA (Community Forest Right Learning & Advocacy) process at national level. Participation in the process of report preparation on "Potential & Performance of CFR in Forest Right Act 2006 after 10 years". Eye-opening outcome in this report – only 3% performance against potential at National level.

1. Observations about ecology- regeneration/ depletion/ conservation: 12% of the forest land was conserved in the name of God. Human intereference in this area reduced. It was observed that foot prints, excreta, and scratching on trees of wild animals have increased. Because of the protection provided, it is felt that the bears have inhabited this place.

Failure stories

At the time of project formulation it was decided that team of youth (both boys and girls) from the village will work as "Society builders" But due to delay in sanction of the project, all these youth took up alternate jobs. Hence, it was necessary to hire people from outside. However, none of the persons who was engaged could continue for a long time

Way forward

With the initiative and lead taken by the women self help groups in the gramsabha the permanent management of community forest rights is started. Under this an experiment was done on Biomass Assesment, Biomass Budgeting for Conservation & Management Plan.

Support structure

A plan is afoot to form a federation of gramsabhas who have been given Community Forest Rights at local, taluka and district level. We are trying to get the support from Government agencies.

72 villages from Gadchiroli District, who have obtained Community Forest Rights have approached Tribal Department of Maharashtra Government for financial assistance to prepare their Forest Protection and Management Plan and give funds directly to the Gramsabha. Work done under the MGB will come handy in this process and will continue further.

2. List of staff involved in the project with their posts and one liner introduction –

Name of Persons	Qualification	Contribution
Mohan Hirabai Hiralal	B.A.	P.I. and social expert
Dewaji Tofa	Class IV	Social Expert
Parag Dandge		From 15/5/2018 to 14/8/2018
Dr Vijay Edlabadkar	M.Sc.; Ph. D.	Scientist and technical expert
Prof. Madhav Gadgil	M.Sc.; Ph. D., Harvard alumni	Ecology expert

Report

6.4

Eco- restoration of Community Forest Resources Lands

Part B: Gadchiroli Action Group

Background

Nearly 1300 gramsabhas have been granted CFR claims in Gadchiroli district, out of which 143 are in Dhanora tahsil alone. Granting of CFR entails that the gramsabhas should prepare their working plan for the management of their CFR areas. However, the gramsabhas do not have members capable of such technical work. To address this issue, the Tribal Development Department decided to create a cadre of such workers from amongst the members of Gramsabhas. A diploma course was designed and conducted by Dept. of Economics and Public Policy, Mumbai University, to create such cadre. The PI and Co-PI of this project played a key role in this endeavor. The first batch of 27 diploma holders hailing from these Gramsabhas is a strong force. It was, therefore, decided to involve these youth, who are now armed with technical knowledge and have a very strong feel of the ecosystem of this area, for this project implementation.

Name of organization/ Institute: Originally Vrikshamitra, Gadchiroli was handling this component. However, due to some issues, Dr. Madhav Gadgil as PI and Dr. Vijay Edlabadkar Co-PI have taken the responsibility to work in this area from April 2019 to the end of the project. The funds were managed directly through IISER.

Area of operation of the organization (districts): 15 nos. of gramsabhas in Dhanora taluka, and 2 nos. from Gadchiroli taluka of Gadchiroli district : Total 17 Gramsabhas.

Geographical location: District Gadchiroli

a. Villages directly benefited from the work

First phase: 5 villages namely 1. JangadaBudruk, 2. Metejangada, 3. Bori, 4. Rajoli and 5. Sinsur from Dhanora taluka of Dist. Gadchiroli.

Second Phase: 17 villages as follows:

Sr. No	Village Code	Village_Name	Taluka
1	538980	Erandi	Dhanora
2	539195	Kanhalgaon	Gadchiroli
3	538977	Gujanwadi	Dhanora
4	538972	Bhurantola	Dhanora
5	538969	Bhusumkudo	Dhanora
6	538946	Jangada Bk	Dhanora
7	538982	Rajoli	Dhanora
8	538971	Navargaon	Dhanora
9	538979	Dudhamala	Dhanora

Sr. No	Village Code	Village_Name	Taluka
10	538991	Kandali	Dhanora
11	538937	Sinsur	Dhanora
12	538992	Kharkadi	Dhanora
13	539207	Marda	Gadchiroli
14	538953	Bori	Dhanora
15	538989	Malanda	Dhanora
16	538945	Metejangada	Dhanora
17	538952	Nimanwada	Dhanora

Community profile: The village community members are predominantly scheduled tribals with some OBC population who are dependent on forest-related activities and farming.

Participants/Beneficiaries

We are approaching the gramsabhas through the youths described earlier. Participants are mainly these youths who take help of different individuals like village

elders, and knowledgeable persons for getting data and information of the study areas, other young boys and girls for survey work. The primary beneficiaries will be the Gramsabhas who will get help in the preparation of management and conservation plan.

Journey with MGBP

Key issues addressed

1. As has been mentioned in the background, preparation of conservation and management plan for the community forest resource is a challenge before the Gramsabhas with CFR rights. The data and information collected through this project will be of immense use for the preparation of this management plan.

2. The youth so involved will be getting additional training of data capture through mobile apps, which we have been developing for different kinds of eco-system related data.

3. Conservation and Management Plans for the forest resource of the CFR villages were prepared by using the data collected in previous phases and additional data collected in extended period up to the end of December 2020.

4. Information management is an important component of the MGB program. The two outstanding challenges that it can address in this context are those of involving people, who are a great repository of detailed information on many facets of their local environment, and of reaching out to people in their own languages, Marathi and Gondi. We have strived to involve people in this endeavour through the cadre of local trained youth who have collected information through constant interaction with the local people.

In this context, we have taken full advantage of the rapidly advancing tools of ICT to organize a collaborative process of knowledge generation. The youth involved in the project made use of smartphones which are generally GPS- enabled. Following on-line and off-line tools were used in information gathering and collation:

(i) Excel sheets (ii) GPS apps for boundary demarcation (iii) Google Earth (iv) On-line data capture using Epicollect 5 modules (v) Compass in smartphone.

Epicollect 5 platform was used extensively to collect supplementary information through constant interaction with the gramsabhas by our trained field workers. With this supplementary information, collection of all data and information that is necessary to prepare the CMP was completed. Application Program Interfaces (APIs) were written in Python to transform the data saved on Epicollect server into readable textual documents.

Objectives

To help the villagers of CFR gramsabhas create their own Conservation and Management Plan for the forest resource.

Sampling methods

(i) Observations in the field by data collectors (ii) Point Centered Quarter Method for Stock mapping

Major work done under MGBP

(i) Identified various land patches as are recognized by the local people that are called 'tapu'.

(ii) Identified land elements with different Landscape Types (LSEs).

(iii) Collected data on species found in the area including their uses, qualitative abundance on each tapu for 5 gramsabhas and for all 17 gramsabhas for landscape elements.

(iv) Stock mapping using Point Centered Quarter Method for 5 gramsabhas for all tapus and for all 17 gramsabhas for landscape elements.

(v) Data was validated and entered in Excel sheets formats designed for uploading the data in RDBMS database.

(vi) Data is collected on RET species from people as well as by a taxonomist. Data was collected on efforts by the people to conserve the RET species.

(vii) Conservation and Management Plans for CFR resource were prepared for all the 17 villages.

Database

Phase 1: Data from five villages using 'tapu' as a land-patch is collected, saved in Excel sheets and uploaded in database as under:

Form	Number of Records
1. Vill-biodiversity	791
2. Special_utility	783
3. Tapu_Information	33
4. Qualitative abundance of Species on Tapus:	3317
5. Tapu_Transect for PCQM	574
6. Species local names	343

Phase 2: Data from Landscape Ecology perspective for 17 CFR Gramsabhas is saved in excel sheets and uploaded in database as under:

Table	No. of records
LSEs and their characteristics	266
Village Biodiversity @	3114
Special Utility @	1116
LSE - Transect Observations by PCQM	8670
RET species and conservation efforts by people	214
RET species from Taxonomist's perspective	45

@ (Data in tables Biodiversity and Special Utility does not include 5 villages already covered in phase 1 but includes additional data from Mendha (Lekha) and Channabodi , Tal Etapalli)

Sample Excel sheets are given as Annexure 1

(ii) Following information based on this database is derived as queries (Annexure 2) :

Query 1: List of species whose roots have medicinal values along with its other attributes like habit, indigenous/ Exotic, storage method, if natural and/or cultivated in a given village (Example 'Rajoli')

Query 2: In a given village find the species where raw fruits are edible. (Example 'Rajoli')

Query 3: Species-wise average number of trees per ha and their basal area in given village (Example 'Sinsur')

Query 4: List of Tapus in a given village where a given species is not found but it is present on other tapus in the same village. (Example village= 'Rajoli' and species = 'Mangiferaindica')

Query 5: Calculate potential Mahua flower and seed production per ha in agiven village (Example 'Sinsur')

Query 6: List of landscape types in a given village along with their area (Example Jangada Br).

Query 7: List of landscape types in the study area along with their area.

Query 8: Species-wise average number of trees per ha and their basal area in given village in a given Landscape type (Example 'Sinsur', landscape type=10)

A variety of diversity indices such as Diversity index, Shannon index, Simpson index along with Relative Abundance diagrams and tree density in different LSEs have been computed from this data (Annexure 3).

'Conservation and Management Plan' for 17 gramsabhas is prepared and is available at the following link. https://drive.google.com/drive/folders/173IEolKRrsvDvtnLxwLizV1X3yqPtw8a

Any unintended outcome

District level functionaries of The National Rural Development and Livelihood Mission are involving our cadre in the identification of issues and projects in these areas.

Qualitative impact of the work

The work has created awareness about the responsibility of conservation and

management of forest resources. The gramsabhas wish to take ownership of the Conservation and Management Plan that will be prepared using the data collected through this work.

Quantitative impact of the work: Before intervention, no data had been collected over 5 years, the very rich dataset has been collected over the last year.

Community participation in MGBP process

Through the cadre of youth involved by us. Community's role in designing or reshaping the work:

a. Communities have a strong feeling that resources under CFR belongs to them, and they have taken the responsibility of protection, sustainable harvest, as well as augmentation through planning. Most of the gramsabhas have formulated their own rules for the use of forest resource. Over-exploitation is curbed mostly after getting CFR.

b. Traditional conservation practices, Sustainable harvest practices: Though there are many traditional conservation practices, they were neglected in the past due to a sense of alienation as the ownership of the resource was with the Forest Department. With the granting of CFR, the sense of ownership is returning, and the old conservation practices are being revived. One of the villages, Jangada (Budruk), has set aside a forest patch as biodiversity reserve as a part of tradition. Another village, Mendha (Lekha), has set aside 10% of their CFR area as 'Pengeda' i.e. biodiversity reserve, recently.

People's preference for livelihood species: All species which they can harvest under MFP.

CFR experience

Plantation strategies, creation of biodiversity parks, devrai experience: One of the Gramsabhas viz Jangada in Dhanora taluka is conserving a forest patch called Manora Gudra with approximate area of 40 hectares for more than one generation. The villagers have banned grazing or any human intervention in this patch. Recently another gramsabha,. Mendha (Lekha) took

suo moto initiative in protecting three patches in their CFR area, called Pengeda. Any human intervention on these patches is strictly prohibited, including grazing by village cattle.

Publications

1. Vijay Edlabadkar and Madhav Gadgil. Deploying modern ICT tools to develop Gramsabha level plans for conserving and managing Community Forest Resources J. of Ecological Society vol 32-33, 136 -139 (2020-21).

2. Vijay Edlabadkar and Madhav Gadgil. Quantification of natural resources by rural youth using ICT tools : a game changer in conservation (communicated to Journal of Indian Statistical Association)

Networking with other MGBP groups

17 of our field workers who worked in this project and who have Diploma in CFR Management granted by Bombay University have formed an Association with duly elected President and Secretary. Our interaction and collaboration with them will continue. Hopefully, they will be involved in the preparation of Conservation and Management Plans for other gramsabhas either by the Tribal Dept of Maharashtra state or other agencies. We will continue our interaction with them.

Way forward

The data collected is very useful in preparing a Conservation and Management Plan for the CFR area. Additional data such as rainfall data, compartment history etc. will have to be obtained from concerning line department.

The group of young people who contributed in this work have formed an association for collaborating in activities related to conservation and management of the CFR areas. The PI and Co-PI will continue their association with them and will help them in preparation of Conservation and Management Plans in future.

List of staff involved in the project with their posts and one liner introduction.

1. Madhav Gadgil - PI (Honorary)

2. Vijay Edlabadkar - Co-PI (Honorary)

Annexure 1

Sample excel sheets uploaded in the database: vill_biodiversity

Sr. No.	Organization	vill_code	Village Name	Taluka	Distt	species Scientific name	indigenous or exotic	plant_ type	Habitat						If Natural	If Cultivated
									forst_ dense	forst_ mod	forst_ sparse	agri_ land	human_ habt	river_ side		
1	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Psidium guajava	Indigenous	Tree	FALSE	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	TRUE
2	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Pterocarpus marsupium	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
3	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Terminalia tomentosa	Indigenous	Tree	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
4	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Madhuca longifolia	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
5	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Diospyros melanoxylon	Indigenous	Tree	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
6	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Albizia odoratissima	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
7	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Chloroxylon swietenia	Indigenous	Tree	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
8	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Anogeissus latifolia	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
9	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Cleistanthus collinus	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
10	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Holarrhena pubescens	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
11	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Ficus amplissima	Indigenous	Tree	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	TRUE	FALSE
12	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Schleichera oleosa	Indigenous	Tree	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
13	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Bauhinia racemosa	Indigenous	Tree	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
14	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Cassia fistula	Indigenous	Tree	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
15	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Xylia xylocarpa	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
16	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Terminalia chebula	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
17	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Careya arborea	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
18	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Syzygium cumini	Indigenous	Tree	FALSE	FALSE	TRUE	TRUE	FALSE	FALSE	TRUE	FALSE
19	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Tectona grandis	Indigenous	Tree	FALSE	TRUE	TRUE	TRUE	FALSE	FALSE	TRUE	FALSE
20	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Boswellia serrata	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
21	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Lannea coromandelica	Indigenous	Tree	FALSE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
22	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Soymida febrifuga	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
23	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Buchanania cochinchinensis	Indigenous	Tree	TRUE	TRUE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
24	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Gardenia latifolia	Indigenous	Tree	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	TRUE	FALSE
25	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Phyllanthus emblica	Indigenous	Tree	TRUE	TRUE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE
26	MGB-GAD	538982	Rajoli	Dhanora	Gadchiroli	Mangifera indica	Indigenous	Tree	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	TRUE

LSE data

Sr. No.	Source	vill_code	lat_7_Lat_long	long_7_Lat_long	8_LSE_type	9_Part_of_LSE_type	10_Area_ha	11_Part_of_tapu	12_Topography	13_Human_interventio
1	MGB-GD	538945	20.345584	80.295576	10_Dense_Hilly_Mixed	1	200	tohgol metta	Steep_slope	No
2	MGB-GD	538945	20.352425	80.294517	10_Dense_Hilly_Mixed	2	247	aljhora (darbar metta)	Undulating	Grazing, Tree_felling
3	MGB-GD	538945	20.345584	80.295576	18_Sparse_Plain_Grass	1	78	uykan jhora	Plain	Grazing, Tree_felling, Irrigation
4	MGB-GD	538945	20.352425	80.294517	18_Sparse_Plain_Grass	2	65	gohadum palla	Plain	Grazing, Irrigation
5	MGB-GD	538945	20.346034	80.295716	30_Farmland	1	17	ali konta	Plain	Irrigation
6	MGB-GD	538945	20.346034	80.295716	30_Farmland	2	15	lat gudra	Plain	Irrigation
7	MGB-GD	538945	20.346034	80.295716	30_Farmland	3	10	darbar metta	Plain	Irrigation
8	MGB-GD	538945	20.346034	80.295716	30_Farmland	4	18	ma ma talav	Plain	Irrigation
9	MGB-GD	538945	20.346227	80.292581	30_Farmland	5	10	dand palla	Plain	Irrigation
10	MGB-GD	538945	20.346227	80.292581	30_Farmland	6	13	dand palla	Plain	Irrigation
11	MGB-GD	538945	20.344789	80.273423	30_Farmland	7	9	dand palla	Plain	Irrigation
12	MGB-GD	538945	20.338661	80.269243	30_Farmland	8	11	hanad dand	Plain	Irrigation
13	MGB-GD	538945	20.343006	80.274468	30_Farmland	9	15	hanan dand	Plain	Plantation, Irrigation
14	MGB-GD	538945	20.352782	80.304423	30_Farmland	10	17	tohgol metta	Plain	Irrigation
15	MGB-GD	538945	20.345923	80.295584	30_Farmland	11	16	uykan jhora	Plain	Irrigation
16	MGB-GD	538945	20.345923	80.295584	30_Farmland	12	20	ambe talav	Plain	Irrigation
17	MGB-GD	538945	20.345923	80.295584	30_Farmland	13	5	vasti	Plain	Habitation
18	MGB-GD	538945	20.352714	80.294598	4_Sparse_Plain_Mixed	1	98	kalya kota	Plain	Irrigation, Grazing
19	MGB-GD	538945	20.350077	80.303278	4_Sparse_Plain_Mixed	2	52	munjal gondi	Plain	Grazing, Tree_felling
20	MGB-GD	538945	20.34717	80.303217	4_Sparse_Plain_Mixed	3	35	thiyya palla	Plain	Tree_felling, Grazing, Irrigation
21	MGB-GD	538945	20.348232	80.304638	4_Sparse_Plain_Mixed	4	30	neli gudra	Plain	Grazing, Irrigation, Tree_felling
22	MGB-GD	538945	20.344696	80.275013	6_Sparse_Hilly_Mixed	1	56	niral gudra	Light_slope	Grazing
23	MGB-GD	538945	20.34425	80.30851	6_Sparse_Hilly_Mixed	2	43	lat gudra	Medium_slope	Tree_felling, Grazing
24	MGB-GD	538945	20.342455	80.31124	9_Medium_Hilly_Mixed	1	143	lat gudra	Steep_slope	Tree_felling, Grazing
25	MGB-GD	538945	20.342084	80.302988	9_Medium_Hilly_Mixed	2	190	darbar metta	Undulating	Grazing, Tree_felling
26	MGB-GD	538945	20.350846	80.30018	9_Medium_Hilly_Mixed	3	76	talay gudra	Light_slope	Grazing, Tree_felling
27	MGB-GD	538945	20.340154	80.300999	9_Medium_Hilly_Mixed	4	170	hichhi konta	Undulating	Grazing, Tree_felling
28	MGB-GD	538945	20.345584	80.295576	9_Medium_Hilly_Mixed	5	195	adjhal metta	Undulating	Grazing
29	MGB-GD	538945	20.349149	80.295087	9_Medium_Hilly_Mixed	6	90	tohgol metta	Medium_slope	Irrigation
30	MGB-GD	538946	20.330782	80.282386	1_Savana_Plain_Mixed	1	3	Vantalav tekar	Plain	Irrigation, Grazing
31	MGB-GD	538946	20.339505	80.282286	1_Savana_Plain_Mixed	2	3	Holi gayran	Plain	Grazing, Irrigation
32	MGB-GD	538946	20.342825	80.277856	1_Savana_Plain_Mixed	3	2	Chichban	Plain	Habitation, Grazing
33	MGB-GD	538946	20.338303	80.284539	1_Savana_Plain_Mixed	4	4	Tekar holi chya varcha	Plain	Grazing, Irrigation
34	MGB-GD	538946	20.344563	80.281924	1_Savana_Plain_Mixed	5	3	Patachi dan	Plain	Grazing, Soil Water_conservation, Irrigation

Annexure 2

Query 1: List of species whose roots have medicinal values along with its other attributes like habit, indigenous/ Exotic, storage method, if natural and/or cultivated in a given village (Example 'Rajoli')

sp_sc_name	sp_part	plant_type	vill_name	vill_id	if_medicine	indi_exot	storage_method	if_natural	if_cultivated
Asparagus racemosus	root	Herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Hemidesmus indicus	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Mucuna pruriens	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Curcuma sp.	root	Herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Gloriosa superba	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Sphaeranthus indicus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cheilocostus speciosus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ochna obtusata	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Tridax procumbens	root	climber	Rajoli	538982	TRUE	Indigenous	stored near house.	TRUE	FALSE
Erythrina suberosa	root	Tree	Rajoli	538982	TRUE	Indigenous	stored near house.	TRUE	FALSE
Amorphophallus margaritifer	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Celosia argentea	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cajanus scarabaeoides	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Vigna sublobata	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Wattakaka volubilis	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Holostemma ada-kodien	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Actinoscirpus grossus	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ceriscoides turgida	root	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Tamilnadia uliginosa	root	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Amorphophallus paeoniifolius	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	FALSE	TRUE
Tephrosia purpurea	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Lepidagathis cristata	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Sphaeranthus indicus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ceriscoides turgida	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cheilocostus speciosus	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE

Query 2: In a given village find the species where raw fruits are edible. (Example 'Rajoli')

sp_sc_name	sp_part	plant_type	vill_name	vill_id	if_food	indi_exot	storage_method	if_natural	if_cultivated
Psidium guajava	raw fruit	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	FALSE	TRUE
Phyllanthus emblica	raw fruit	Tree	Rajoli	538982	TRUE	Indigenous	stored near house.	TRUE	FALSE
Mangifera indica	raw fruit	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	FALSE	TRUE

Query 3 : Species-wise average number of trees per ha and their basal area in given village (Example 'Rajoli')

vill_name	sp_sc_name	trees_per_ha	basal_area_per_ha
Rajoli	Chloroxylon swietenia	47.55	0.798395
Rajoli	Cleistanthus collinus	35.66	0.319764
Rajoli	Madhuca longifolia	33.02	1.548083
Rajoli	Tectona grandis	29.06	0.646023
Rajoli	Pterocarpus marsupium	25.1	2.19481
Rajoli	Terminalia tomentosa	25.1	0.555243
Rajoli	Diospyros melanoxylon	22.45	0.606576
Rajoli	Anogeissus latifolia	18.49	0.766138
Rajoli	Buchanania cochinchinensis	17.17	0.111854
Rajoli	Lagerstroemia parviflora	17.17	0.128166
Rajoli	Lannea coromandelica	10.57	0.15872
Rajoli	Soymida febrifuga	7.92	0.09716
Rajoli	Terminalia bellirica	6.6	0.28223
Rajoli	Phyllanthus emblica	3.96	0.02573
Rajoli	Xylia xylocarpa	3.96	0.027107
Rajoli	Acacia catechu	2.64	0.010143
Rajoli	Albizia odoratissima	2.64	0.023975
Rajoli	Boswellia serrata	2.64	0.04549
Rajoli	Butea monosperma	2.64	0.017237
Rajoli	Ixora coccinea	2.64	0.010931
Rajoli	Mitragyna parvifolia	2.64	0.17457
Rajoli	Acacia leucophlora	1.32	0.063946
Rajoli	Bauhinia racemosa	1.32	0.011446
Rajoli	Bombax ceiba	1.32	0.206007
Rajoli	Bridelia hamiltoniana	1.32	0.340543
Rajoli	Bridelia retusa	1.32	0.036587
Rajoli	Careya arborea	1.32	0.015177
Rajoli	Cordia dichotoma	1.32	0.177629
Rajoli	Dalbergia latifolia	1.32	0.016817
Rajoli	Gardenia latifolia	1.32	0.00824
Rajoli	Hymendictyon obovaty	1.32	0.006054
Rajoli	Schleichera oleosa	1.32	0.269071
Rajoli	Semecarpus anacardium	1.32	0.037838
Rajoli	Bambusa bambos	1.32	NULL
Rajoli	Holarrhena pubescens	1.32	0.003038

Query 4 : List of species found in abundance on various tapus in a given village (Example village= 'Sinsur ')

sp_sc_name	source_org	vill_name	tapu_name	abundance
Albizia odoratissima	MGB-GAD	Sinsur	Adyam gudra	abundant
Anogeissus latifolia	MGB-GAD	Sinsur	Adyam gudra	abundant
Boerhavia diffusa	MGB-GAD	Sinsur	Pen gudra	abundant
Boerhavia diffusa	MGB-GAD	Sinsur	Kalkasa	abundant
Boswellia serrata	MGB-GAD	Sinsur	Gudra	abundant
Buchanania cochinchinensis	MGB-GAD	Sinsur	Gudra	abundant
Butea monosperma	MGB-GAD	Sinsur	Gudra	abundant
Cassia fistula	MGB-GAD	Sinsur	Kalkasa	abundant
Cassia fistula	MGB-GAD	Sinsur	Pen gudra	abundant
Chloroxylon swietenia	MGB-GAD	Sinsur	Gudra	abundant
Chloroxylon swietenia	MGB-GAD	Sinsur	Adyam gudra	abundant
Cleistanthus collinus	MGB-GAD	Sinsur	Gudra	abundant
Cleistanthus collinus	MGB-GAD	Sinsur	Adyam gudra	abundant
Diospyros melanoxylon	MGB-GAD	Sinsur	Gudra	abundant
Diospyros melanoxylon	MGB-GAD	Sinsur	Adyam gudra	abundant
Ficus amplissima	MGB-GAD	Sinsur	Kalkasa	abundant
Ficus amplissima	MGB-GAD	Sinsur	Pen gudra	abundant
Holarrhena pubescens	MGB-GAD	Sinsur	Kalkasa	abundant
Holarrhena pubescens	MGB-GAD	Sinsur	Pen gudra	abundant
Holarrhena pubescens	MGB-GAD	Sinsur	Adyam gudra	abundant
Lagerstroemia parviflora	MGB-GAD	Sinsur	Kalkasa	abundant
Lagerstroemia parviflora	MGB-GAD	Sinsur	Pen gudra	abundant
Madhuca longifolia	MGB-GAD	Sinsur	Gudra	abundant
Schleichera oleosa	MGB-GAD	Sinsur	Kalkasa	abundant
Schleichera oleosa	MGB-GAD	Sinsur	Pen gudra	abundant
Semecarpus anacardium	MGB-GAD	Sinsur	Gudra	abundant
Soymida febrifuga	MGB-GAD	Sinsur	Gudra	abundant
Tamarindus indica	MGB-GAD	Sinsur	Pen gudra	abundant
Tamarindus indica	MGB-GAD	Sinsur	Kalkasa	abundant
Tectona grandis	MGB-GAD	Sinsur	Gudra	abundant
Terminalia bellirica	MGB-GAD	Sinsur	Gudra	abundant
Terminalia bellirica	MGB-GAD	Sinsur	Adyam gudra	abundant
Xylia xylocarpa	MGB-GAD	Sinsur	Kalkasa	abundant
Xylia xylocarpa	MGB-GAD	Sinsur	Pen gudra	abundant

Query5 : For given species no. of plants/ trees and Basal Area per ha and in all villages.

vill_name	sp_sc_name	trees_per_ha	basal_area_per_ha	average area / tree (sq.cm.)
Virpur	Tectona grandis	188.78	1.178508	62.42758767
Jangada Bk	Tectona grandis	50.72	1.618503	319.1054811
Rajoli	Tectona grandis	29.06	0.646023	222.306607
Lawada(van)	Tectona grandis	27.42	1.912186	697.3690737
Sinsur	Tectona grandis	20.55	3.801014	1849.641849
Bori	Tectona grandis	12.06	0.737114	611.2056385

vill_name	sp_sc_name	trees_per_ha	basal_area_per_ha	average area / tree (sq.cm.)
Nayakheda(jambhala)	Tectona grandis	1.27	0.007107	55.96062992
Metejangada	Tectona grandis	0	NULL	
Payvihir	Tectona grandis	0	NULL	
Parala	Tectona grandis	0	NULL	

Query 6: List of all landscape types village-wise in the study area along with their area.

village_with_code	lse_type	no_of_patches	tot_area_in_ha
(Bhurantola,538972)	2_Savana_Rocky_Mixed	1	45
(Bhurantola,538972)	30_Farmland	2	355
(Bhurantola,538972)	4_Sparse_Plain_Mixed	2	135
(Bhurantola,538972)	7_Medium_Plain_Mixed	1	130
(Bhusumkudo,538969)	1_Savana_Plain_Mixed	1	9
(Bhusumkudo,538969)	10_Dense_Hilly_Mixed	1	25
(Bhusumkudo,538969)	11_Dense_Plain_Mixed	1	6
(Bhusumkudo,538969)	2_Savana_Rocky_Mixed	1	9
(Bhusumkudo,538969)	30_Farmland	1	45
(Bhusumkudo,538969)	4_Sparse_Plain_Mixed	2	33
(Bhusumkudo,538969)	5_Sparse_Rocky_Mixed	1	12
(Bhusumkudo,538969)	7_Medium_Plain_Mixed	1	30
(Bori,538953)	1_Savana_Plain_Mixed	1	5
(Bori,538953)	11_Dense_Plain_Mixed	1	20
(Bori,538953)	18_Sparse_Plain_Grass	2	14
(Bori,538953)	4_Sparse_Plain_Mixed	1	8
(Bori,538953)	5_Sparse_Rocky_Mixed	1	7
(Bori,538953)	7_Medium_Plain_Mixed	2	39
(Dudhamala,538979)	1_Savana_Plain_Mixed	4	50
(Dudhamala,538979)	10_Dense_Hilly_Mixed	1	12
(Dudhamala,538979)	11_Dense_Plain_Mixed	1	36
(Dudhamala,538979)	18_Sparse_Plain_Grass	1	10
(Dudhamala,538979)	4_Sparse_Plain_Mixed	4	93
(Dudhamala,538979)	7_Medium_Plain_Mixed	3	68
(Dudhamala,538979)	9_Medium_Hilly_Mixed	2	103
(Erandi,538980)	1_Savana_Plain_Mixed	1	6
(Erandi,538980)	2_Savana_Rocky_Mixed	2	31
(Erandi,538980)	27_Dense_Hilly_Bamboo	1	50
(Erandi,538980)	30_Farmland	1	2
(Erandi,538980)	4_Sparse_Plain_Mixed	5	175
(Erandi,538980)	5_Sparse_Rocky_Mixed	2	12
(Erandi,538980)	7_Medium_Plain_Mixed	3	90
(Erandi,538980)	8_Medium_Rocky_Mixed	2	20
(Erandi,538980)	9_Medium_Hilly_Mixed	2	50
(Gujanwadi,538977)	1_Savana_Plain_Mixed	1	5
(Gujanwadi,538977)	11_Dense_Plain_Mixed	1	25
(Gujanwadi,538977)	12_Savana_Plain_Grass	4	55
(Gujanwadi,538977)	4_Sparse_Plain_Mixed	9	152

village_with_code	lse_type	no_of_patches	tot_area_in_ha
(Gujanwadi,538977)	7_Medium_Plain_Mixed	3	75
("Jangada Bk",538946)	1_Savana_Plain_Mixed	6	22
("Jangada Bk",538946)	10_Dense_Hilly_Mixed	1	8
("Jangada Bk",538946)	16_Savana_Hilly_Grass	1	8
("Jangada Bk",538946)	18_Sparse_Plain_Grass	1	8
("Jangada Bk",538946)	2_Savana_Rocky_Mixed	1	5
("Jangada Bk",538946)	22_Medium_Plain_Grass	2	7
("Jangada Bk",538946)	4_Sparse_Plain_Mixed	5	31
("Jangada Bk",538946)	5_Sparse_Rocky_Mixed	2	7
("Jangada Bk",538946)	7_Medium_Plain_Mixed	1	5
("Jangada Bk",538946)	8_Medium_Rocky_Mixed	6	40
(Kandali,538991)	10_Dense_Hilly_Mixed	1	5
(Kandali,538991)	12_Savana_Plain_Grass	1	20
(Kandali,538991)	18_Sparse_Plain_Grass	3	65
(Kandali,538991)	2_Savana_Rocky_Mixed	1	30
(Kandali,538991)	22_Medium_Plain_Grass	1	20
(Kandali,538991)	28_Dense_Plain_Grass	1	30
(Kandali,538991)	30_Farmland	2	32
(Kandali,538991)	8_Medium_Rocky_Mixed	1	3
(Kanhalgaon,539195)	1_Savana_Plain_Mixed	5	80
(Kanhalgaon,539195)	10_Dense_Hilly_Mixed	3	40
(Kanhalgaon,539195)	12_Savana_Plain_Grass	2	30
(Kanhalgaon,539195)	18_Sparse_Plain_Grass	1	15
(Kanhalgaon,539195)	2_Savana_Rocky_Mixed	1	15
(Kanhalgaon,539195)	25_Medium_Hilly_Bamboo	1	15
(Kanhalgaon,539195)	3_Savana_Hilly_Mixed	1	5
(Kanhalgaon,539195)	4_Sparse_Plain_Mixed	3	60
(Kanhalgaon,539195)	5_Sparse_Rocky_Mixed	4	45
(Kanhalgaon,539195)	6_Sparse_Hilly_Mixed	2	25
(Kanhalgaon,539195)	7_Medium_Plain_Mixed	3	38
(Kanhalgaon,539195)	8_Medium_Rocky_Mixed	2	30
(Kanhalgaon,539195)	9_Medium_Hilly_Mixed	4	50
(Kharkali,538992)	4_Sparse_Plain_Mixed	5	89
(Kharkali,538992)	7_Medium_Plain_Mixed	1	16
(Malanda,538989)	10_Dense_Hilly_Mixed	1	20
(Malanda,538989)	11_Dense_Plain_Mixed	2	55
(Malanda,538989)	12_Savana_Plain_Grass	1	20
(Malanda,538989)	18_Sparse_Plain_Grass	2	22
(Malanda,538989)	21_Sparse_Hilly_Bamboo	1	12
(Malanda,538989)	30_Farmland	1	25
(Malanda,538989)	4_Sparse_Plain_Mixed	3	55
(Malanda,538989)	6_Sparse_Hilly_Mixed	1	15
(Malanda,538989)	7_Medium_Plain_Mixed	3	75
(Malanda,538989)	9_Medium_Hilly_Mixed	1	12
(Marda,539207)	1_Savana_Plain_Mixed	1	30
(Marda,539207)	10_Dense_Hilly_Mixed	6	374

village_with_code	lse_type	no_of_patches	tot_area_in_ha
(Marda,539207)	12_Savana_Plain_Grass	1	85
(Marda,539207)	15_Savana_Rocky_Bamboo	1	60
(Marda,539207)	17_Savana_Hilly_Bamboo	1	25
(Marda,539207)	18_Sparse_Plain_Grass	1	10
(Marda,539207)	20_Sparse_Hilly_Grass	1	25
(Marda,539207)	21_Sparse_Hilly_Bamboo	1	50
(Marda,539207)	25_Medium_Hilly_Bamboo	1	100
(Marda,539207)	29_Dense_Plain_Bamboo	1	45
(Marda,539207)	4_Sparse_Plain_Mixed	4	170
(Marda,539207)	8_Medium_Rocky_Mixed	1	25
(Marda,539207)	9_Medium_Hilly_Mixed	1	150
(Metejangada,538945)	10_Dense_Hilly_Mixed	2	447
(Metejangada,538945)	18_Sparse_Plain_Grass	2	143
(Metejangada,538945)	30_Farmland	13	176
(Metejangada,538945)	4_Sparse_Plain_Mixed	4	215
(Metejangada,538945)	6_Sparse_Hilly_Mixed	2	99
(Metejangada,538945)	9_Medium_Hilly_Mixed	6	864
(Navargaon,538971)	1_Savana_Plain_Mixed	5	124
(Navargaon,538971)	11_Dense_Plain_Mixed	4	52
(Navargaon,538971)	19_Sparse_Plain_Bamboo	1	45
(Navargaon,538971)	21_Sparse_Hilly_Bamboo	1	10
(Navargaon,538971)	23_Medium_Plain_Bamboo	2	31
(Navargaon,538971)	27_Dense_Hilly_Bamboo	1	30
(Navargaon,538971)	4_Sparse_Plain_Mixed	3	57
(Navargaon,538971)	5_Sparse_Rocky_Mixed	1	24
(Navargaon,538971)	7_Medium_Plain_Mixed	2	29
(Navargaon,538971)	9_Medium_Hilly_Mixed	2	35
(Nimanwada,538952)	1_Savana_Plain_Mixed	8	44
(Nimanwada,538952)	10_Dense_Hilly_Mixed	1	12
(Nimanwada,538952)	11_Dense_Plain_Mixed	3	33
(Nimanwada,538952)	30_Farmland	1	2
(Nimanwada,538952)	4_Sparse_Plain_Mixed	3	29
(Nimanwada,538952)	7_Medium_Plain_Mixed	4	50
(Nimanwada,538952)	9_Medium_Hilly_Mixed	3	23
(Rajoli,538982)	4_Sparse_Plain_Mixed	2	8
(Rajoli,538982)	7_Medium_Plain_Mixed	2	9
	Total		6997

Query 7:List of all landscape types in the study area along with their area.

lse_type	tot_area
4_Sparse_Plain_Mixed	1310
9_Medium_Hilly_Mixed	1287
10_Dense_Hilly_Mixed	943
7_Medium_Plain_Mixed	654
30_Farmland	637

lse_type	tot_area
1_Savana_Plain_Mixed	375
18_Sparse_Plain_Grass	287
11_Dense_Plain_Mixed	227
12_Savana_Plain_Grass	210
6_Sparse_Hilly_Mixed	139

lse_type	tot_area
2_Savana_Rocky_Mixed	135
8_Medium_Rocky_Mixed	118
25_Medium_Hilly_Bamboo	115
5_Sparse_Rocky_Mixed	107
27_Dense_Hilly_Bamboo	80
21_Sparse_Hilly_Bamboo	72
15_Savana_Rocky_Bamboo	60
19_Sparse_Plain_Bamboo	45

lse_type	tot_area
29_Dense_Plain_Bamboo	45
23_Medium_Plain_Bamboo	31
28_Dense_Plain_Grass	30
22_Medium_Plain_Grass	27
17_Savana_Hilly_Bamboo	25
20_Sparse_Hilly_Grass	25
16_Savana_Hilly_Grass	8
3_Savana_Hilly_Mixed	5

Query 8: Species-wise average number of trees per ha and their basal area in given village in a given Landscape type (Example Metejangada, landscape type=10_Dense_Hilly_Mixed)

vill_id	vill_name	lse_type	sp_sc_name	trees_per_ha	basal_area_per_ha
538945	Metejangada	10_Dense_Hilly_Mixed	Dendrocalamus strictus	161.53	0
538945	Metejangada	10_Dense_Hilly_Mixed	Tectona grandis	57.43	47.940511
538945	Metejangada	10_Dense_Hilly_Mixed	Diospyros melanoxylon	25.13	22.420923
538945	Metejangada	10_Dense_Hilly_Mixed	Xylia xylocarpa	21.54	10.355413
538945	Metejangada	10_Dense_Hilly_Mixed	Cleistanthus collinus	21.54	6.023457
538945	Metejangada	10_Dense_Hilly_Mixed	Dalbergia sissoo	17.95	7.630262
538945	Metejangada	10_Dense_Hilly_Mixed	Lagerstroemia parviflora	17.95	8.550339
538945	Metejangada	10_Dense_Hilly_Mixed	Mitragyna parvifolia	14.36	8.804595
538945	Metejangada	10_Dense_Hilly_Mixed	Gardenia latifolia	10.77	2.681275
538945	Metejangada	10_Dense_Hilly_Mixed	Schleichera oleosa	10.77	12.56928
538945	Metejangada	10_Dense_Hilly_Mixed	Boswellia serrata	7.18	4.797079
538945	Metejangada	10_Dense_Hilly_Mixed	Terminalia tomentosa	7.18	10.034972
538945	Metejangada	10_Dense_Hilly_Mixed	Anogeissus latifolia	7.18	3.898569
538945	Metejangada	10_Dense_Hilly_Mixed	Chloroxylon swietenia	7.18	4.025655
538945	Metejangada	10_Dense_Hilly_Mixed	Pterocarpus marsupium	3.59	5.038852
538945	Metejangada	10_Dense_Hilly_Mixed	Careya arborea	3.59	4.616206
538945	Metejangada	10_Dense_Hilly_Mixed	Smilax zeylanica	3.59	1.259713
538945	Metejangada	10_Dense_Hilly_Mixed	Bombax ceiba	3.59	5.038852
538945	Metejangada	10_Dense_Hilly_Mixed	Albizia odoratissima	3.59	0.600578
538945	Metejangada	10_Dense_Hilly_Mixed	Aegle marmelos	3.59	0.668676
538945	Metejangada	10_Dense_Hilly_Mixed	Buchanania cochinchinensis	3.59	0.749658
538945	Metejangada	10_Dense_Hilly_Mixed	Madhuca longifolia	3.59	5.062876

Query 9: Calculate potential Mahua flower and seed production per ha in all Eco Restoration MGB villages

vill_name	sp_sc_name	trees_per_ha	flowers_wt	seed_wt
Jangada Bk	Madhuca longifolia	55.79	3180.03	446.32
Bori	Madhuca longifolia	52.27	2979.39	418.16
Sinsur	Madhuca longifolia	41.1	2342.7	328.8
Rajoli	Madhuca longifolia	33.02	1882.14	264.16

vill_name	sp_sc_name	trees_per_ha	flowers_wt	seed_wt
Metejangada	Madhuca longifolia	5.89	335.73	47.12
Lawada(van)	Madhuca longifolia	1.61	91.77	12.88
Nayakheda(jambhala)	Madhuca longifolia	0	0	0
Parala	Madhuca longifolia	0	0	0
Payvihir	Madhuca longifolia	0	0	0
Virpur	Madhuca longifolia	0	0	0

Query 10: Species common in all MGB study area of eco-restoration

Sr.No.	sp_id	sp_sc_name
1	2	Acacia catechu
2	3	Acacia leucophlora
3	7	Aegle marmelos
4	23	Annona squamosa
5	24	Anogeissus latifolia
6	31	Azadirachta indica
7	35	Bauhinia racemosa
8	41	Boswellia serrata
9	47	Butea monosperma

Sr.No.	sp_id	sp_sc_name
10	62	Celosia argentea
11	103	Ficus racemosa
12	133	Lannea coromandelica
13	144	Mangifera indica
14	156	Moringa oleifera
15	200	Syzygium cumini
16	202	Tamarindus indica
17	204	Tectona grandis
18	208	Terminalia bellirica

Q11: Trees per ha and basal area per ha in lse_type of Dense Plain_Mixed

lse_type_id	lse_type	sp_sc_name	trees_per_ha	basal_area
11	11_Dense_Plain_Mixed	Terminalia tomentosa	138.6	6.172766
11	11_Dense_Plain_Mixed	Cleistanthus collinus	132.37	4.134547
11	11_Dense_Plain_Mixed	Madhuca longifolia	107.45	10.818181
11	11_Dense_Plain_Mixed	Anogeissus latifolia	79.42	7.499172
11	11_Dense_Plain_Mixed	Semecarpus anacardium	57.62	6.691243
11	11_Dense_Plain_Mixed	Buchanania cochinchinensis	51.39	2.97964
11	11_Dense_Plain_Mixed	Tectona grandis	43.6	4.978476
11	11_Dense_Plain_Mixed	Chloroxylon swietenia	37.37	1.512963
11	11_Dense_Plain_Mixed	Lagerstroemia parviflora	35.82	0.853992
11	11_Dense_Plain_Mixed	Lannea coromandelica	28.03	1.364476
11	11_Dense_Plain_Mixed	Diospyros melanoxylon	26.47	1.873994
11	11_Dense_Plain_Mixed	Holarrhena pubescens	20.24	0.465586
11	11_Dense_Plain_Mixed	Soymida febrifuga	15.57	0.522778
11	11_Dense_Plain_Mixed	Pterocarpus marsupium	15.57	2.277816
11	11_Dense_Plain_Mixed	Dendrocalamus strictus	12.46	0
11	11_Dense_Plain_Mixed	Xylia xylocarpa	12.46	0.921308
11	11_Dense_Plain_Mixed	Terminalia bellirica	12.46	1.181736
11	11_Dense_Plain_Mixed	Casearia graveolens	10.9	0.37527
11	11_Dense_Plain_Mixed	Ceriscoides turgida	10.9	0.305339
11	11_Dense_Plain_Mixed	Boswellia serrata	10.9	0.447295
11	11_Dense_Plain_Mixed	Schleichera oleosa	9.34	1.248978
11	11_Dense_Plain_Mixed	Ziziphus xylopyrus	9.34	0.202184
11	11_Dense_Plain_Mixed	Ougenia dalbergiodes	7.79	3.322429

lse_type_id	lse_type	sp_sc_name	trees_per_ha	basal_area
11	11_Dense_Plain_Mixed	Butea monosperma	6.23	0.404974
11	11_Dense_Plain_Mixed	Bauhinia racemosa	6.23	0.103564
11	11_Dense_Plain_Mixed	Bridelia retusa	6.23	0.903426
11	11_Dense_Plain_Mixed	Getonia floribunda	4.67	0.04413
11	11_Dense_Plain_Mixed	Mitragyna parvifolia	4.67	1.303208
11	11_Dense_Plain_Mixed	Careya arborea	4.67	0.108434
11	11_Dense_Plain_Mixed	Bombax ceiba	4.67	1.360696
11	11_Dense_Plain_Mixed	Albizia odoratissima	4.67	0.293083
11	11_Dense_Plain_Mixed	Dalbergia lanceolaria	3.11	1.031676
11	11_Dense_Plain_Mixed	Cassia fistula	3.11	0.05019
11	11_Dense_Plain_Mixed	Dalbergia latifolia	3.11	0.424133
11	11_Dense_Plain_Mixed	Acacia catechu	3.11	0.067539
11	11_Dense_Plain_Mixed	Acacia pennata	1.56	0.011153
11	11_Dense_Plain_Mixed	Antidesma ghaesembilla	1.56	0.025095
11	11_Dense_Plain_Mixed	Ixora coccinea	1.56	0.009716
11	11_Dense_Plain_Mixed	Schrebera swietenioides	1.56	0.178452
11	11_Dense_Plain_Mixed	Syzygium cumini	1.56	0.546509
11	11_Dense_Plain_Mixed	Terminalia chebula	1.56	0.040263
11	11_Dense_Plain_Mixed	Aegle marmelos	1.56	0.025095
11	11_Dense_Plain_Mixed	Gardenia latifolia	1.56	0.020832

Annexure 3

Diversity

lse_type_id	lse_type	Diversity Index
1	1_Savana_Plain_Mixed Count	70
2	2_Savana_Rocky_Mixed Count	48
4	4_Sparse_Plain_Mixed Count	170
5	5_Sparse_Rocky_Mixed Count	49
6	6_Sparse_Hilly_Mixed Count	51
7	7_Medium_Plain_Mixed Count	117
8	8_Medium_Rocky_Mixed Count	62
9	9_Medium_Hilly_Mixed Count	131
10	10_Dense_Hilly_Mixed Count	90
11	11_Dense_Plain_Mixed Count	115
12	12_Savana_Plain_Grass Count	46
13	14_Savana_Rocky_Grass Count	13
14	15_Savana_Rocky_Bamboo Count	24

lse_type_id	lse_type	Diversity Index
15	17_Savana_Hilly_Bamboo Count	15
16	18_Sparse_Plain_Grass Count	90
17	19_Sparse_Plain_Bamboo Count	96
18	20_Sparse_Hilly_Grass Count	19
19	21_Sparse_Hilly_Bamboo Count	30
20	22_Medium_Plain_Grass Count	19
21	23_Medium_Plain_Bamboo Count	102
22	25_Medium_Hilly_Bamboo Count	34
23	27_Dense_Hilly_Bamboo Count	26
24	28_Dense_Plain_Grass Count	20
25	29_Dense_Plain_Bamboo Count	27
26	30_Farmland Count	45

Tree density in different LSEs (trees with density less than 5% of the highest density are not listed here if list is too long)

lse_type	sp_id	sp_sc_name	density (trees/ha)
1_Savana_Plain_Mixed	211	Terminalia tomentosa	9.310031
1_Savana_Plain_Mixed	143	Madhuca longifolia	9.180725
1_Savana_Plain_Mixed	70	Cleistanthus collinus	5.301545
1_Savana_Plain_Mixed	130	Lagerstroemia parviflora	3.749873
1_Savana_Plain_Mixed	93	Diospyros melanoxylon	3.620567
1_Savana_Plain_Mixed	24	Anogeissus latifolia	3.361955
1_Savana_Plain_Mixed	180	Pterocarpus marsupium	2.844732
1_Savana_Plain_Mixed	67	Chloroxylon swietenia	2.198202
1_Savana_Plain_Mixed	195	Soymida febrifuga	2.068896
1_Savana_Plain_Mixed	47	Butea monosperma	1.93959
1_Savana_Plain_Mixed	204	Tectona grandis	1.93959
1_Savana_Plain_Mixed	44	Buchanania cochinchinensis	1.422366
1_Savana_Plain_Mixed	119	Holarrhena pubescens	1.163754
1_Savana_Plain_Mixed	208	Terminalia bellirica	1.163754
1_Savana_Plain_Mixed	227	Ziziphus xylopyrus	1.034448
1_Savana_Plain_Mixed	133	Lannea coromandelica	0.775836
1_Savana_Plain_Mixed	886	Ougenia dalbergiodes	0.775836
1_Savana_Plain_Mixed	2	Acacia catechu	0.64653
1_Savana_Plain_Mixed	188	Semecarpus anacardium	0.517224
1_Savana_Plain_Mixed	43	Bridelia retusa	0.517224
1_Savana_Plain_Mixed	186	Schleichera oleosa	0.517224

lse_type	sp_id	sp_sc_name	density (trees/ha)
2_Savana_Rocky_Mixed	70	Cleistanthus collinus	50.286223
2_Savana_Rocky_Mixed	67	Chloroxylon swietenia	50.286223
2_Savana_Rocky_Mixed	44	Buchanania cochinchinensis	40.228978
2_Savana_Rocky_Mixed	211	Terminalia tomentosa	40.228978
2_Savana_Rocky_Mixed	24	Anogeissus latifolia	30.171734
2_Savana_Rocky_Mixed	143	Madhuca longifolia	30.171734
2_Savana_Rocky_Mixed	133	Lannea coromandelica	20.114489
2_Savana_Rocky_Mixed	42	Bridelia hamiltoniana	20.114489
2_Savana_Rocky_Mixed	119	Holarrhena pubescens	20.114489
2_Savana_Rocky_Mixed	204	Tectona grandis	20.114489
2_Savana_Rocky_Mixed	105	Flacourtia indica	10.057245
2_Savana_Rocky_Mixed	39	Bombax ceiba	10.057245
2_Savana_Rocky_Mixed	223	Xylia xylocarpa	10.057245
2_Savana_Rocky_Mixed	195	Soymida febrifuga	10.057245
2_Savana_Rocky_Mixed	2	Acacia catechu	10.057245
2_Savana_Rocky_Mixed	41	Boswellia serrata	10.057245
2_Savana_Rocky_Mixed	43	Bridelia retusa	10.057245
2_Savana_Rocky_Mixed	208	Terminalia bellirica	10.057245
3_Savana_Hilly_Mixed	70	Cleistanthus collinus	85.44074
3_Savana_Hilly_Mixed	244	Dendrocalamus strictus	85.44074
3_Savana_Hilly_Mixed	204	Tectona grandis	85.44074
3_Savana_Hilly_Mixed	188	Semecarpus anacardium	42.72037
3_Savana_Hilly_Mixed	24	Anogeissus latifolia	25.632222
3_Savana_Hilly_Mixed	192	Smilax zeylanica	17.088148
3_Savana_Hilly_Mixed	39	Bombax ceiba	17.088148
3_Savana_Hilly_Mixed	186	Schleichera oleosa	17.088148
3_Savana_Hilly_Mixed	67	Chloroxylon swietenia	8.544074
3_Savana_Hilly_Mixed	223	Xylia xylocarpa	8.544074
3_Savana_Hilly_Mixed	11	Albizia odoratissima	8.544074
3_Savana_Hilly_Mixed	42	Bridelia hamiltoniana	8.544074
3_Savana_Hilly_Mixed	41	Boswellia serrata	8.544074
3_Savana_Hilly_Mixed	211	Terminalia tomentosa	8.544074
3_Savana_Hilly_Mixed	130	Lagerstroemia parviflora	8.544074
3_Savana_Hilly_Mixed	143	Madhuca longifolia	8.544074
4_Sparse_Plain_Mixed	211	Terminalia tomentosa	31.403657
4_Sparse_Plain_Mixed	143	Madhuca longifolia	21.496025
4_Sparse_Plain_Mixed	70	Cleistanthus collinus	19.461422
4_Sparse_Plain_Mixed	204	Tectona grandis	11.499931
4_Sparse_Plain_Mixed	24	Anogeissus latifolia	10.969165
4_Sparse_Plain_Mixed	130	Lagerstroemia parviflora	10.349938

lse_type	sp_id	sp_sc_name	density (trees/ha)
4_Sparse_Plain_Mixed	67	Chloroxylon swietenia	10.173016
4_Sparse_Plain_Mixed	180	Pterocarpus marsupium	9.023023
4_Sparse_Plain_Mixed	44	Buchanania cochinchinensis	8.934562
4_Sparse_Plain_Mixed	93	Diospyros melanoxylon	8.580718
4_Sparse_Plain_Mixed	47	Butea monosperma	6.899959
4_Sparse_Plain_Mixed	195	Soymida febrifuga	6.369192
4_Sparse_Plain_Mixed	133	Lannea coromandelica	4.42305
4_Sparse_Plain_Mixed	244	Dendrocalamus strictus	4.42305
4_Sparse_Plain_Mixed	119	Holarrhena pubescens	3.715362
4_Sparse_Plain_Mixed	43	Bridelia retusa	2.565369
4_Sparse_Plain_Mixed	186	Schleichera oleosa	2.476908
4_Sparse_Plain_Mixed	188	Semecarpus anacardium	2.034603
4_Sparse_Plain_Mixed	41	Boswellia serrata	1.680759
5_Sparse_Rocky_Mixed	70	Cleistanthus collinus	28.885615
5_Sparse_Rocky_Mixed	211	Terminalia tomentosa	26.389327
5_Sparse_Rocky_Mixed	67	Chloroxylon swietenia	20.683527
5_Sparse_Rocky_Mixed	143	Madhuca longifolia	17.830627
5_Sparse_Rocky_Mixed	24	Anogeissus latifolia	17.117401
5_Sparse_Rocky_Mixed	93	Diospyros melanoxylon	16.047564
5_Sparse_Rocky_Mixed	204	Tectona grandis	12.838051
5_Sparse_Rocky_Mixed	180	Pterocarpus marsupium	8.202088
5_Sparse_Rocky_Mixed	244	Dendrocalamus strictus	7.488863
5_Sparse_Rocky_Mixed	133	Lannea coromandelica	6.062413
5_Sparse_Rocky_Mixed	130	Lagerstroemia parviflora	6.062413
5_Sparse_Rocky_Mixed	44	Buchanania cochinchinensis	5.705801
5_Sparse_Rocky_Mixed	41	Boswellia serrata	5.705801
5_Sparse_Rocky_Mixed	195	Soymida febrifuga	5.349188
5_Sparse_Rocky_Mixed	188	Semecarpus anacardium	5.349188
5_Sparse_Rocky_Mixed	47	Butea monosperma	4.635963
5_Sparse_Rocky_Mixed	107	Gardenia latifolia	3.922738
5_Sparse_Rocky_Mixed	223	Xylia xylocarpa	3.566125
5_Sparse_Rocky_Mixed	42	Bridelia hamiltoniana	3.209513
5_Sparse_Rocky_Mixed	119	Holarrhena pubescens	2.496288
5_Sparse_Rocky_Mixed	186	Schleichera oleosa	2.496288
5_Sparse_Rocky_Mixed	63	Ceriscoides turgida	2.139675
5_Sparse_Rocky_Mixed	2	Acacia catechu	1.783063
5_Sparse_Rocky_Mixed	227	Ziziphus xylopyrus	1.783063
5_Sparse_Rocky_Mixed	200	Syzygium cumini	1.783063
5_Sparse_Rocky_Mixed	172	Phyllanthus emblica	1.783063
6_Sparse_Hilly_Mixed	70	Cleistanthus collinus	49.39061

lse_type	sp_id	sp_sc_name	density (trees/ha)
6_Sparse_Hilly_Mixed	204	Tectona grandis	27.988012
6_Sparse_Hilly_Mixed	244	Dendrocalamus strictus	15.64036
6_Sparse_Hilly_Mixed	24	Anogeissus latifolia	13.994006
6_Sparse_Hilly_Mixed	133	Lannea coromandelica	11.524476
6_Sparse_Hilly_Mixed	223	Xylia xylocarpa	9.878122
6_Sparse_Hilly_Mixed	186	Schleichera oleosa	9.878122
6_Sparse_Hilly_Mixed	180	Pterocarpus marsupium	9.054945
6_Sparse_Hilly_Mixed	67	Chloroxylon swietenia	6.585415
6_Sparse_Hilly_Mixed	42	Bridelia hamiltoniana	6.585415
6_Sparse_Hilly_Mixed	119	Holarrhena pubescens	6.585415
6_Sparse_Hilly_Mixed	143	Madhuca longifolia	6.585415
6_Sparse_Hilly_Mixed	107	Gardenia latifolia	5.762238
6_Sparse_Hilly_Mixed	93	Diospyros melanoxylon	5.762238
6_Sparse_Hilly_Mixed	211	Terminalia tomentosa	5.762238
6_Sparse_Hilly_Mixed	41	Boswellia serrata	4.939061
6_Sparse_Hilly_Mixed	86	Dalbergia latifolia	4.115884
6_Sparse_Hilly_Mixed	188	Semecarpus anacardium	4.115884
6_Sparse_Hilly_Mixed	44	Buchanania cochinchinensis	3.292707
6_Sparse_Hilly_Mixed	43	Bridelia retusa	2.469531
6_Sparse_Hilly_Mixed	47	Butea monosperma	2.469531
6_Sparse_Hilly_Mixed	130	Lagerstroemia parviflora	2.469531
7_Medium_Plain_Mixed	211	Terminalia tomentosa	97.340824
7_Medium_Plain_Mixed	70	Cleistanthus collinus	93.57886
7_Medium_Plain_Mixed	24	Anogeissus latifolia	54.078236
7_Medium_Plain_Mixed	143	Madhuca longifolia	47.024553
7_Medium_Plain_Mixed	204	Tectona grandis	44.673325
7_Medium_Plain_Mixed	130	Lagerstroemia parviflora	33.857678
7_Medium_Plain_Mixed	180	Pterocarpus marsupium	31.976696
7_Medium_Plain_Mixed	67	Chloroxylon swietenia	31.50645
7_Medium_Plain_Mixed	44	Buchanania cochinchinensis	26.33375
7_Medium_Plain_Mixed	93	Diospyros melanoxylon	22.10154
7_Medium_Plain_Mixed	133	Lannea coromandelica	16.928839
7_Medium_Plain_Mixed	195	Soymida febrifuga	14.107366
7_Medium_Plain_Mixed	188	Semecarpus anacardium	13.166875
7_Medium_Plain_Mixed	119	Holarrhena pubescens	10.345402
7_Medium_Plain_Mixed	43	Bridelia retusa	7.053683
7_Medium_Plain_Mixed	2	Acacia catechu	6.583437
7_Medium_Plain_Mixed	208	Terminalia bellirica	5.642946
7_Medium_Plain_Mixed	186	Schleichera oleosa	5.172701
7_Medium_Plain_Mixed	886	Ougenia dalbergiodes	5.172701

lse_type	sp_id	sp_sc_name	density (trees/ha)
8_Medium_Rocky_Mixed	70	Cleistanthus collinus	87.130601
8_Medium_Rocky_Mixed	211	Terminalia tomentosa	39.034509
8_Medium_Rocky_Mixed	24	Anogeissus latifolia	30.669971
8_Medium_Rocky_Mixed	204	Tectona grandis	29.275882
8_Medium_Rocky_Mixed	67	Chloroxylon swietenia	26.487703
8_Medium_Rocky_Mixed	180	Pterocarpus marsupium	19.517255
8_Medium_Rocky_Mixed	143	Madhuca longifolia	18.82021
8_Medium_Rocky_Mixed	223	Xylia xylocarpa	16.729075
8_Medium_Rocky_Mixed	93	Diospyros melanoxylon	14.637941
8_Medium_Rocky_Mixed	133	Lannea coromandelica	13.243851
8_Medium_Rocky_Mixed	244	Dendrocalamus strictus	10.455672
8_Medium_Rocky_Mixed	130	Lagerstroemia parviflora	10.455672
8_Medium_Rocky_Mixed	44	Buchanania cochinchinensis	8.364538
8_Medium_Rocky_Mixed	188	Semecarpus anacardium	8.364538
8_Medium_Rocky_Mixed	43	Bridelia retusa	6.970448
8_Medium_Rocky_Mixed	195	Soymida febrifuga	6.273403
8_Medium_Rocky_Mixed	227	Ziziphus xylopyrus	6.273403
8_Medium_Rocky_Mixed	119	Holarrhena pubescens	6.273403
8_Medium_Rocky_Mixed	2	Acacia catechu	5.576358
8_Medium_Rocky_Mixed	42	Bridelia hamiltoniana	5.576358
8_Medium_Rocky_Mixed	186	Schleichera oleosa	4.182269
8_Medium_Rocky_Mixed	886	Ougenia dalbergiodes	4.182269
9_Medium_Hilly_Mixed	70	Cleistanthus collinus	46.790223
9_Medium_Hilly_Mixed	244	Dendrocalamus strictus	41.376478
9_Medium_Hilly_Mixed	204	Tectona grandis	37.122822
9_Medium_Hilly_Mixed	24	Anogeissus latifolia	22.041675
9_Medium_Hilly_Mixed	180	Pterocarpus marsupium	17.014627
9_Medium_Hilly_Mixed	93	Diospyros melanoxylon	11.214186
9_Medium_Hilly_Mixed	41	Boswellia serrata	10.82749
9_Medium_Hilly_Mixed	223	Xylia xylocarpa	10.440794
9_Medium_Hilly_Mixed	67	Chloroxylon swietenia	8.894009
9_Medium_Hilly_Mixed	186	Schleichera oleosa	8.894009
9_Medium_Hilly_Mixed	43	Bridelia retusa	6.960529
9_Medium_Hilly_Mixed	211	Terminalia tomentosa	6.960529
9_Medium_Hilly_Mixed	107	Gardenia latifolia	6.187137
9_Medium_Hilly_Mixed	88	Dalbergia sissoo	5.800441
9_Medium_Hilly_Mixed	133	Lannea coromandelica	5.413745
9_Medium_Hilly_Mixed	42	Bridelia hamiltoniana	5.413745
9_Medium_Hilly_Mixed	143	Madhuca longifolia	4.640353
9_Medium_Hilly_Mixed	44	Buchanania cochinchinensis	4.253657

lse_type	sp_id	sp_sc_name	density (trees/ha)
10_Dense_Hilly_Mixed	244	Dendrocalamus strictus	120.92475
10_Dense_Hilly_Mixed	70	Cleistanthus collinus	83.947762
10_Dense_Hilly_Mixed	204	Tectona grandis	57.963931
10_Dense_Hilly_Mixed	24	Anogeissus latifolia	25.983831
10_Dense_Hilly_Mixed	223	Xylia xylocarpa	20.986941
10_Dense_Hilly_Mixed	93	Diospyros melanoxylon	15.99005
10_Dense_Hilly_Mixed	180	Pterocarpus marsupium	15.99005
10_Dense_Hilly_Mixed	130	Lagerstroemia parviflora	15.99005
10_Dense_Hilly_Mixed	42	Bridelia hamiltoniana	14.990672
10_Dense_Hilly_Mixed	211	Terminalia tomentosa	12.991916
10_Dense_Hilly_Mixed	186	Schleichera oleosa	11.992537
10_Dense_Hilly_Mixed	150	Mitragyna parvifolia	10.993159
10_Dense_Hilly_Mixed	67	Chloroxylon swietenia	9.993781
10_Dense_Hilly_Mixed	133	Lannea coromandelica	9.993781
10_Dense_Hilly_Mixed	39	Bombax ceiba	7.995025
10_Dense_Hilly_Mixed	43	Bridelia retusa	7.995025
10_Dense_Hilly_Mixed	107	Gardenia latifolia	6.995647
10_Dense_Hilly_Mixed	41	Boswellia serrata	6.995647
10_Dense_Hilly_Mixed	86	Dalbergia latifolia	5.996269
10_Dense_Hilly_Mixed	44	Buchanania cochinchinensis	5.996269
10_Dense_Hilly_Mixed	88	Dalbergia sissoo	5.996269
10_Dense_Hilly_Mixed	143	Madhuca longifolia	4.996891
11_Dense_Plain_Mixed	70	Cleistanthus collinus	178.61248
11_Dense_Plain_Mixed	211	Terminalia tomentosa	154.86631
11_Dense_Plain_Mixed	143	Madhuca longifolia	90.854901
11_Dense_Plain_Mixed	24	Anogeissus latifolia	72.270944
11_Dense_Plain_Mixed	44	Buchanania cochinchinensis	46.459893
11_Dense_Plain_Mixed	130	Lagerstroemia parviflora	41.297682
11_Dense_Plain_Mixed	204	Tectona grandis	40.26524
11_Dense_Plain_Mixed	188	Semecarpus anacardium	38.200356
11_Dense_Plain_Mixed	67	Chloroxylon swietenia	33.038146
11_Dense_Plain_Mixed	93	Diospyros melanoxylon	28.908378
11_Dense_Plain_Mixed	195	Soymida febrifuga	23.746167
11_Dense_Plain_Mixed	133	Lannea coromandelica	20.648841
11_Dense_Plain_Mixed	180	Pterocarpus marsupium	18.583957
11_Dense_Plain_Mixed	227	Ziziphus xylopyrus	17.551515
11_Dense_Plain_Mixed	119	Holarrhena pubescens	17.551515
11_Dense_Plain_Mixed	886	Ougenia dalbergiodes	11.356863
11_Dense_Plain_Mixed	186	Schleichera oleosa	10.324421
11_Dense_Plain_Mixed	63	Ceriscoides turgida	9.291979
11_Dense_Plain_Mixed	223	Xylia xylocarpa	9.291979

lse_type	sp_id	sp_sc_name	density (trees/ha)
11_Dense_Plain_Mixed	312	Casearia graveolens	9.291979
11_Dense_Plain_Mixed	43	Bridelia retusa	9.291979
12_Savana_Plain_Grass	70	Cleistanthus collinus	18.569712
12_Savana_Plain_Grass	93	Diospyros melanoxylon	18.569712
12_Savana_Plain_Grass	44	Buchanania cochinchinensis	15.47476
12_Savana_Plain_Grass	211	Terminalia tomentosa	15.47476
12_Savana_Plain_Grass	143	Madhuca longifolia	15.47476
12_Savana_Plain_Grass	195	Soymida febrifuga	12.379808
12_Savana_Plain_Grass	180	Pterocarpus marsupium	9.284856
12_Savana_Plain_Grass	204	Tectona grandis	9.284856
12_Savana_Plain_Grass	894	Stereospermum sp.	6.189904
12_Savana_Plain_Grass	2	Acacia catechu	6.189904
12_Savana_Plain_Grass	243	Dalbergia lanceolaria	6.189904
12_Savana_Plain_Grass	150	Mitragyna parvifolia	6.189904
12_Savana_Plain_Grass	208	Terminalia bellirica	6.189904
12_Savana_Plain_Grass	172	Phyllanthus emblica	6.189904
13_Savana_Plain_Bamboo	70	Cleistanthus collinus	314.19864
13_Savana_Plain_Bamboo	204	Tectona grandis	261.8322
13_Savana_Plain_Bamboo	63	Ceriscoides turgida	104.73288
13_Savana_Plain_Bamboo	223	Xylia xylocarpa	52.366439
13_Savana_Plain_Bamboo	133	Lannea coromandelica	52.366439
13_Savana_Plain_Bamboo	42	Bridelia hamiltoniana	52.366439
13_Savana_Plain_Bamboo	41	Boswellia serrata	52.366439
13_Savana_Plain_Bamboo	24	Anogeissus latifolia	52.366439
13_Savana_Plain_Bamboo	244	Dendrocalamus strictus	52.366439
13_Savana_Plain_Bamboo	143	Madhuca longifolia	52.366439
14_Savana_Rocky_Grass	70	Cleistanthus collinus	60.507193
14_Savana_Rocky_Grass	44	Buchanania cochinchinensis	60.507193
14_Savana_Rocky_Grass	143	Madhuca longifolia	60.507193
14_Savana_Rocky_Grass	24	Anogeissus latifolia	40.338129
14_Savana_Rocky_Grass	894	Stereospermum sp.	20.169064
14_Savana_Rocky_Grass	67	Chloroxylon swietenia	20.169064
14_Savana_Rocky_Grass	63	Ceriscoides turgida	20.169064
14_Savana_Rocky_Grass	93	Diospyros melanoxylon	20.169064
14_Savana_Rocky_Grass	133	Lannea coromandelica	20.169064
14_Savana_Rocky_Grass	227	Ziziphus xylopyrus	20.169064
14_Savana_Rocky_Grass	119	Holarrhena pubescens	20.169064
14_Savana_Rocky_Grass	211	Terminalia tomentosa	20.169064
14_Savana_Rocky_Grass	56	Cassia fistula	20.169064

lse_type	sp_id	sp_sc_name	density (trees/ha)
17_Savana_Hilly_Bamboo	70	Cleistanthus collinus	117.92336
17_Savana_Hilly_Bamboo	93	Diospyros melanoxylon	58.961677
17_Savana_Hilly_Bamboo	188	Semecarpus anacardium	58.961677
17_Savana_Hilly_Bamboo	7	Aegle marmelos	29.480839
17_Savana_Hilly_Bamboo	24	Anogeissus latifolia	29.480839
17_Savana_Hilly_Bamboo	244	Dendrocalamus strictus	29.480839
17_Savana_Hilly_Bamboo	923	Morinda pubescens	29.480839
18_Sparse_Plain_Grass	211	Terminalia tomentosa	91.15608
18_Sparse_Plain_Grass	93	Diospyros melanoxylon	41.167262
18_Sparse_Plain_Grass	70	Cleistanthus collinus	23.52415
18_Sparse_Plain_Grass	126	Ixora coccinea	17.643112
18_Sparse_Plain_Grass	186	Schleichera oleosa	17.643112
18_Sparse_Plain_Grass	204	Tectona grandis	17.643112
18_Sparse_Plain_Grass	143	Madhuca longifolia	17.643112
18_Sparse_Plain_Grass	44	Buchanania cochinchinensis	14.702594
18_Sparse_Plain_Grass	119	Holarrhena pubescens	14.702594
18_Sparse_Plain_Grass	24	Anogeissus latifolia	14.702594
18_Sparse_Plain_Grass	195	Soymida febrifuga	11.762075
18_Sparse_Plain_Grass	47	Butea monosperma	11.762075
18_Sparse_Plain_Grass	150	Mitragyna parvifolia	8.821556
18_Sparse_Plain_Grass	109	Getonia floribunda	5.881037
18_Sparse_Plain_Grass	7	Aegle marmelos	5.881037
18_Sparse_Plain_Grass	48	Butea superba	5.881037
18_Sparse_Plain_Grass	208	Terminalia bellirica	5.881037
18_Sparse_Plain_Grass	3	Acacia leucophlora	5.881037
21_Sparse_Hilly_Bamboo	70	Cleistanthus collinus	29.874659
21_Sparse_Hilly_Bamboo	244	Dendrocalamus strictus	29.874659
21_Sparse_Hilly_Bamboo	223	Xylia xylocarpa	12.447775
21_Sparse_Hilly_Bamboo	24	Anogeissus latifolia	12.447775
21_Sparse_Hilly_Bamboo	204	Tectona grandis	12.447775
21_Sparse_Hilly_Bamboo	88	Dalbergia sissoo	7.468665
21_Sparse_Hilly_Bamboo	130	Lagerstroemia parviflora	6.223887
21_Sparse_Hilly_Bamboo	133	Lannea coromandelica	4.97911
21_Sparse_Hilly_Bamboo	186	Schleichera oleosa	3.734332
22_Medium_Plain_Grass	93	Diospyros melanoxylon	20.681397
22_Medium_Plain_Grass	119	Holarrhena pubescens	16.545118
22_Medium_Plain_Grass	130	Lagerstroemia parviflora	10.340699
22_Medium_Plain_Grass	24	Anogeissus latifolia	8.272559
22_Medium_Plain_Grass	211	Terminalia tomentosa	8.272559

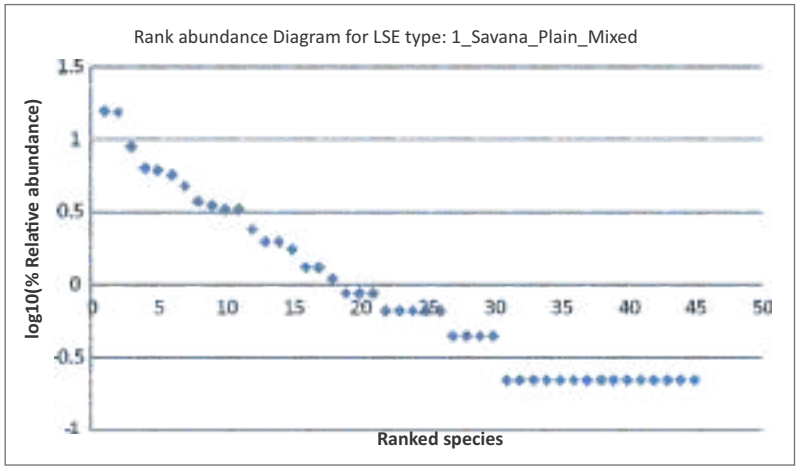
lse_type	sp_id	sp_sc_name	density (trees/ha)
22_Medium_Plain_Grass	70	Cleistanthus collinus	6.204419
22_Medium_Plain_Grass	47	Butea monosperma	6.204419
22_Medium_Plain_Grass	143	Madhuca longifolia	6.204419
22_Medium_Plain_Grass	186	Schleichera oleosa	4.136279
23_Medium_Plain_Bamboo	244	Dendrocalamus strictus	331.79375
23_Medium_Plain_Bamboo	70	Cleistanthus collinus	104.77697
23_Medium_Plain_Bamboo	211	Terminalia tomentosa	87.314145
23_Medium_Plain_Bamboo	67	Chloroxylon swietenia	69.851316
23_Medium_Plain_Bamboo	204	Tectona grandis	69.851316
23_Medium_Plain_Bamboo	93	Diospyros melanoxylon	52.388487
23_Medium_Plain_Bamboo	133	Lannea coromandelica	52.388487
23_Medium_Plain_Bamboo	243	Dalbergia lanceolaria	52.388487
23_Medium_Plain_Bamboo	24	Anogeissus latifolia	52.388487
23_Medium_Plain_Bamboo	143	Madhuca longifolia	52.388487
23_Medium_Plain_Bamboo	44	Buchanania cochinchinensis	34.925658
23_Medium_Plain_Bamboo	172	Phyllanthus emblica	34.925658
23_Medium_Plain_Bamboo	130	Lagerstroemia parviflora	34.925658
23_Medium_Plain_Bamboo	107	Gardenia latifolia	17.462829
23_Medium_Plain_Bamboo	223	Xylia xylocarpa	17.462829
23_Medium_Plain_Bamboo	188	Semecarpus anacardium	17.462829
23_Medium_Plain_Bamboo	119	Holarrhena pubescens	17.462829
23_Medium_Plain_Bamboo	186	Schleichera oleosa	17.462829
25_Medium_Hilly_Bamboo	244	Dendrocalamus strictus	189.86729
25_Medium_Hilly_Bamboo	70	Cleistanthus collinus	94.933645
25_Medium_Hilly_Bamboo	24	Anogeissus latifolia	79.11137
25_Medium_Hilly_Bamboo	186	Schleichera oleosa	63.289096
25_Medium_Hilly_Bamboo	204	Tectona grandis	63.289096
25_Medium_Hilly_Bamboo	130	Lagerstroemia parviflora	47.466822
25_Medium_Hilly_Bamboo	894	Stereospermum sp.	15.822274
25_Medium_Hilly_Bamboo	67	Chloroxylon swietenia	15.822274
25_Medium_Hilly_Bamboo	107	Gardenia latifolia	15.822274
25_Medium_Hilly_Bamboo	223	Xylia xylocarpa	15.822274
25_Medium_Hilly_Bamboo	112	Grewia tilaefolia	15.822274
25_Medium_Hilly_Bamboo	133	Lannea coromandelica	15.822274
25_Medium_Hilly_Bamboo	11	Albizia odoratissima	15.822274
25_Medium_Hilly_Bamboo	119	Holarrhena pubescens	15.822274
25_Medium_Hilly_Bamboo	43	Bridelia retusa	15.822274
25_Medium_Hilly_Bamboo	211	Terminalia tomentosa	15.822274
27_Dense_Hilly_Bamboo	70	Cleistanthus collinus	77.438909
27_Dense_Hilly_Bamboo	244	Dendrocalamus strictus	70.399008

lse_type	sp_id	sp_sc_name	density (trees/ha)
27_Dense_Hilly_Bamboo	204	Tectona grandis	63.359107
27_Dense_Hilly_Bamboo	186	Schleichera oleosa	30.506237
27_Dense_Hilly_Bamboo	223	Xylia xylocarpa	21.119702
27_Dense_Hilly_Bamboo	93	Diospyros melanoxylon	18.773069
27_Dense_Hilly_Bamboo	42	Bridelia hamiltoniana	14.079802
27_Dense_Hilly_Bamboo	180	Pterocarpus marsupium	11.733168
27_Dense_Hilly_Bamboo	924	Haldinia cordifolia	11.733168
27_Dense_Hilly_Bamboo	24	Anogeissus latifolia	11.733168
27_Dense_Hilly_Bamboo	107	Gardenia latifolia	9.386534
27_Dense_Hilly_Bamboo	150	Mitragyna parvifolia	9.386534
27_Dense_Hilly_Bamboo	133	Lannea coromandelica	7.039901
27_Dense_Hilly_Bamboo	41	Boswellia serrata	4.693267

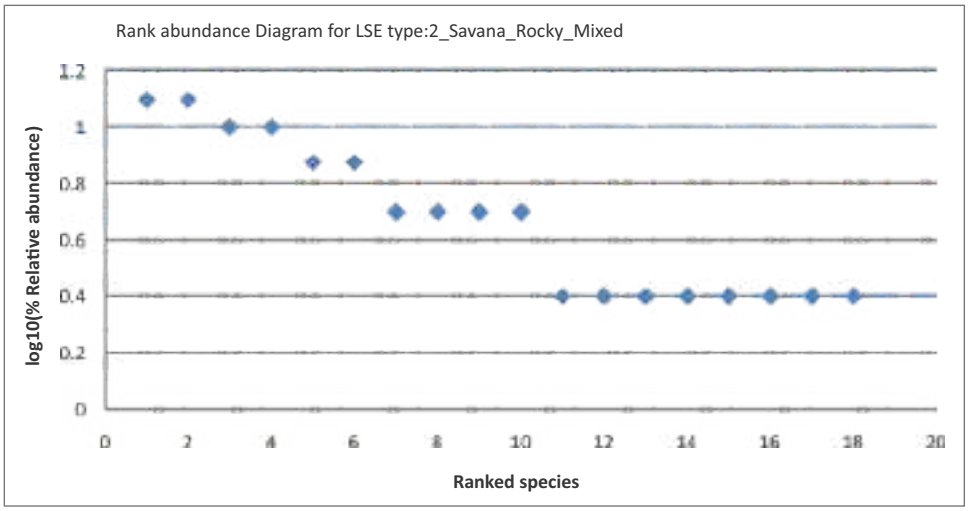
rank abnd_All

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		1_Savana_Plain_Mixed		
1	211	Terminalia tomentosa	9.310031	1.198368
2	143	Madhuca longifolia	9.180725	1.192294
3	70	Cleistanthus collinus	5.301545	0.953819
4	130	Lagerstroemia parviflora	3.749873	0.803433
5	93	Diospyros melanoxylon	3.620567	0.788193
6	24	Anogeissus latifolia	3.361955	0.756008
7	180	Pterocarpus marsupium	2.844732	0.683458
8	67	Chloroxylon swietenia	2.198202	0.571484
9	195	Soymida febrifuga	2.068896	0.545155
10	47	Butea monosperma	1.93959	0.517126
11	204	Tectona grandis	1.93959	0.517126
12	44	Buchanania cochinchinensis	1.422366	0.382428
13	119	Holarrhena pubescens	1.163754	0.295278
14	208	Terminalia bellirica	1.163754	0.295278
15	227	Ziziphus xylopyrus	1.034448	0.244125
16	133	Lannea coromandelica	0.775836	0.119186
17	886	Ougenia dalbergiodes	0.775836	0.119186
18	2	Acacia catechu	0.64653	0.040005
19	188	Semecarpus anacardium	0.517224	-0.0569
20	43	Bridelia retusa	0.517224	-0.0569
21	186	Schleichera oleosa	0.517224	-0.0569
22	109	Getonia floribunda	0.387918	-0.18184
23	243	Dalbergia lanceolaria	0.387918	-0.18184
24	53	Careya arborea	0.387918	-0.18184

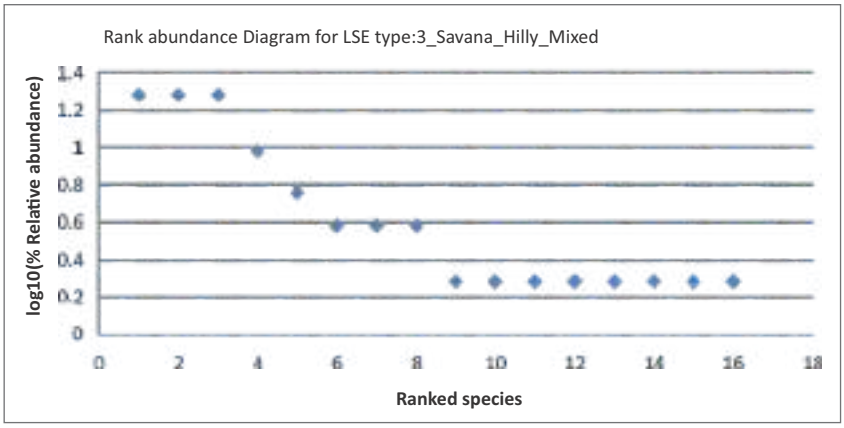
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
25	3	Acacia leucophlora	0.387918	-0.18184
26	215	Trichosanthes cucumerina	0.387918	-0.18184
27	225	Ziziphus mauritiana	0.258612	-0.35793
28	149	Millettia pinnata	0.258612	-0.35793
29	200	Syzygium cumini	0.258612	-0.35793
30	104	Ficus religiosa	0.258612	-0.35793
31	63	Ceriscoides turgida	0.129306	-0.65896
32	35	Bauhinia racemosa	0.129306	-0.65896
33	107	Gardenia latifolia	0.129306	-0.65896
34	192	Smilax zeylanica	0.129306	-0.65896
35	39	Bombax ceiba	0.129306	-0.65896
36	223	Xylia xylocarpa	0.129306	-0.65896
37	31	Azadirachta indica	0.129306	-0.65896
38	312	Casearia graveolens	0.129306	-0.65896
39	112	Grewia tilaefolia	0.129306	-0.65896
40	126	Ixora coccinea	0.129306	-0.65896
41	103	Ficus racemosa	0.129306	-0.65896
42	7	Aegle marmelos	0.129306	-0.65896
43	150	Mitragyna parvifolia	0.129306	-0.65896
44	187	Schrebera swietenioides	0.129306	-0.65896
45	56	Cassia fistula	0.129306	-0.65896
		Total	58.96353	



Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		2_Savana_Rocky_Mixed		
1	70	Cleistanthus collinus	50.286223	1.09691
2	67	Chloroxylon swietenia	50.286223	1.09691
3	44	Buchanania cochinchinensis	40.228978	1
4	211	Terminalia tomentosa	40.228978	1
5	24	Anogeissus latifolia	30.171734	0.8750613
6	143	Madhuca longifolia	30.171734	0.8750613
7	133	Lannea coromandelica	20.114489	0.69897
8	42	Bridelia hamiltoniana	20.114489	0.69897
9	119	Holarrhena pubescens	20.114489	0.69897
10	204	Tectona grandis	20.114489	0.69897
11	105	Flacourtia indica	10.057245	0.39794
12	39	Bombax ceiba	10.057245	0.39794
13	223	Xylia xylocarpa	10.057245	0.39794
14	195	Soymida febrifuga	10.057245	0.39794
15	2	Acacia catechu	10.057245	0.39794
16	41	Boswellia serrata	10.057245	0.39794
17	43	Bridelia retusa	10.057245	0.39794
18	208	Terminalia bellirica	10.057245	0.39794



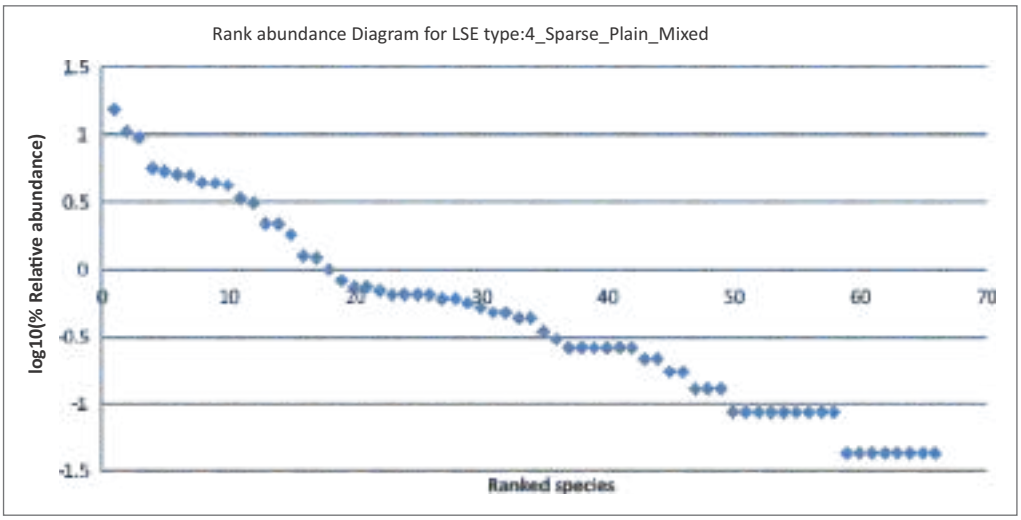
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		3_Savana_Hilly_Mixed		
1	70	Cleistanthus collinus	85.44074	1.283997
2	244	Dendrocalamus strictus	85.44074	1.283997
3	204	Tectona grandis	85.44074	1.283997
4	188	Semecarpus anacardium	42.72037	0.982967
5	24	Anogeissus latifolia	25.632222	0.761118
6	192	Smilax zeylanica	17.088148	0.585027
7	39	Bombax ceiba	17.088148	0.585027
8	186	Schleichera oleosa	17.088148	0.585027
9	67	Chloroxylon swietenia	8.544074	0.283997
10	223	Xylia xylocarpa	8.544074	0.283997
11	11	Albizia odoratissima	8.544074	0.283997
12	42	Bridelia hamiltoniana	8.544074	0.283997
13	41	Boswellia serrata	8.544074	0.283997
14	211	Terminalia tomentosa	8.544074	0.283997
15	130	Lagerstroemia parviflora	8.544074	0.283997
16	143	Madhuca longifolia	8.544074	0.283997



Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		4_Sparse_Plain_Mixed		
1	211	Terminalia tomentosa	31.403657	1.187746
2	143	Madhuca longifolia	21.496025	1.023124
3	70	Cleistanthus collinus	19.461422	0.97994
4	204	Tectona grandis	11.499931	0.751461
5	24	Anogeissus latifolia	10.969165	0.730939
6	130	Lagerstroemia parviflora	10.349938	0.705703
7	67	Chloroxylon swietenia	10.173016	0.698215
8	180	Pterocarpus marsupium	9.023023	0.646118
9	44	Buchanania cochinchinensis	8.934562	0.641839
10	93	Diospyros melanoxylon	8.580718	0.624289
11	47	Butea monosperma	6.899959	0.529612
12	195	Soymida febrifuga	6.369192	0.49485

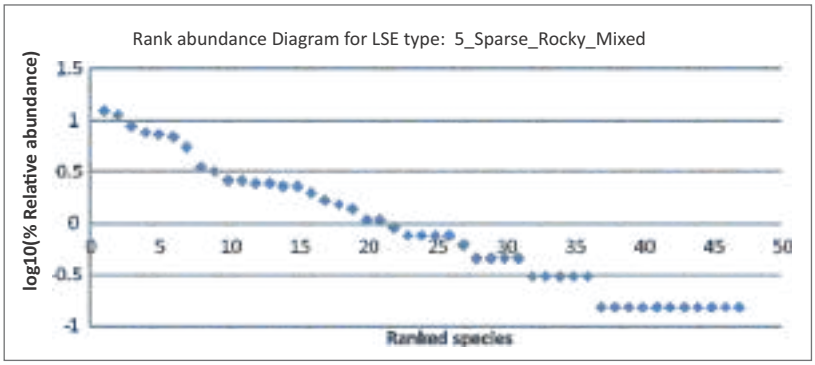
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
13	133	Lannea coromandelica	4.42305	0.336487
14	244	Dendrocalamus strictus	4.42305	0.336487
15	119	Holarrhena pubescens	3.715362	0.260767
16	43	Bridelia retusa	2.565369	0.099915
17	186	Schleichera oleosa	2.476908	0.084676
18	188	Semecarpus anacardium	2.034603	-0.00075
19	41	Boswellia serrata	1.680759	-0.08373
20	63	Ceriscoides turgida	1.503837	-0.13203
21	243	Dalbergia lanceolaria	1.503837	-0.13203
22	208	Terminalia bellirica	1.415376	-0.15836
23	223	Xylia xylocarpa	1.326915	-0.18639
24	2	Acacia catechu	1.326915	-0.18639
25	227	Ziziphus xylopyrus	1.326915	-0.18639
26	53	Careya arborea	1.326915	-0.18639
27	126	Ixora coccinea	1.238454	-0.21635
28	56	Cassia fistula	1.238454	-0.21635
29	109	Getonia floribunda	1.149993	-0.24854
30	172	Phyllanthus emblica	1.061532	-0.2833
31	107	Gardenia latifolia	0.973071	-0.32109
32	886	Ougenia dalbergiodes	0.973071	-0.32109
33	35	Bauhinia racemosa	0.88461	-0.36248
34	200	Syzygium cumini	0.88461	-0.36248
35	373	Eucalyptus globulus	0.707688	-0.45939
36	150	Mitragyna parvifolia	0.619227	-0.51738
37	209	Terminalia chebula	0.530766	-0.58433
38	39	Bombax ceiba	0.530766	-0.58433
39	42	Bridelia hamiltoniana	0.530766	-0.58433
40	924	Haldinia cordifolia	0.530766	-0.58433
41	187	Schrebera swietenioides	0.530766	-0.58433
42	3	Acacia leucophlora	0.530766	-0.58433
43	312	Casearia graveolens	0.442305	-0.66351
44	112	Grewia tilaefolia	0.442305	-0.66351
45	86	Dalbergia latifolia	0.353844	-0.76042
46	9	Alangium salviifolium	0.353844	-0.76042
47	103	Ficus racemosa	0.265383	-0.88536
48	202	Tamarindus indica	0.265383	-0.88536
49	7	Aegle marmelos	0.265383	-0.88536
50	31	Azadirachta indica	0.176922	-1.06145
51	123	Hymendictyon obovaty	0.176922	-1.06145
52	149	Millettia pinnata	0.176922	-1.06145
53	11	Albizia odoratissima	0.176922	-1.06145
54	88	Dalbergia sissoo	0.176922	-1.06145

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
55	113	Hardwickia binata	0.176922	-1.06145
56	925	Diospyros montana	0.176922	-1.06145
57	250	Gardenia resinifera	0.176922	-1.06145
58	228	Acacia pennata	0.176922	-1.06145
59	894	Stereospermum sp.	0.088461	-1.36248
60	849	Cansjera rheedii	0.088461	-1.36248
61	99	Ficus amplissima	0.088461	-1.36248
62	206	Terminalia cuneata	0.088461	-1.36248
63	48	Butea superba	0.088461	-1.36248
64	198	Sterculia urens	0.088461	-1.36248
65	104	Ficus religiosa	0.088461	-1.36248
66	249	Dolichandrone falcata	0.088461	-1.36248

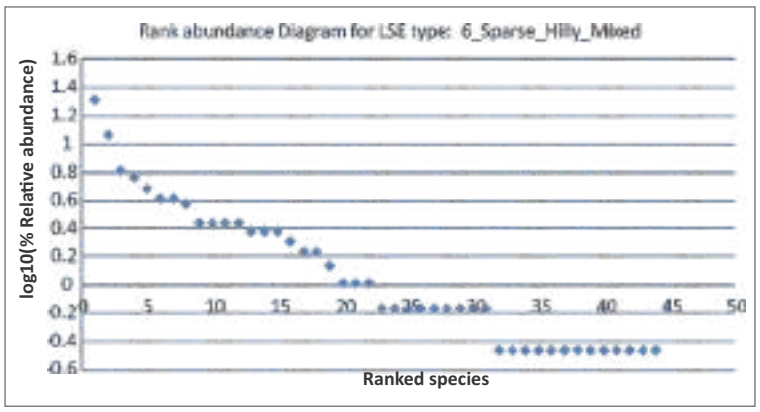


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		5_Sparse_Rocky_Mixed		
1	70	Cleistanthus collinus	28.885615	1.094237
2	211	Terminalia tomentosa	26.389327	1.054984
3	67	Chloroxylon swietenia	20.683527	0.94918
4	143	Madhuca longifolia	17.830627	0.884722
5	24	Anogeissus latifolia	17.117401	0.866994
6	93	Diospyros melanoxylon	16.047564	0.838965
7	204	Tectona grandis	12.838051	0.742055
8	180	Pterocarpus marsupium	8.202088	0.54748
9	244	Dendrocalamus strictus	7.488863	0.507972
10	133	Lannea coromandelica	6.062413	0.416201
11	130	Lagerstroemia parviflora	6.062413	0.416201
12	44	Buchanania cochinchinensis	5.705801	0.389872
13	41	Boswellia serrata	5.705801	0.389872
14	195	Soymida febrifuga	5.349188	0.361844

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
15	188	Semecarpus anacardium	5.349188	0.361844
16	47	Butea monosperma	4.635963	0.299696
17	107	Gardenia latifolia	3.922738	0.227145
18	223	Xylia xylocarpa	3.566125	0.185752
19	42	Bridelia hamiltoniana	3.209513	0.139995
20	119	Holarrhena pubescens	2.496288	0.03085
21	186	Schleichera oleosa	2.496288	0.03085
22	63	Ceriscoides turgida	2.139675	-0.0361
23	2	Acacia catechu	1.783063	-0.11528
24	227	Ziziphus xylopyrus	1.783063	-0.11528
25	200	Syzygium cumini	1.783063	-0.11528
26	172	Phyllanthus emblica	1.783063	-0.11528
27	56	Cassia fistula	1.42645	-0.21219
28	243	Dalbergia lanceolaria	1.069838	-0.33713
29	924	Haldinia cordifolia	1.069838	-0.33713
30	43	Bridelia retusa	1.069838	-0.33713
31	208	Terminalia bellirica	1.069838	-0.33713
32	86	Dalbergia latifolia	0.713225	-0.51322
33	238	Cochlospermum religiosum	0.713225	-0.51322
34	126	Ixora coccinea	0.713225	-0.51322
35	161	Ochna obtusata	0.713225	-0.51322
36	886	Ougenia dalbergiodes	0.713225	-0.51322
37	209	Terminalia chebula	0.356613	-0.81425
38	35	Bauhinia racemosa	0.356613	-0.81425
39	176	Pongamia pinnata	0.356613	-0.81425
40	192	Smilax zeylanica	0.356613	-0.81425
41	39	Bombax ceiba	0.356613	-0.81425
42	373	Eucalyptus globulus	0.356613	-0.81425
43	173	Phyllanthus reticulatus	0.356613	-0.81425
44	88	Dalbergia sissoo	0.356613	-0.81425
45	150	Mitragyna parvifolia	0.356613	-0.81425
46	922	Holarrhena antidysenterica	0.356613	-0.81425
47	251	Gmelina arborea	0.356613	-0.81425

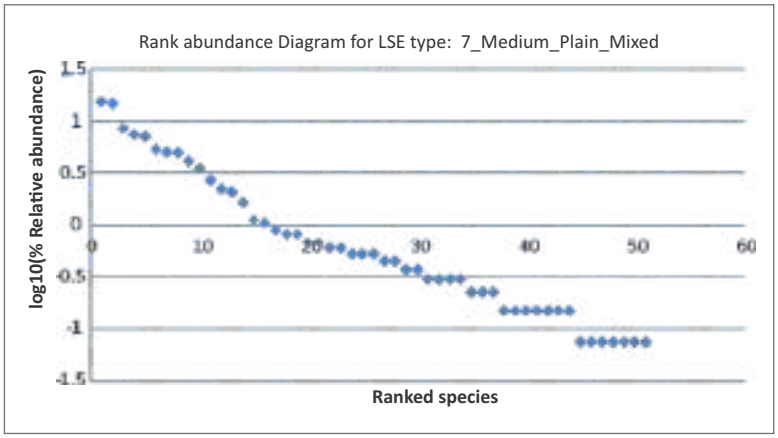


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		6_Sparse_Hilly_Mixed		
1	70	Cleistanthus collinus	49.39061	1.312768
2	204	Tectona grandis	27.988012	1.066096
3	244	Dendrocalamus strictus	15.64036	0.813371
4	24	Anogeissus latifolia	13.994006	0.765066
5	133	Lannea coromandelica	11.524476	0.680745
6	223	Xylia xylocarpa	9.878122	0.613798
7	186	Schleichera oleosa	9.878122	0.613798
8	180	Pterocarpus marsupium	9.054945	0.57601
9	67	Chloroxylon swietenia	6.585415	0.437707
10	42	Bridelia hamiltoniana	6.585415	0.437707
11	119	Holarrhena pubescens	6.585415	0.437707
12	143	Madhuca longifolia	6.585415	0.437707
13	107	Gardenia latifolia	5.762238	0.379715
14	93	Diospyros melanoxylon	5.762238	0.379715
15	211	Terminalia tomentosa	5.762238	0.379715
16	41	Boswellia serrata	4.939061	0.312768
17	86	Dalbergia latifolia	4.115884	0.233587
18	188	Semecarpus anacardium	4.115884	0.233587
19	44	Buchanania cochinchinensis	3.292707	0.136677
20	43	Bridelia retusa	2.469531	0.011738
21	47	Butea monosperma	2.469531	0.011738
22	130	Lagerstroemia parviflora	2.469531	0.011738
23	63	Ceriscoides turgida	1.646354	-0.16435
24	39	Bombax ceiba	1.646354	-0.16435
25	238	Cochlospermum religiosum	1.646354	-0.16435
26	195	Soymida febrifuga	1.646354	-0.16435
27	227	Ziziphus xylopyrus	1.646354	-0.16435
28	200	Syzygium cumini	1.646354	-0.16435
29	11	Albizia odoratissima	1.646354	-0.16435
30	88	Dalbergia sissoo	1.646354	-0.16435
31	150	Mitragyna parvifolia	1.646354	-0.16435
32	35	Bauhinia racemosa	0.823177	-0.46538
33	192	Smilax zeylanica	0.823177	-0.46538
34	2	Acacia catechu	0.823177	-0.46538
35	924	Haldinia cordifolia	0.823177	-0.46538
36	113	Hardwickia binata	0.823177	-0.46538
37	9	Alangium salviifolium	0.823177	-0.46538
38	48	Butea superba	0.823177	-0.46538
39	187	Schrebera swietenioides	0.823177	-0.46538
40	208	Terminalia bellirica	0.823177	-0.46538
41	172	Phyllanthus emblica	0.823177	-0.46538
42	886	Ougenia dalbergiodes	0.823177	-0.46538
43	251	Gmelina arborea	0.823177	-0.46538
44	56	Cassia fistula	0.823177	-0.46538



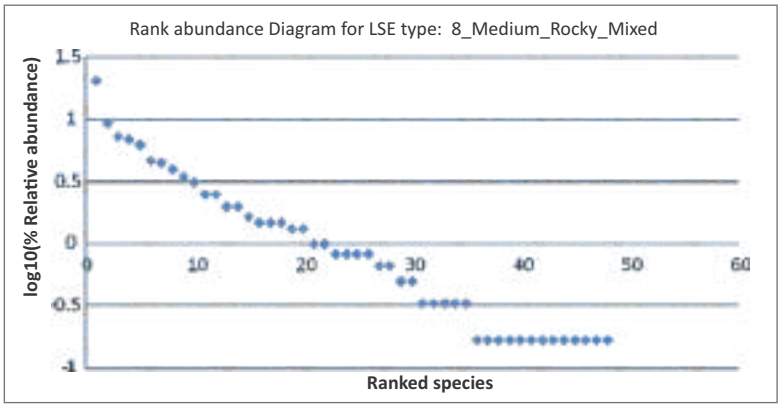
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		7_Medium_Plain_Mixed		
1	211	Terminalia tomentosa	97.340824	1.192772
2	70	Cleistanthus collinus	93.57886	1.175655
3	24	Anogeissus latifolia	54.078236	0.9375
4	143	Madhuca longifolia	47.024553	0.876802
5	204	Tectona grandis	44.673325	0.854526
6	130	Lagerstroemia parviflora	33.857678	0.734134
7	180	Pterocarpus marsupium	31.976696	0.709311
8	67	Chloroxylon swietenia	31.50645	0.702877
9	44	Buchanania cochinchinensis	26.33375	0.62499
10	93	Diospyros melanoxylon	22.10154	0.5489
11	133	Lannea coromandelica	16.928839	0.433104
12	195	Soymida febrifuga	14.107366	0.353923
13	188	Semecarpus anacardium	13.166875	0.32396
14	119	Holarrhena pubescens	10.345402	0.219225
15	43	Bridelia retusa	7.053683	0.052893
16	2	Acacia catechu	6.583437	0.02293
17	208	Terminalia bellirica	5.642946	-0.04402
18	186	Schleichera oleosa	5.172701	-0.08181
19	886	Ougenia dalbergiodes	5.172701	-0.08181
20	243	Dalbergia lanceolaria	4.23221	-0.16896
21	41	Boswellia serrata	4.23221	-0.16896
22	63	Ceriscoides turgida	3.761964	-0.22011
23	227	Ziziphus xylopyrus	3.761964	-0.22011
24	223	Xylia xylocarpa	3.291719	-0.2781
25	312	Casearia graveolens	3.291719	-0.2781
26	47	Butea monosperma	3.291719	-0.2781
27	107	Gardenia latifolia	2.821473	-0.34505
28	172	Phyllanthus emblica	2.821473	-0.34505
29	53	Careya arborea	2.351228	-0.42423
30	250	Gardenia resinifera	2.351228	-0.42423
31	35	Bauhinia racemosa	1.880982	-0.52114
32	7	Aegle marmelos	1.880982	-0.52114
33	187	Schrebera swietenioides	1.880982	-0.52114

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
34	244	Dendrocalamus strictus	1.880982	-0.52114
35	39	Bombax ceiba	1.410737	-0.64608
36	109	Getonia floribunda	1.410737	-0.64608
37	126	Ixora coccinea	1.410737	-0.64608
38	86	Dalbergia latifolia	0.940491	-0.82217
39	200	Syzygium cumini	0.940491	-0.82217
40	11	Albizia odoratissima	0.940491	-0.82217
41	113	Hardwickia binata	0.940491	-0.82217
42	150	Mitragyna parvifolia	0.940491	-0.82217
43	48	Butea superba	0.940491	-0.82217
44	94	Diospyros oocarpa	0.940491	-0.82217
45	209	Terminalia chebula	0.470246	-1.1232
46	894	Stereospermum sp.	0.470246	-1.1232
47	192	Smilax zeylanica	0.470246	-1.1232
48	373	Eucalyptus globulus	0.470246	-1.1232
49	42	Bridelia hamiltoniana	0.470246	-1.1232
50	202	Tamarindus indica	0.470246	-1.1232
51	56	Cassia fistula	0.470246	-1.1232



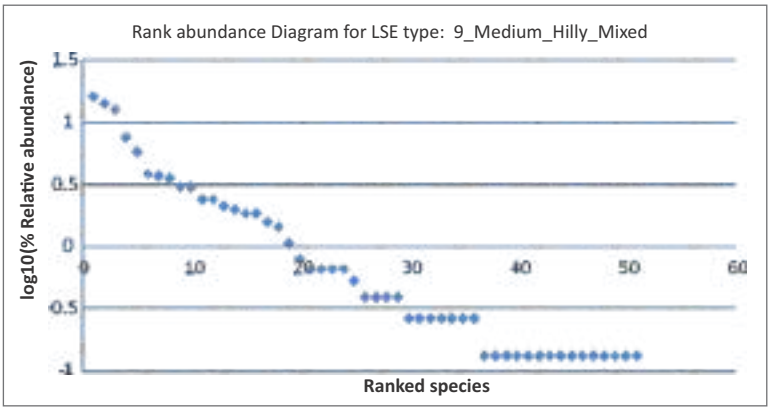
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		8_Medium_Rocky_Mixed		
1	70	Cleistanthus collinus	87.130601	1.318759
2	211	Terminalia tomentosa	39.034509	0.970037
3	24	Anogeissus latifolia	30.669971	0.865301
4	204	Tectona grandis	29.275882	0.845098
5	67	Chloroxylon swietenia	26.487703	0.801632
6	180	Pterocarpus marsupium	19.517255	0.669007
7	143	Madhuca longifolia	18.82021	0.653213
8	223	Xylia xylocarpa	16.729075	0.60206
9	93	Diospyros melanoxylon	14.637941	0.544068
10	133	Lannea coromandelica	13.243851	0.500602
11	244	Dendrocalamus strictus	10.455672	0.39794
12	130	Lagerstroemia parviflora	10.455672	0.39794

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
13	44	Buchanania cochinchinensis	8.364538	0.30103
14	188	Semecarpus anacardium	8.364538	0.30103
15	43	Bridelia retusa	6.970448	0.221849
16	195	Soymida febrifuga	6.273403	0.176091
17	227	Ziziphus xylopyrus	6.273403	0.176091
18	119	Holarrhena pubescens	6.273403	0.176091
19	2	Acacia catechu	5.576358	0.124939
20	42	Bridelia hamiltoniana	5.576358	0.124939
21	186	Schleichera oleosa	4.182269	1.45E-08
22	886	Ougenia dalbergiodes	4.182269	1.45E-08
23	63	Ceriscoides turgida	3.485224	-0.07918
24	86	Dalbergia latifolia	3.485224	-0.07918
25	243	Dalbergia lanceolaria	3.485224	-0.07918
26	41	Boswellia serrata	3.485224	-0.07918
27	107	Gardenia latifolia	2.788179	-0.17609
28	208	Terminalia bellirica	2.788179	-0.17609
29	126	Ixora coccinea	2.091134	-0.30103
30	172	Phyllanthus emblica	2.091134	-0.30103
31	209	Terminalia chebula	1.39409	-0.47712
32	34	Bauhinia purpurea	1.39409	-0.47712
33	39	Bombax ceiba	1.39409	-0.47712
34	11	Albizia odoratissima	1.39409	-0.47712
35	56	Cassia fistula	1.39409	-0.47712
36	35	Bauhinia racemosa	0.697045	-0.77815
37	312	Casearia graveolens	0.697045	-0.77815
38	112	Grewia tilaefolia	0.697045	-0.77815
39	123	Hymendictyon obovaty	0.697045	-0.77815
40	88	Dalbergia sissoo	0.697045	-0.77815
41	924	Haldinia cordifolia	0.697045	-0.77815
42	53	Careya arborea	0.697045	-0.77815
43	7	Aegle marmelos	0.697045	-0.77815
44	150	Mitragyna parvifolia	0.697045	-0.77815
45	48	Butea superba	0.697045	-0.77815
46	187	Schrebera swietenioides	0.697045	-0.77815
47	232	Antidesma ghaesembilla	0.697045	-0.77815
48	94	Diospyros oocarpa	0.697045	-0.77815



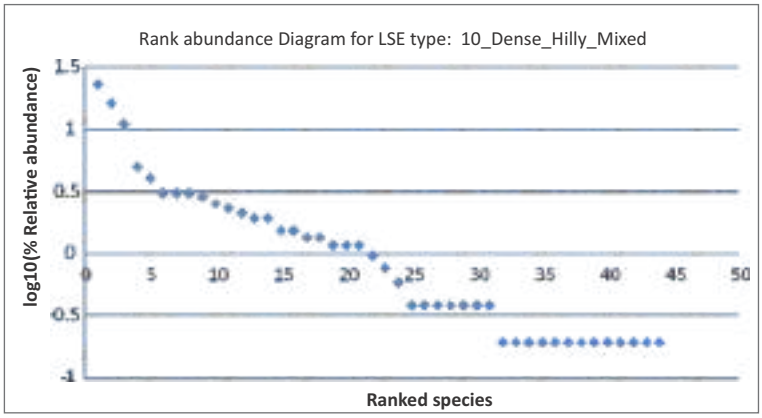
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		9_Medium_Hilly_Mixed		
1	70	Cleistanthus collinus	46.790223	1.206568
2	244	Dendrocalamus strictus	41.376478	1.153166
3	204	Tectona grandis	37.122822	1.106053
4	24	Anogeissus latifolia	22.041675	0.879657
5	180	Pterocarpus marsupium	17.014627	0.767235
6	93	Diospyros melanoxylon	11.214186	0.58618
7	41	Boswellia serrata	10.82749	0.57094
8	223	Xylia xylocarpa	10.440794	0.555146
9	67	Chloroxylon swietenia	8.894009	0.48551
10	186	Schleichera oleosa	8.894009	0.48551
11	43	Bridelia retusa	6.960529	0.379055
12	211	Terminalia tomentosa	6.960529	0.379055
13	107	Gardenia latifolia	6.187137	0.327902
14	88	Dalbergia sissoo	5.800441	0.299873
15	133	Lannea coromandelica	5.413745	0.26991
16	42	Bridelia hamiltoniana	5.413745	0.26991
17	143	Madhuca longifolia	4.640353	0.202963
18	44	Buchanania cochinchinensis	4.253657	0.165175
19	130	Lagerstroemia parviflora	3.093568	0.026872
20	188	Semecarpus anacardium	2.320176	-0.09807
21	63	Ceriscoides turgida	1.93348	-0.17725
22	243	Dalbergia lanceolaria	1.93348	-0.17725
23	924	Haldinia cordifolia	1.93348	-0.17725
24	119	Holarrhena pubescens	1.93348	-0.17725
25	150	Mitragyna parvifolia	1.546784	-0.27416
26	86	Dalbergia latifolia	1.160088	-0.3991
27	176	Pongamia pinnata	1.160088	-0.3991
28	2	Acacia catechu	1.160088	-0.3991
29	123	Hymendictyon obovaty	1.160088	-0.3991
30	39	Bombax ceiba	0.773392	-0.57519
31	112	Grewia tilaefolia	0.773392	-0.57519
32	227	Ziziphus xylopyrus	0.773392	-0.57519
33	733	Chrysopogon zizanioides	0.773392	-0.57519
34	11	Albizia odoratissima	0.773392	-0.57519
35	7	Aegle marmelos	0.773392	-0.57519
36	922	Holarrhena antidysenterica	0.773392	-0.57519
37	209	Terminalia chebula	0.386696	-0.87622
38	894	Stereospermum sp.	0.386696	-0.87622
39	312	Casearia graveolens	0.386696	-0.87622
40	126	Ixora coccinea	0.386696	-0.87622
41	113	Hardwickia binata	0.386696	-0.87622
42	53	Careya arborea	0.386696	-0.87622
43	925	Diospyros montana	0.386696	-0.87622
44	187	Schrebera swietenioides	0.386696	-0.87622
45	208	Terminalia bellirica	0.386696	-0.87622

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
46	172	Phyllanthus emblica	0.386696	-0.87622
47	198	Sterculia urens	0.386696	-0.87622
48	886	Ougenia dalbergiodes	0.386696	-0.87622
49	251	Gmelina arborea	0.386696	-0.87622
50	215	Trichosanthes cucumerina	0.386696	-0.87622
51	56	Cassia fistula	0.386696	-0.87622



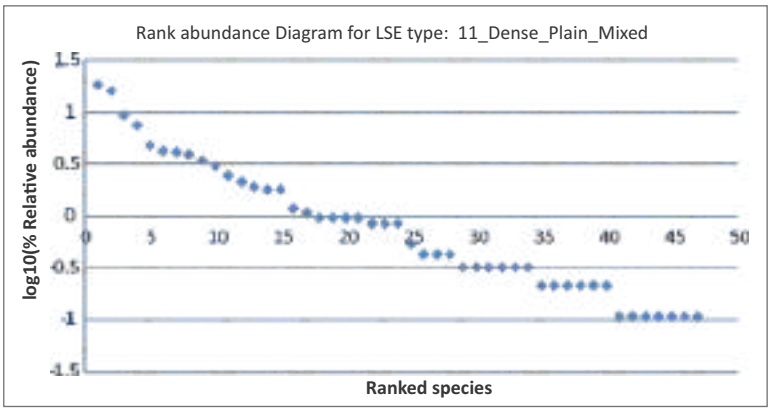
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		10_Dense_Hilly_Mixed		
1	244	Dendrocalamus strictus	120.924753	1.370136
2	70	Cleistanthus collinus	83.947762	1.21163
3	204	Tectona grandis	57.963931	1.050778
4	24	Anogeissus latifolia	25.983831	0.702324
5	223	Xylia xylocarpa	20.986941	0.60957
6	93	Diospyros melanoxylon	15.99005	0.49147
7	180	Pterocarpus marsupium	15.99005	0.49147
8	130	Lagerstroemia parviflora	15.99005	0.49147
9	42	Bridelia hamiltoniana	14.990672	0.463442
10	211	Terminalia tomentosa	12.991916	0.401294
11	186	Schleichera oleosa	11.992537	0.366532
12	150	Mitragyna parvifolia	10.993159	0.328743
13	67	Chloroxylon swietenia	9.993781	0.28735
14	133	Lannea coromandelica	9.993781	0.28735
15	39	Bombax ceiba	7.995025	0.19044
16	43	Bridelia retusa	7.995025	0.19044
17	107	Gardenia latifolia	6.995647	0.132448
18	41	Boswellia serrata	6.995647	0.132448
19	86	Dalbergia latifolia	5.996269	0.065502
20	44	Buchanania cochinchinensis	5.996269	0.065502
21	88	Dalbergia sissoo	5.996269	0.065502
22	143	Madhuca longifolia	4.996891	-0.01368
23	188	Semecarpus anacardium	3.997512	-0.11059
24	123	Hymendictyon obovaty	2.998134	-0.23553
25	227	Ziziphus xylopyrus	1.998756	-0.41162

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
26	11	Albizia odoratissima	1.998756	-0.41162
27	924	Haldinia cordifolia	1.998756	-0.41162
28	53	Careya arborea	1.998756	-0.41162
29	7	Aegle marmelos	1.998756	-0.41162
30	100	Ficus bengalensis	1.998756	-0.41162
31	56	Cassia fistula	1.998756	-0.41162
32	209	Terminalia chebula	0.999378	-0.71265
33	894	Stereospermum sp.	0.999378	-0.71265
34	63	Ceriscoides turgida	0.999378	-0.71265
35	35	Bauhinia racemosa	0.999378	-0.71265
36	192	Smilax zeylanica	0.999378	-0.71265
37	114	Helicteres isora	0.999378	-0.71265
38	238	Cochlospermum religiosum	0.999378	-0.71265
39	243	Dalbergia lanceolaria	0.999378	-0.71265
40	48	Butea superba	0.999378	-0.71265
41	187	Schrebera swietenioides	0.999378	-0.71265
42	208	Terminalia bellirica	0.999378	-0.71265
43	172	Phyllanthus emblica	0.999378	-0.71265
44	251	Gmelina arborea	0.999378	-0.71265

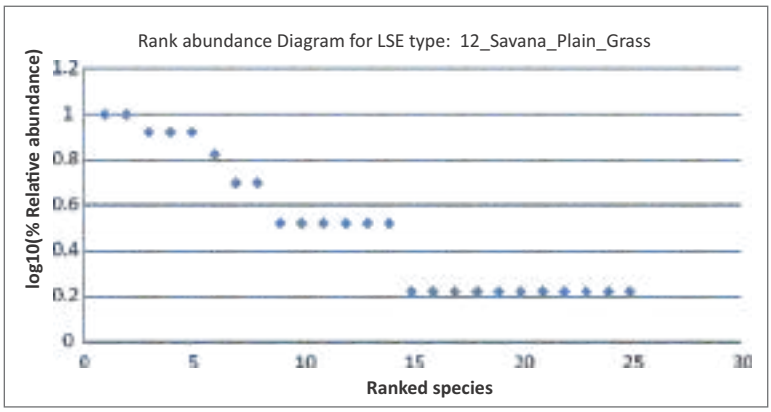


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		11_Dense_Plain_Mixed		
1	70	Cleistanthus collinus	178.612476	1.26863
2	211	Terminalia tomentosa	154.866309	1.206675
3	143	Madhuca longifolia	90.854901	0.975067
4	24	Anogeissus latifolia	72.270944	0.875682
5	44	Buchanania cochinchinensis	46.459893	0.683797
6	130	Lagerstroemia parviflora	41.297682	0.632644
7	204	Tectona grandis	40.26524	0.621649
8	188	Semecarpus anacardium	38.200356	0.598786
9	67	Chloroxylon swietenia	33.038146	0.535734
10	93	Diospyros melanoxylon	28.908378	0.477742
11	195	Soymida febrifuga	23.746167	0.392312
12	133	Lannea coromandelica	20.648841	0.331614

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
13	180	Pterocarpus marsupium	18.583957	0.285857
14	227	Ziziphus xylopyrus	17.551515	0.261033
15	119	Holarrhena pubescens	17.551515	0.261033
16	886	Ougenia dalbergiodes	11.356863	0.071977
17	186	Schleichera oleosa	10.324421	0.030584
18	63	Ceriscoides turgida	9.291979	-0.01517
19	223	Xylia xylocarpa	9.291979	-0.01517
20	312	Casearia graveolens	9.291979	-0.01517
21	43	Bridelia retusa	9.291979	-0.01517
22	41	Boswellia serrata	8.259536	-0.06633
23	208	Terminalia bellirica	8.259536	-0.06633
24	244	Dendrocalamus strictus	8.259536	-0.06633
25	47	Butea monosperma	5.16221	-0.27045
26	35	Bauhinia racemosa	4.129768	-0.36736
27	39	Bombax ceiba	4.129768	-0.36736
28	126	Ixora coccinea	4.129768	-0.36736
29	107	Gardenia latifolia	3.097326	-0.49229
30	109	Getonia floribunda	3.097326	-0.49229
31	243	Dalbergia lanceolaria	3.097326	-0.49229
32	11	Albizia odoratissima	3.097326	-0.49229
33	53	Careya arborea	3.097326	-0.49229
34	172	Phyllanthus emblica	3.097326	-0.49229
35	209	Terminalia chebula	2.064884	-0.66839
36	86	Dalbergia latifolia	2.064884	-0.66839
37	2	Acacia catechu	2.064884	-0.66839
38	150	Mitragyna parvifolia	2.064884	-0.66839
39	187	Schrebera swietenioides	2.064884	-0.66839
40	56	Cassia fistula	2.064884	-0.66839
41	112	Grewia tilaefolia	1.032442	-0.96942
42	200	Syzygium cumini	1.032442	-0.96942
43	924	Haldinia cordifolia	1.032442	-0.96942
44	7	Aegle marmelos	1.032442	-0.96942
45	922	Holarrhena antidysenterica	1.032442	-0.96942
46	232	Antidesma ghaesembilla	1.032442	-0.96942
47	228	Acacia pennata	1.032442	-0.96942

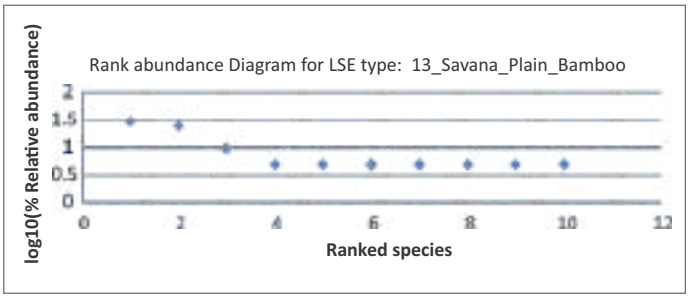


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		12_Savana_Plain_Grass		
1	70	Cleistanthus collinus	18.569712	1
2	93	Diospyros melanoxylon	18.569712	1
3	44	Buchanania cochinchinensis	15.47476	0.920819
4	211	Terminalia tomentosa	15.47476	0.920819
5	143	Madhuca longifolia	15.47476	0.920819
6	195	Soymida febrifuga	12.379808	0.823909
7	180	Pterocarpus marsupium	9.284856	0.69897
8	204	Tectona grandis	9.284856	0.69897
9	894	Stereospermum sp.	6.189904	0.522879
10	2	Acacia catechu	6.189904	0.522879
11	243	Dalbergia lanceolaria	6.189904	0.522879
12	150	Mitragyna parvifolia	6.189904	0.522879
13	208	Terminalia bellirica	6.189904	0.522879
14	172	Phyllanthus emblica	6.189904	0.522879
15	67	Chloroxylon swietenia	3.094952	0.221849
16	133	Lannea coromandelica	3.094952	0.221849
17	126	Ixora coccinea	3.094952	0.221849
18	119	Holarrhena pubescens	3.094952	0.221849
19	7	Aegle marmelos	3.094952	0.221849
20	24	Anogeissus latifolia	3.094952	0.221849
21	244	Dendrocalamus strictus	3.094952	0.221849
22	186	Schleichera oleosa	3.094952	0.221849
23	47	Butea monosperma	3.094952	0.221849
24	251	Gmelina arborea	3.094952	0.221849
25	56	Cassia fistula	3.094952	0.221849

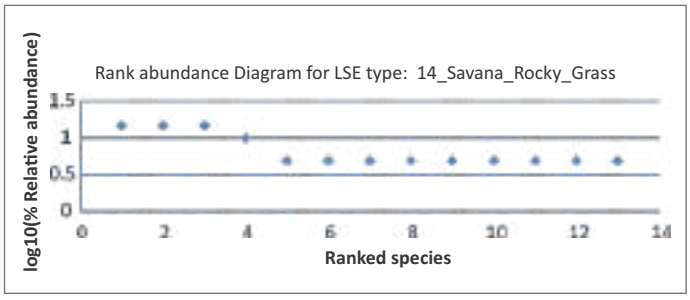


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		13_Savana_Plain_Bamboo		
1	70	Cleistanthus collinus	314.198636	1.477121
2	204	Tectona grandis	261.832197	1.39794
3	63	Ceriscoides turgida	104.732879	1
4	223	Xylia xylocarpa	52.366439	0.69897
5	133	Lannea coromandelica	52.366439	0.69897

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
6	42	Bridelia hamiltoniana	52.366439	0.69897
7	41	Boswellia serrata	52.366439	0.69897
8	24	Anogeissus latifolia	52.366439	0.69897
9	244	Dendrocalamus strictus	52.366439	0.69897
10	143	Madhuca longifolia	52.366439	0.69897

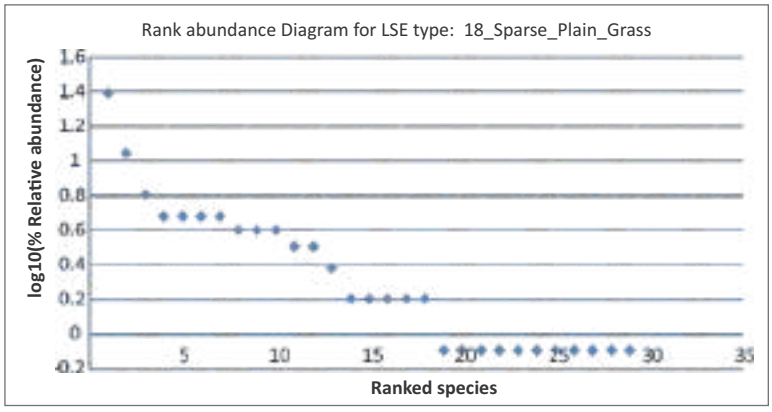


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		14_Savana_Rocky_Grass		
1	70	Cleistanthus collinus	60.507193	1.176091
2	44	Buchanania cochinchinensis	60.507193	1.176091
3	143	Madhuca longifolia	60.507193	1.176091
4	24	Anogeissus latifolia	40.338129	1
5	894	Stereospermum sp.	20.169064	0.69897
6	67	Chloroxylon swietenia	20.169064	0.69897
7	63	Ceriscoides turgida	20.169064	0.69897
8	93	Diospyros melanoxylon	20.169064	0.69897
9	133	Lannea coromandelica	20.169064	0.69897
10	227	Ziziphus xylopyrus	20.169064	0.69897
11	119	Holarrhena pubescens	20.169064	0.69897
12	211	Terminalia tomentosa	20.169064	0.69897
13	56	Cassia fistula	20.169064	0.69897



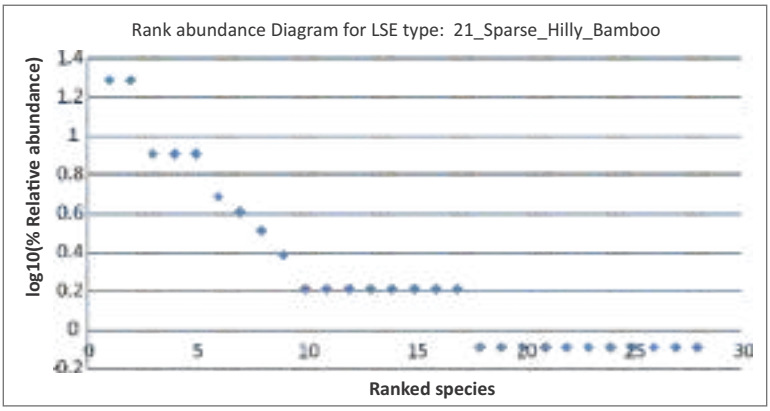
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		18_Sparse_Plain_Grass		
1	211	Terminalia tomentosa	91.15608	1.39794
2	93	Diospyros melanoxylon	41.167262	1.052706
3	70	Cleistanthus collinus	23.52415	0.809668
4	126	Ixora coccinea	17.643112	0.68473
5	186	Schleichera oleosa	17.643112	0.68473

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
6	204	Tectona grandis	17.643112	0.68473
7	143	Madhuca longifolia	17.643112	0.68473
8	44	Buchanania cochinchinensis	14.702594	0.605548
9	119	Holarrhena pubescens	14.702594	0.605548
10	24	Anogeissus latifolia	14.702594	0.605548
11	195	Soymida febrifuga	11.762075	0.508638
12	47	Butea monosperma	11.762075	0.508638
13	150	Mitragyna parvifolia	8.821556	0.3837
14	109	Getonia floribunda	5.881037	0.207608
15	7	Aegle marmelos	5.881037	0.207608
16	48	Butea superba	5.881037	0.207608
17	208	Terminalia bellirica	5.881037	0.207608
18	3	Acacia leucophlora	5.881037	0.207608
19	894	Stereospermum sp.	2.940519	-0.09342
20	67	Chloroxylon swietenia	2.940519	-0.09342
21	35	Bauhinia racemosa	2.940519	-0.09342
22	180	Pterocarpus marsupium	2.940519	-0.09342
23	112	Grewia tilaefolia	2.940519	-0.09342
24	133	Lannea coromandelica	2.940519	-0.09342
25	200	Syzygium cumini	2.940519	-0.09342
26	188	Semecarpus anacardium	2.940519	-0.09342
27	41	Boswellia serrata	2.940519	-0.09342
28	251	Gmelina arborea	2.940519	-0.09342
29	130	Lagerstroemia parviflora	2.940519	-0.09342

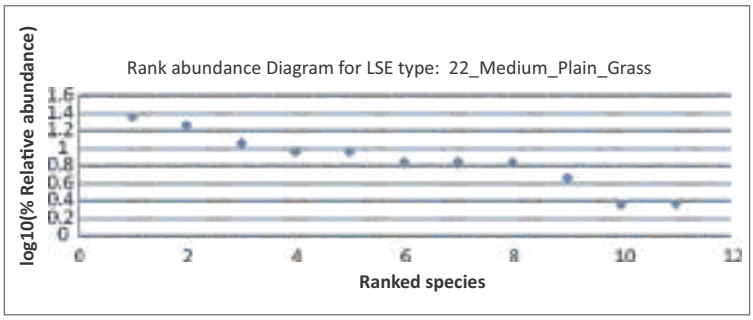


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		21_Sparse_Hilly_Bamboo		
1	70	Cleistanthus collinus	29.874659	1.290306
2	244	Dendrocalamus strictus	29.874659	1.290306
3	223	Xylia xylocarpa	12.447775	0.910095
4	24	Anogeissus latifolia	12.447775	0.910095
5	204	Tectona grandis	12.447775	0.910095
6	88	Dalbergia sissoo	7.468665	0.688246
7	130	Lagerstroemia parviflora	6.223887	0.609065

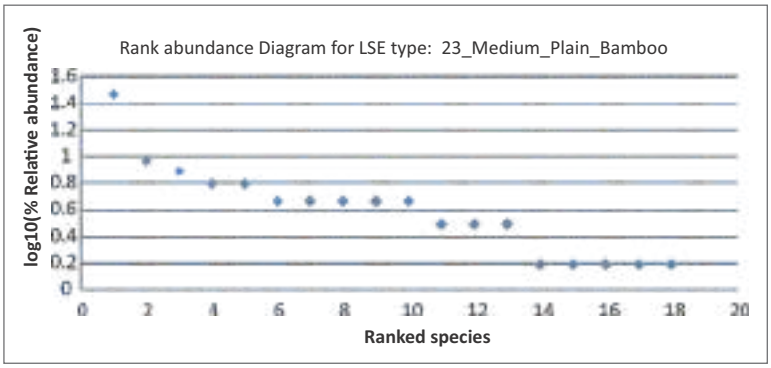
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
8	133	Lannea coromandelica	4.97911	0.512155
9	186	Schleichera oleosa	3.734332	0.387216
10	93	Diospyros melanoxylon	2.489555	0.211125
11	243	Dalbergia lanceolaria	2.489555	0.211125
12	42	Bridelia hamiltoniana	2.489555	0.211125
13	41	Boswellia serrata	2.489555	0.211125
14	43	Bridelia retusa	2.489555	0.211125
15	150	Mitragyna parvifolia	2.489555	0.211125
16	211	Terminalia tomentosa	2.489555	0.211125
17	143	Madhuca longifolia	2.489555	0.211125
18	67	Chloroxylon swietenia	1.244777	-0.08991
19	176	Pongamia pinnata	1.244777	-0.08991
20	39	Bombax ceiba	1.244777	-0.08991
21	112	Grewia tilaefolia	1.244777	-0.08991
22	44	Buchanania cochinchinensis	1.244777	-0.08991
23	188	Semecarpus anacardium	1.244777	-0.08991
24	119	Holarrhena pubescens	1.244777	-0.08991
25	48	Butea superba	1.244777	-0.08991
26	208	Terminalia bellirica	1.244777	-0.08991
27	172	Phyllanthus emblica	1.244777	-0.08991
28	886	Ougenia dalbergiodes	1.244777	-0.08991



Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		22_Medium_Plain_Grass		
1	93	Diospyros melanoxylon	20.681397	1.356547
2	119	Holarrhena pubescens	16.545118	1.259637
3	130	Lagerstroemia parviflora	10.340699	1.055517
4	24	Anogeissus latifolia	8.272559	0.958607
5	211	Terminalia tomentosa	8.272559	0.958607
6	70	Cleistanthus collinus	6.204419	0.833669
7	47	Butea monosperma	6.204419	0.833669
8	143	Madhuca longifolia	6.204419	0.833669
9	186	Schleichera oleosa	4.136279	0.657577
10	44	Buchanania cochinchinensis	2.06814	0.356547
11	43	Bridelia retusa	2.06814	0.356547

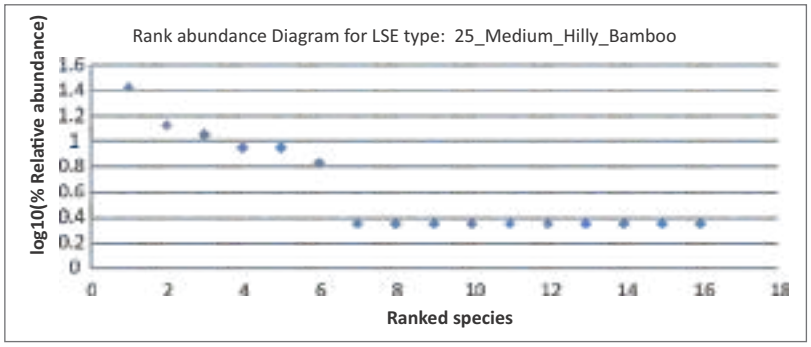


Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		23_Medium_Plain_Bamboo		
1	244	Dendrocalamus strictus	331.793752	1.472574
2	70	Cleistanthus collinus	104.776974	0.971971
3	211	Terminalia tomentosa	87.314145	0.89279
4	67	Chloroxylon swietenia	69.851316	0.79588
5	204	Tectona grandis	69.851316	0.79588
6	93	Diospyros melanoxylon	52.388487	0.670941
7	133	Lannea coromandelica	52.388487	0.670941
8	243	Dalbergia lanceolaria	52.388487	0.670941
9	24	Anogeissus latifolia	52.388487	0.670941
10	143	Madhuca longifolia	52.388487	0.670941
11	44	Buchanania cochinchinensis	34.925658	0.49485
12	172	Phyllanthus emblica	34.925658	0.49485
13	130	Lagerstroemia parviflora	34.925658	0.49485
14	107	Gardenia latifolia	17.462829	0.19382
15	223	Xylia xylocarpa	17.462829	0.19382
16	188	Semecarpus anacardium	17.462829	0.19382
17	119	Holarrhena pubescens	17.462829	0.19382
18	186	Schleichera oleosa	17.462829	0.19382



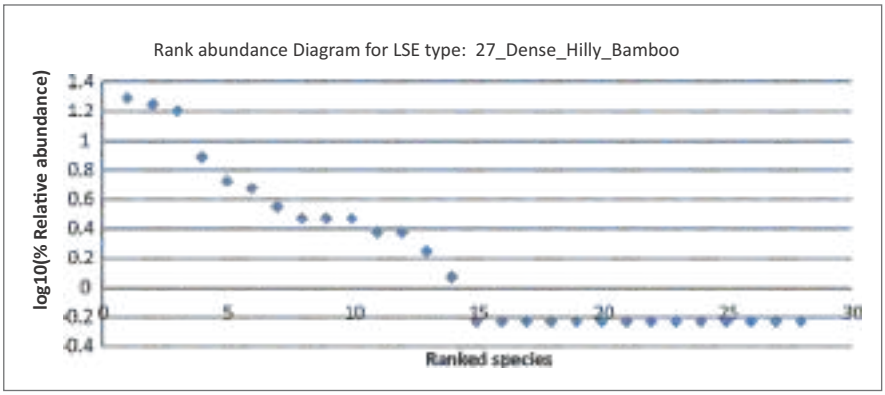
Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		25_Medium_Hilly_Bamboo		
1	244	Dendrocalamus strictus	189.867289	1.435729
2	70	Cleistanthus collinus	94.933645	1.134699
3	24	Anogeissus latifolia	79.11137	1.055517
4	186	Schleichera oleosa	63.289096	0.958607
5	204	Tectona grandis	63.289096	0.958607

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
6	130	Lagerstroemia parviflora	47.466822	0.833669
7	894	Stereospermum sp.	15.822274	0.356547
8	67	Chloroxylon swietenia	15.822274	0.356547
9	107	Gardenia latifolia	15.822274	0.356547
10	223	Xylia xylocarpa	15.822274	0.356547
11	112	Grewia tilaefolia	15.822274	0.356547
12	133	Lannea coromandelica	15.822274	0.356547
13	11	Albizia odoratissima	15.822274	0.356547
14	119	Holarrhena pubescens	15.822274	0.356547
15	43	Bridelia retusa	15.822274	0.356547
16	211	Terminalia tomentosa	15.822274	0.356547



Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
		27_Dense_Hilly_Bamboo		
1	70	Cleistanthus collinus	77.438909	1.293205
2	244	Dendrocalamus strictus	70.399008	1.251812
3	204	Tectona grandis	63.359107	1.206054
4	186	Schleichera oleosa	30.506237	0.888634
5	223	Xylia xylocarpa	21.119702	0.728933
6	93	Diospyros melanoxylon	18.773069	0.677781
7	42	Bridelia hamiltoniana	14.079802	0.552842
8	180	Pterocarpus marsupium	11.733168	0.473661
9	924	Haldinia cordifolia	11.733168	0.473661
10	24	Anogeissus latifolia	11.733168	0.473661
11	107	Gardenia latifolia	9.386534	0.376751
12	150	Mitragyna parvifolia	9.386534	0.376751
13	133	Lannea coromandelica	7.039901	0.251812
14	41	Boswellia serrata	4.693267	0.075721
15	63	Ceriscoides turgida	2.346634	-0.22531
16	112	Grewia tilaefolia	2.346634	-0.22531
17	123	Hymendictyon obovaty	2.346634	-0.22531
18	227	Ziziphus xylopyrus	2.346634	-0.22531
19	88	Dalbergia sissoo	2.346634	-0.22531
20	188	Semecarpus anacardium	2.346634	-0.22531

Rank	sp_id	sp_sc_name	trees per ha	log10(% relative abnd)
21	43	Bridelia retusa	2.346634	-0.22531
22	187	Schrebera swietenioides	2.346634	-0.22531
23	94	Diospyros oocarpa	2.346634	-0.22531
24	211	Terminalia tomentosa	2.346634	-0.22531
25	198	Sterculia urens	2.346634	-0.22531
26	130	Lagerstroemia parviflora	2.346634	-0.22531
27	143	Madhuca longifolia	2.346634	-0.22531
28	56	Cassia fistula	2.346634	-0.22531



Shannon & Simpson

lse_type_id	lse_type	shannon_ndx	simpson_ndx
1	1_Savana_Plain_Mixed	1.296052	0.078169
2	2_Savana_Rocky_Mixed	1.175124	0.0775
3	3_Savana_Hilly_Mixed	1.009614	0.130917
4	4_Sparse_Plain_Mixed	1.378015	0.065066
5	5_Sparse_Rocky_Mixed	1.353903	0.063094
6	6_Sparse_Hilly_Mixed	1.342784	0.077321
7	7_Medium_Plain_Mixed	1.27619	0.077576
8	8_Medium_Rocky_Mixed	1.327666	0.078501
9	9_Medium_Hilly_Mixed	1.285412	0.080464
10	10_Dense_Hilly_Mixed	1.226885	0.106026
11	11_Dense_Plain_Mixed	1.270624	0.087633
12	12_Savana_Plain_Grass	1.299722	0.06
13	13_Savana_Plain_Bamboo	0.862736	0.18
17	17_Savana_Hilly_Bamboo	0.778152	0.194443
18	18_Sparse_Plain_Grass	1.223093	0.098333
21	21_Sparse_Hilly_Bamboo	1.164687	0.102822
22	22_Medium_Plain_Grass	0.951812	0.131199
23	23_Medium_Plain_Bamboo	1.083691	0.125976
25	25_Medium_Hilly_Bamboo	1.021592	0.132235
27	27_Dense_Hilly_Bamboo	1.121911	0.113445
28	28_Dense_Plain_Grass	0.60206	0.25

Report

6.5

Conservation and development of arboretum of RET and Endemic tree species of Angiosperms of Western Ghats

Department of Botany, Shivaji University, Kolhapur

Background

Botanical Gardens of government, public and educational institutes are field gene banks from which germplasm flows to various organizations. All citizens have access to biological material from these institutes serving various needs of the society at large. Therefore, there is a need to undertake programs for the introduction of RET and endemic species in botanical gardens. Taking into account the importance of RET and endemic species, their sustainable utilization and conservation is needed.

In addition to the introduction of more than 100 species in Botanical garden, the Botany Department of Shivaji University has made significant activities which have direct implication and impact on plant diversity awareness, sustainable utilization and boost to the conservation of our plant diversity.

Nurseries have been developed in Botanical Garden which is entirely devoted for raising of saplings of ndigenous, medicinal and endemic tree species of Western Ghats. During last five years saplings of more than 100 plant species, especially from the Western Ghats have been raised. Saplings are raised in thousands and more than 7,000 saplings belonging to more than 100 species have been distributed to various botanical gardens, public gardens, Grampanchayat, private gardens, people interested in plantation and especially to the forest department. Presently more than 10,000 saplings belonging to about 100 plant species are available in the garden.

Reading materials on RET species of flowering plants have been compiled.

Conservation of genetic diversity: While collecting seeds of endemic species, the seeds from different individuals were collected to maintain genetic diversity. Similarly, 6/9 individuals of each endemic tree species are planted which maintain the genetic diversity within the species in the Arboretum.

Regeneration of depleting biodiversity: The seedlings of each endemic tree species were raised in large numbers and then same seedlings were provided to the forest department, various Botanical Gardens and individuals. Forest department has reintroduced these seedlings in forest areas as well as in biodiversity parks.

Journey with MGBP

Key issues

Ex-situ conservation of RET and Endemic tree species of Western Ghats.

Objectives and achievements

Objectives

(i) Survey, documentation and collection of germplasm of RET and Endemic tree species from wild habitats

(ii) Study on seed dormancy, seed germination and seedling establishment

(iii) Introduction of RET and endemic tree species at various places

(iv) Development of arboretum of RET and endemic tree species in University campus

(v) To prepare a database of enlisted species

Major work done under MGBP

1. The objectives of the project were discussed once again in details in the meeting in order to device a working plan and coordination between all the participating institutes of the project. All the possible strengths and weaknesses in the forthcoming work-steps were discussed in this meeting.

2. Land preparation was the primary task accomplished during this period. The area where the arboretum is being established has black soil having high water holding capacity. The landscape was designed for plantation, taking into consideration the roads, pits, water facility, electric supply and land slope. In total 1200 pits were dug with 20ft distance between them and filled with a mixture of red soil and field manure for proper plantation. Water harvesting and storage was the other work done in this duration. Well was drilled near the site of the plantation. Furthermore, a lake is also developed for the same purpose. Electricity was supplied from the University substation to the field **(Plate- XXXX).**

3.Field tours were arranged during this period to the Western Ghats for the collection of propagules. Plantations were carried out from March 2014 to March 2020. In total 87 RET endemic tree species have been planted. The total individuals planted are more than

5000, including 800 individuals of RET and endemic tree species. Seeds collected during these tours were identified, processed, and seedlings were raised in the nursery. During these collection trips, seeds of more than 100 species have been collected.

4. The nursery techniques have been developed for the seed germination and sapling growth of about 25 species (Annexure- D). Presently there are about 100 seedlings of 100 species available in the nursery. Of these, 25 species are target species of the project. In addition to this we have multiplied 11 other endemic species of the Western Ghats.

5. The database is prepared for 70 species (Annexure- E).

6. Introduced about 125 RET and Endemic tree species (including targeted species) in Arboretum.

7. The department has undertaken a Programme of seed and seedling distribution in which about 7000 saplings were distributed to 113 institutes and colleges (Annexure-H).

8. Development of paths along the water bodies and arboretum.

Details of sampling methods

1.Extensive field visits

2.Collection of plants, seeds, propagules and cuttings for raising seedlings and introduction in Shivaji University Botanical Garden.

Details of Seed treatment, germination and nursery techniques

The output of the project in the form of developing nursery techniques for *ex-situ* conservation of RET and endemic tree species. These techniques will help to undertake similar programmes in future and will be a guideline for implementation of *ex-situ* conservation of tree species.

Database

Submitted

Unintended outcomes

Multiplied 11 other endemic tree species of the Western Ghats

Qualitative impact

a. The project helps the enlisted RET and Endemic tree species survival by conserving them *ex- situ.* The germplasm further facilitates a platform to understand and study these species better and in-depth. The distribution and introduction of these species widely into botanic gardens, public and private gardens further grant popularity to these less known species and will give them a necessary priority. The major impact of the project is conservation of 87 species.

b. The project after completion will have readymade guidelines for other organizations to undertake such programs for the conservation of RET and endemic species in various parts of the country. The project has set a benchmark in *Ex-situ* conservation of endemic tree species. It would be a torchbearer for institutes who wish to carry on such projects on endemic tree conservation. The project scores on by providing introduction-propagation guidelines, expertise and conservation database.

c. Open new doors for further research and development-based studies like bioprospection of these tree species and other academic research, phytochemical analysis for bioactive molecules, and commercial exploitation for medicinal and ornamental values of the RET species.

d. The project contribution to biodiversity awareness is by mainly being effective in creating awareness amongst young Graduate and Post graduate students and teachers in the campus and also visitors who regularly visit the botanical garden for educational excursions.

Quantitative impact

i. Out of 102 targeted species, 87 species are growing well in the Botanical Garden (arboretum) with a total 800 individuals.

ii. The saplings of 37 targeted species and other indigenous species are distributed to various botanical, institutional, public and private gardens (5905 saplings to 857 beneficiaries).

iii. Seeds of 20 species are distributed to various organizations.

iv. 7807 students from 166 colleges visited the botanical garden.

v. Nursery techniques for 20 RET and endemic tree species have been developed.

vi. Survival and growth performance of RET and endemic tree species in Arboretum were recorded

Community participation

During visits from various colleges/schools to Botanical garden, the importance of plants is explained to them and they are made aware of the conservation of biodiversity. The public is made aware of the need for conservation through lectures.

The expert like Mr. Gogate from Pune, Dr. Janarthanam from Goa, Dr. Pandurangan from Trivandrum, Dr. Sanjappa from Bengaluru and Dr. Vasudeva from Sirsi, etc. have been consulted for the success of the project. Similarly, in procuring Germplasm, help from various institutes, viz. AJCB Botanical garden, Kolkata; NBPGR, New Delhi; KFRI, Kerala and Pilikula Botanical Garden, Kerala; M. S. Swaminathan Foundation, Tamilnadu, etc. hase been obtained.

Beneficiaries

Demography

Colleges, Schools, Social Forestry and individuals

Types of benefits

i. University as a public institute the arboretum of RET and Endemic species will be helpful to the entire society.

ii. School students educated about different types of plants, college students get the knowledge of plant diversity and its conservation.

iii. Many people come for morning and evening walk through arboretum, which gives mind relaxation and ideal scenario of the arboretum as an aesthetic value.

iv. Through seedling distribution, the saplings of RET and Endemic species are made available to the public.

v. The seedlings produced through the MGBP were provided to the Forest department which were reintroduced in forest areas as well as in biodiversity parks.

Duration of benefits

They are benefitted long term even for lifetime

Measures to continue benefits post-MGBP

The development of the arboretum of RET and Endemic species of Western Ghats on the Shivaji University campus will be continued for generations to come.

List of Publications and presentations

1. **Yadav et al.** (2016). Lead Botanic Garden: Enumeration of plant Wealth. Publisher: Shivaji University, Kolhapur.

2. **Yadav et al.** (2016). Nilambari- newsletter. DOI: 10.13140/RG.2.1.1924.6960

3. Mane et al. (2017). The taxonomic status of two geophytic *Euphorbia* species (Euphorbiaceae) from Maharashtra, India. ***Phytotaxa*** 307(2):141-146

4. Mane, R. N. Gosavi, K. V. C., Gholave, A. R. & **Yadav, S. R.** (2018). Version of Record IOPB Column 1235 1245. ***Taxon*** 67 (6): 1239

5. Mane R. N., M. M. Lekhak & **S. R. Yadav** (2018). "Lectotypification of *Areca dicksonii* Roxburgh (Arecaceae) " ***Phytotaxa*** 401 (2): 146–148

6. A. R. Gholave, R. N. Mane, R. D. Gore and S. P. Gaikwad (2019). Karyomorphology of *Curculigo janarthanamii* (Hypoxidaceae): An Important Medicinal Plant from Maharashtra, India. ***Cytologia*** 84 (1): 1–3

7. Rohit N. Mane and **Shrirang R. Yadav** (2017). Fruit, Seed and Seedling Morphology of *Licuala*. State level conference. Abeda Inamdar College, Pune, India.

8. Rohit N. Mane, Manoj M. Lekhak and **Shrirang R. Yadav** (2018). Fruit, Seed and Seedling Morphology of Indigenous Palms" Conference: XXVIII Annual Conference of Indian Association for Angiosperm Taxonomy & International Symposium on Conservation of Angiosperm Diversity: Hidden Treasure for Today and Tomorrow October 29-31, 2018. At: Department of Botany, Faculty of Science, The Maharaja Sayajirao University of Baroda, Vadodara 390002. Gujarat, India.

9. Rohit N. Mane, Manoj M. Lekhak and **Shrirang R. Yadav** (2019). Karyomorphological analysis of *Holigarna arnottiana* (Anacardiaceae): an endemic species from the Western Ghats, India. "National Conference on New Trends in Bio-Technology & 14th Conference of Society of Cytologists and Geneticists" held between March 6-8, 2019. At: BIET, Davangere, Karnataka, India.

10. Deshmukh Pradip, Mane Rohit, Dalavi Jagadish and **S. R. Yadav** (2019). Cytological studies on species of Aponogeton in India. "National Conference on New Trends in Bio-Technology & 14th Conference of Society of Cytologists and Geneticists" held between March 6-8, 2019. At: BIET, Davangere, Karnataka, India.

11. Rohit N. Mane, Manoj M. Lekhak and **Shrirang R. Yadav** (2019). Karyomorphology of a critically endangered species of *Vateria* L., *V. indica* L. (Dipterocarpaceae) from India. "National Conference on 'Mangroves and coastal resources' held on April 12, 2019. At Department of Botany, Shivaji University, Kolhapur.

Outreach

During visits from various colleges/schools to Botanical garden, the importance of plants is explained to them and they are made aware of the conservation of biodiversity. The public is made aware of the need for conservation through lectures.

Knowledge Outcomes

Interesting facts

a) In total, 87 RET/ Endemic species with 800 individuals are growing well in the arboretum.

b) A rare achievement of the project is growing sal (*Shorea robusta*) trees successfully for the first time in Western Maharashtra. It is well known that sal survives and thrives only in the sandstone substratum region and never so ever in igneous rock terrain ('Teak on trap, Sal on sandstone'). However, all the individuals introduced in the arboretum are performing well.

c) A unique feature of the arboretum is well grown *Corypha umbraculifera,* a rare huge palm which produces the largest inflorescence in the world.

d) Several endangered and critically endangered species are growing well in the arboretum. They are as

below: *Hopea ponga* Status:Endangered A1cd+2cd, B1+2c ver 2.3, *Vateria indica* Status: Critically Endangered A1cd ver 2.3, *Madhuca bourdillonii* Status: Endangered A1cd+2c ver 2.3, *Kingiodendron pinnatum* Status: Endangered A1cd ver 2.3, *Dysoxylum malabaricum* (White Cedar) Status:Endangered A2cd ver 3.1, *Hopea racophloea* Status: Endangered A1cd+2cd, B1+2c ver 2.3, *Hopea canarensis* Status:Endangered B1ab (i, iii, v) ver 3.1, *Hopea parviflora* (Malabar Ironwood) Status:Endangered A1cd+2cd, B1+2c ver 2.3, *Pterospermum reticulatum* Status:Vulnerable B1+2c ver 2.3, *Myristica malabarica* Status:Vulnerable B1+2c ver 2.3, *Myristica dactyloides* Status: Vulnerable A2cd ver 3.1, *Chloroxylon swietenia* (East Indian Satinwood) Status:Vulnerable A1c ver 2.3, *Arenga wightii* Status: Vulnerable B1+2c ver 2.3, *Hyphaene dichotoma* Status: Lower Risk/near threatened ver 2.3, *Hildegardia populifolia* Status: Critically Endangered D ver 2.3, *Syzygium stocksii* Status: Endangered B1+2c ver 2.3, *Bentinckia condapanna*, Status: Endangered B1+2c ver 2.3

Stories emerged

The local expertise available in the department has been extensively utilized; similarly, the indigenous technique, infrastructure in the garden has been used to a maximum extent to achieve the goals.

New facts noticed

It was observed that the dichotomously branched palm *Hyphaene dichotoma* does not like transplantation. Seeds should be directly sown in the soil where the plant is expected to grow.

This may be because of their specific growth requirements which are not yet understood.

New understandings/ philosophy/ realizations emerged

Ex-situ conservation of RET/ Endemic tree species is possible, however, only proper and intentional inputs are required.

Species lists/inventory

80 targeted species are growing in the arboretum

Impact

Ecological

The trees are of great significance, especially in the maintenance of the health of an ecosystem and are responsible for maintenance of maximum biodiversity as each tree species supports 20-60 species of other organisms. They play a very significant role in the ecosystem. Tree species composition of various types of forests varies greatly, and these tree species form a characteristic feature of the vegetation. The trees contribute to the major portion of biomass and its production.

In arboretum, about 80 tree species from the Western Ghats are grown with 800 individuals thereby maintaining the genetic diversity of each species. In future, it will be responsible for the positive change in the ecology of the Shivaji University campus.

Community

The project on completion will have readymade guidelines for other organizations to undertake such programs for the conservation of RET and endemic species in various parts of the country. The project will set a benchmark in *Ex-situ* conservation of endemic tree species. It will be a torchbearer for institutes who wish to carry on such projects on conservation of endemic trees. Thus the project would score on by providing introduction-propagation guidelines, expertise and conservation database.

During the last four years, the number of visitors to the Botanical garden has increased substantially. It indicates that there is awareness among the masses about the importance and conservation of biodiversity.

The visitors of the arboretum from various sectors including education, industry, pharmaceutical, forest department, etc. will be directly benefited. The material, as well as literature and knowledge sharing will be continued from the arboretum.

Academia

The project is helping the enlisted RET and endemic tree species survival by conserving them *ex-situ.* The germplasm would further facilitate a platform to understand and study these species better and in-depth. Also, the distribution and introduction of these species widely into botanic gardens, public and private gardens would further grant popularity to these lesser known species and will give them necessary prioritization. The major impact of the project shall be the conservation of these species by introducing and prioritizing them. It will open new doors for further research and development-based studies like bioprospection of these tree species and other academic research, phytochemical analysis for bioactive molecules, commercial exploitation for medicinal and ornamental values of the RET species.

The project would be a contribution to biodiversity awareness by mostly being effective in creating awareness amongst young Graduate, Postgraduate students and teachers in the campus and also visitors who regularly visit the botanical garden for educational excursions. The project would rightly score on biodiversity conservation and socio-economic values.

Failures

Not yet collected some plants *Diospyros saldanhae*, *Geoffroea decorticans*, *Gymnacranthera canarica*,

Melicope lunu-ankenda, *Pajanelia longifolia*, *Palaquim ellipticum*, *Pseudoglochidion anamalayanum*, *Rhododendron arboreum*, *Vernonia travancorica.* It was found that the seeds of some plants such as *Canthium dicoccum, Tabernaemontana alternifolia* could not germinate.

Poor survival of some plants such as *Poeceloneuron indicum, Diospyros buxifola, Myristica fatua, Humboltia bourdillonii etc.*

Way forward

The garden has 3 sanctioned regular posts of malies and a separate budget of Rs. 1.50 lakhs for daily wagers. However, presently department has only one gardener on regular post. The request will be made to the University to fill up the remaining two posts so that the manpower required for maintenance of the garden can be fulfilled. The University provides a separate annual budget of Rs. 1.00 lakh for the maintenance of the botanical garden. The department has 'Garden Committee' which looks after the development and regular maintenance of the garden. Thus, University has some financial provision and man power for the maintenance of the garden even after the period of assistance is over. The department has established 'Corpus Fund', and the amount generated from the retail sale of plants, consultancy services by faculty and a donation is deposited in it. In future, the department may be able to utilize this fund for further maintenance of the garden. The department is continuously trying to procure funds through various projects from national/ international agencies.

Staff

Sr. No.	Name	Designation	Introduction
1	Dr. R. V. Gurav	Principal Investigator	Associate Professor, Department of Botany, Shivaji University, Kolhapur. He is a trained cytogeneticist working on Orchids of the Western Ghats. He has introduced and maintained more than 75 species of orchids in the Botanical garden. He has been trained in molecular techniques, micropropagation, nursery techniques and fieldwork
2	Prof. S. R. Yadav	Co-Investigator	UGC BSR Faculty, Fellow, Department of Botany, Shivaji University, Kolhapur. He is a trained taxonomist working in the University since 1985. Since 1988 he has been running 'Taxonomy of Angiosperms' as a specialization at postgraduate level.
3	Prof. G. B. Dixit	Co-Investigator	Retd. Professor, Department of Botany, Shivaji University, Kolhapur. He is a well-trained biotechnologist, specialists in Cytogenetics, Plant breeding and Biotechnology.
4	Dr. N. B. Gaikwad	Co-Investigator	Associate Professor, Department of Botany, Shivaji University, Kolhapur. He is in Cytogenetics and Plant Breeding and also involved in the teaching programme of the Plant Biotechnology
5	Dr. M. M. Lekhak	Co-Investigator	Assistant Professor, Department of Botany, Shivaji University, Kolhapur

Annexure 1

Available Palm Saplings in Arboretum

Sr. No.	Name
1	*Adonidia merrillii* (Becc.) Becc.
2	*Aiphanes caryotifolia* (Linden) Burret
3	*Areca triandra* Roxb. ex Buch.-Ham.
4	*Arenga wightii* Griff.
5	*Bentinckia condapanna* Berry ex Roxb.
6	*Carpentaria acuminata* (H. Wendl. & Drude) Becc.
7	*Caryota mitis* Lour.
8	*Coccothrinax argentata* (Jacq.) L.H. Bailey
9	*Corypha umbraculifera* L.
10	*Dypsis decaryi* (Jum.) Beentje & J. Dransf.
11	*Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf.
12	*Elaeis guineensis* Jacq.
13	*Licuala grandis* H. Wendl. ex Linden
14	*Licuala peltata* Roxb.
15	*Licuala spinosa* Wurmb
16	*Livistona jenkinsiana Griff*
17	*Pritchardia pacifica* Seem. & H. Wendl.
18	*Ptychosperma macarthurii* (H. Wendl. ex H.J. Veitch) H. Wendl. ex Hook. f.
19	*Sabal palmetto* (Walter) Lodd. ex Schult. & Schult. f.
20	*Syagrus romanzoffiana* (Cham.) Glassman
21	*Thrinax parviflora* Sw.
22	*Trachycarpus fortunei* (Hook.) H. Wendl.
23	*Trachycarpus martianus* (Wall. ex Mart.) H. Wendl.
24	*Wodyetia bifurcata* A.K. Irvine

Plate No.1: a. Dysoxylum binectiferum, b. Artocarpus hirsutus, c. Artocarpus lakoocha d. Ailanthus malabarica

Plate No. II: a. Hopea racophloea, b. Hopea ponga, c. Hopea parviflora, d. Hopea canerensis

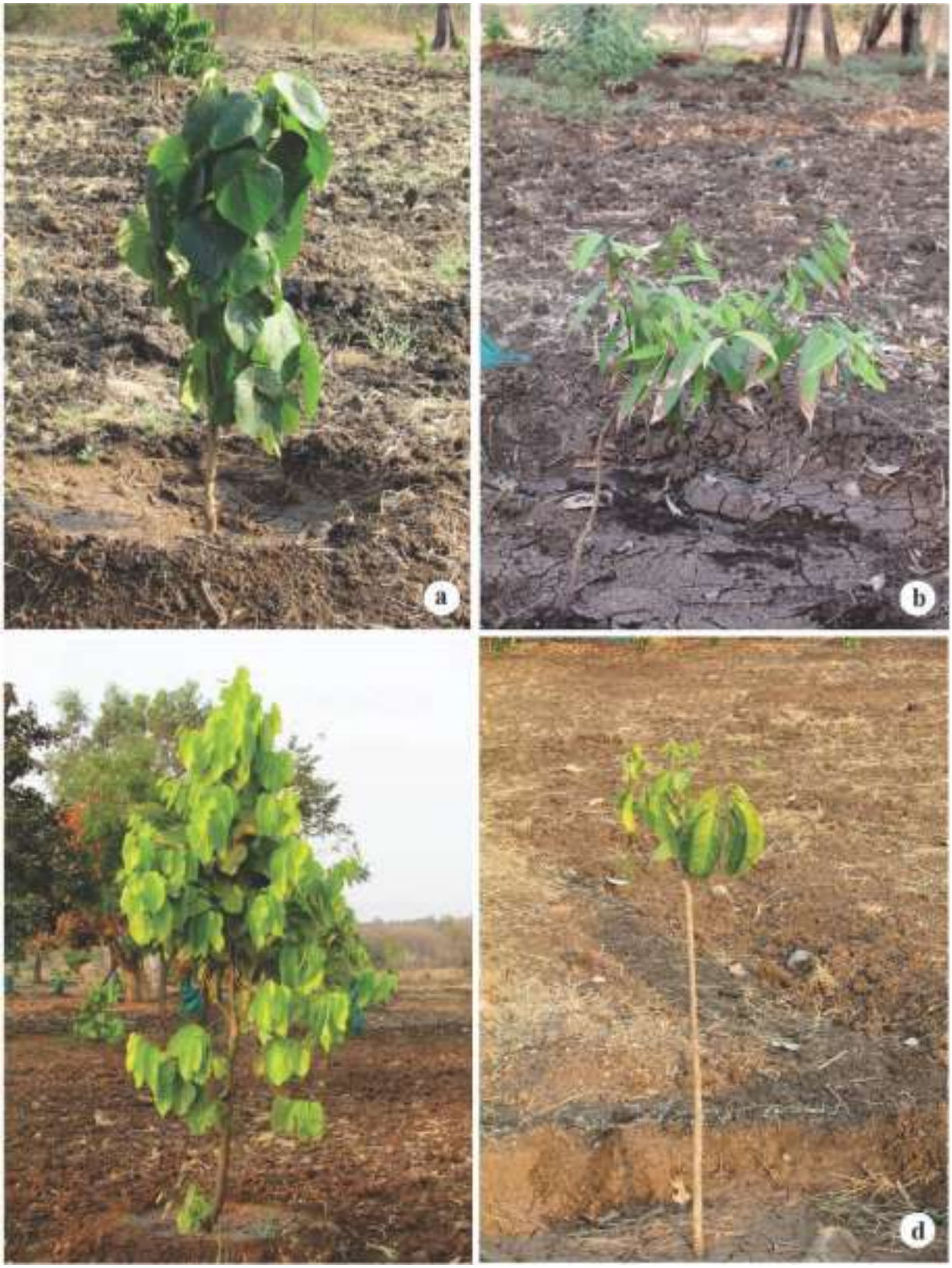


Plate No. III : a. Macranga peltata, b. Mesua ferrea, c. Shorea robusta, d. Dysoxylum malabaricum

Plate No. IV : a. Chionanthus lanceroides, b. Hydnocarpus pentandrus, c. Canarium strictum d. Chioanthus mala-elengi

Plate No. III: a. Holigarna arnottiana, b. Holigarna grahamii, c. Erinocarpus nimmonii, d. Otonephalium stipulaceum

Plate No. VI: a. Pterospermum reticulatum, b. Nothopegia racemosa, c. 47. Flacourtia Montana, d. Semicarpus kurzii

Plate No. VII: a. Lophopetallum wightianum, b. Callophyllum inophyllum, c. Agalai barberi, d. Aphanomixis polystachya

Plate No. VIII: a. Garcinia indica, b. Garcinia xanthochymus, c. Garcinia talbottii, d. Knemma attenuata

Plate No. IX: a. Diospyros bourdillonii, b. Diospyros buxifolia, c. Diospyros crumenata, d. Diospyros discolor

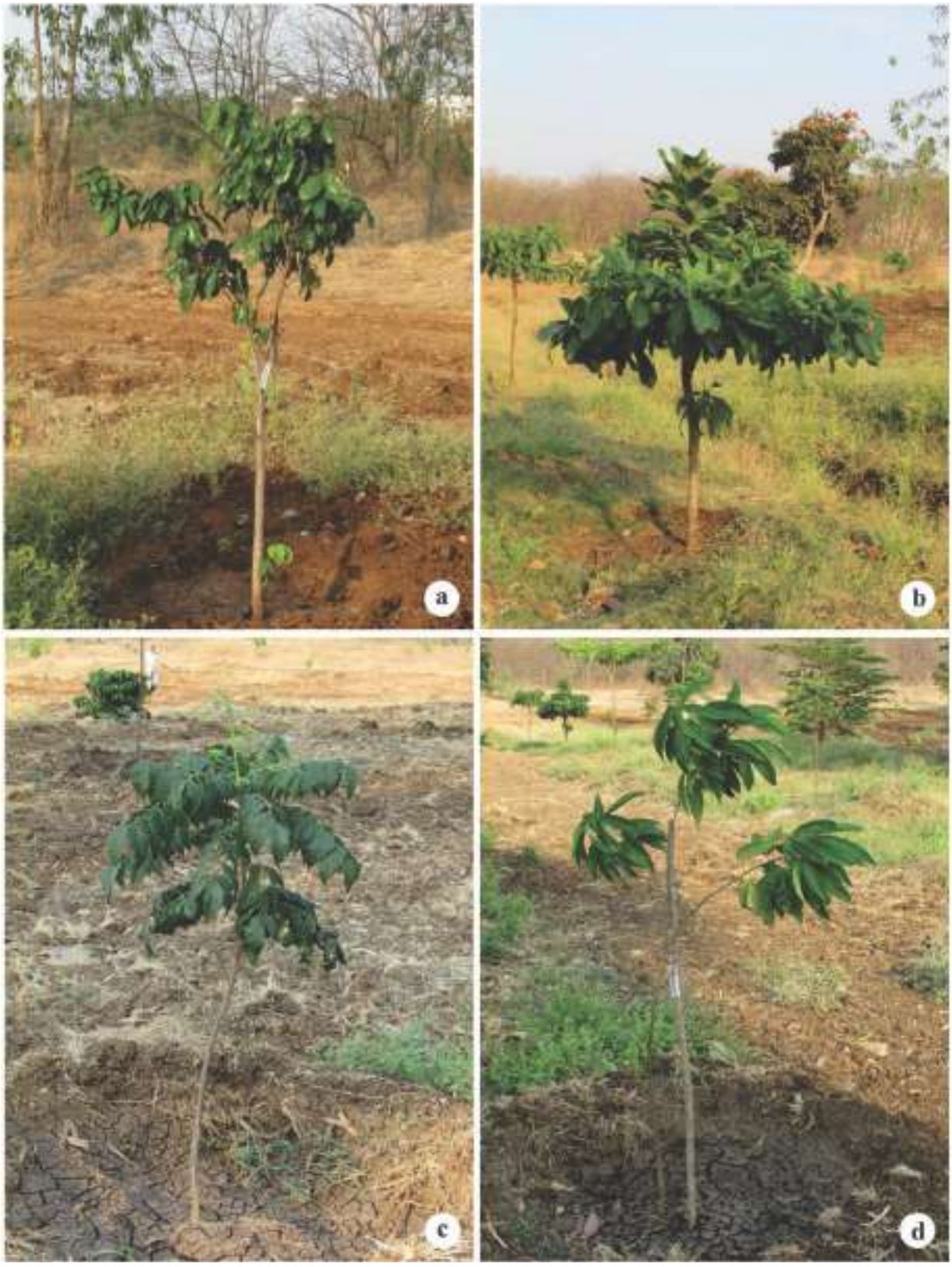


Plate No. X: a. Kingiodendron pinnatum, b. Terminalia bilata, c. Clausena aniseta, d. Vepris bilocularis

Plate No. XI: a. Harpullia arborea, b. Vitex altissima, c. Cynometra travancorica, d. Semicarpus kathalakanensis

Plate No. XII: a. Myristica malabarica, b. Myristica dactaloides, c. Myristica fatua, d. Madhuca bourdillonii

Plate – XIII: a. Madhuca longifolia, b. Madhuca insigne, c. Manilkara littolaris, d. Dipterocarpus indicus

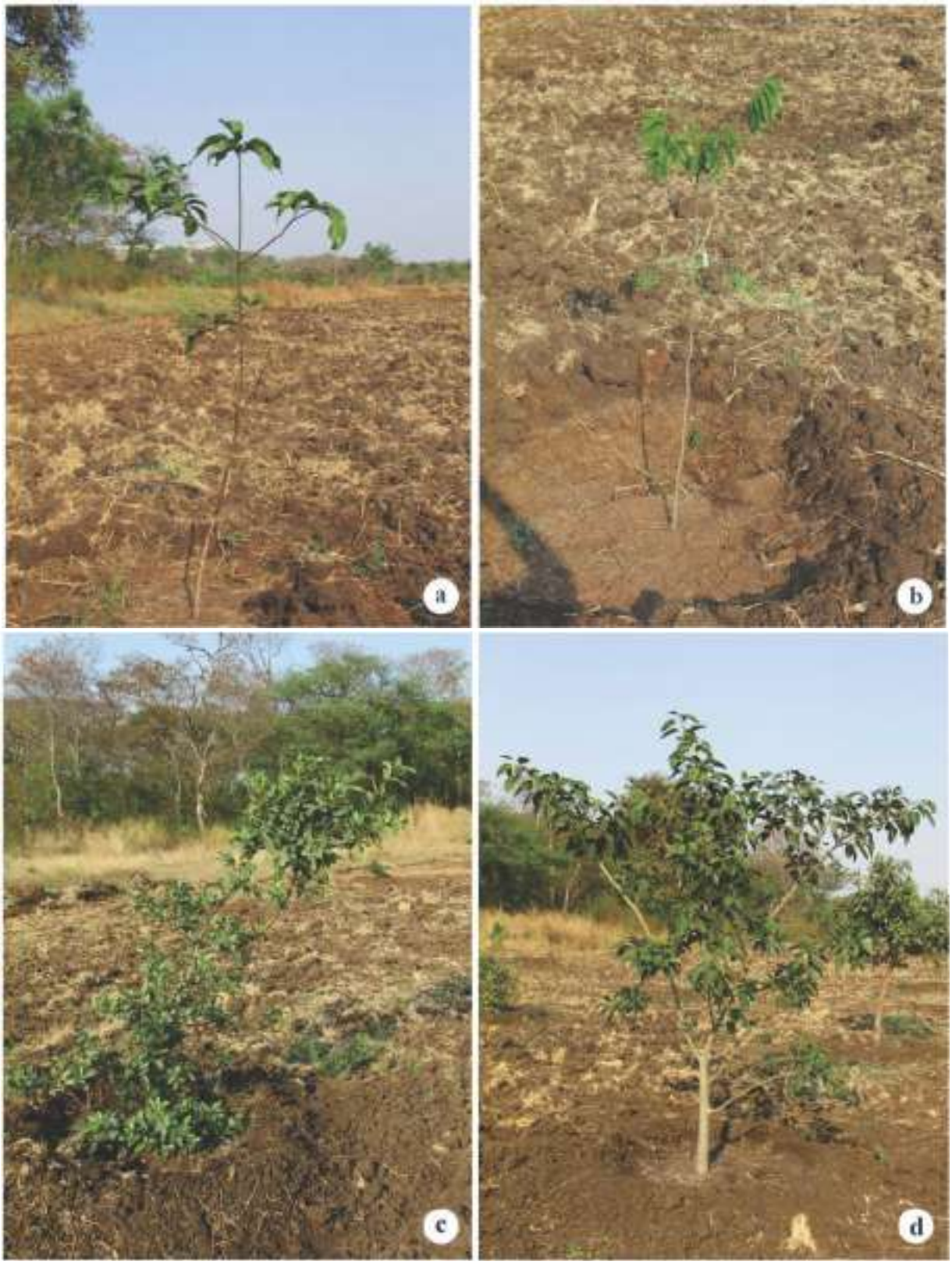
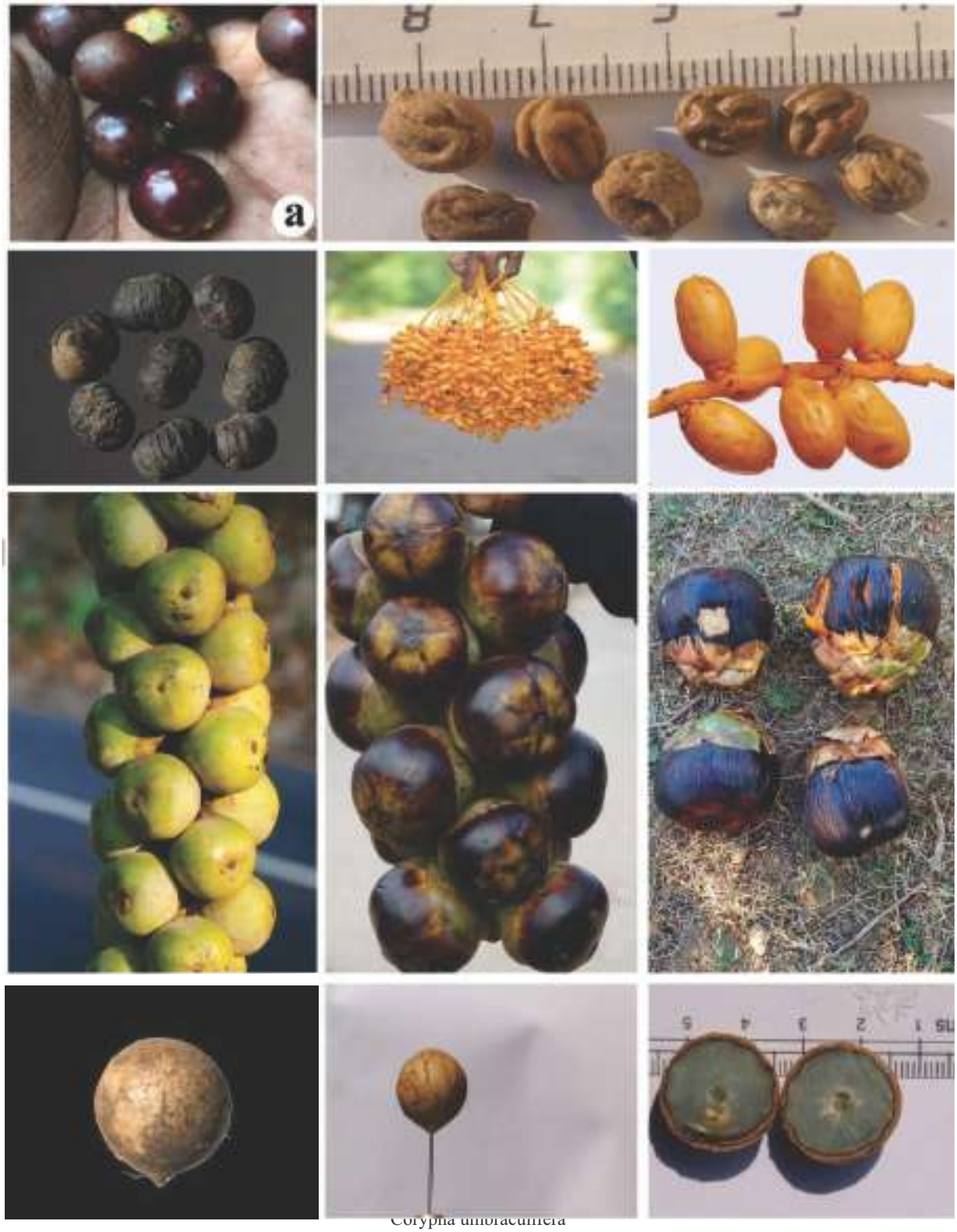


Plate- XIV: a. Belchimedia dalzellii, b. Antiaris toxicaria, c. Ficus racemosa, d. Ficus religiosa



Corypha umbraculifera

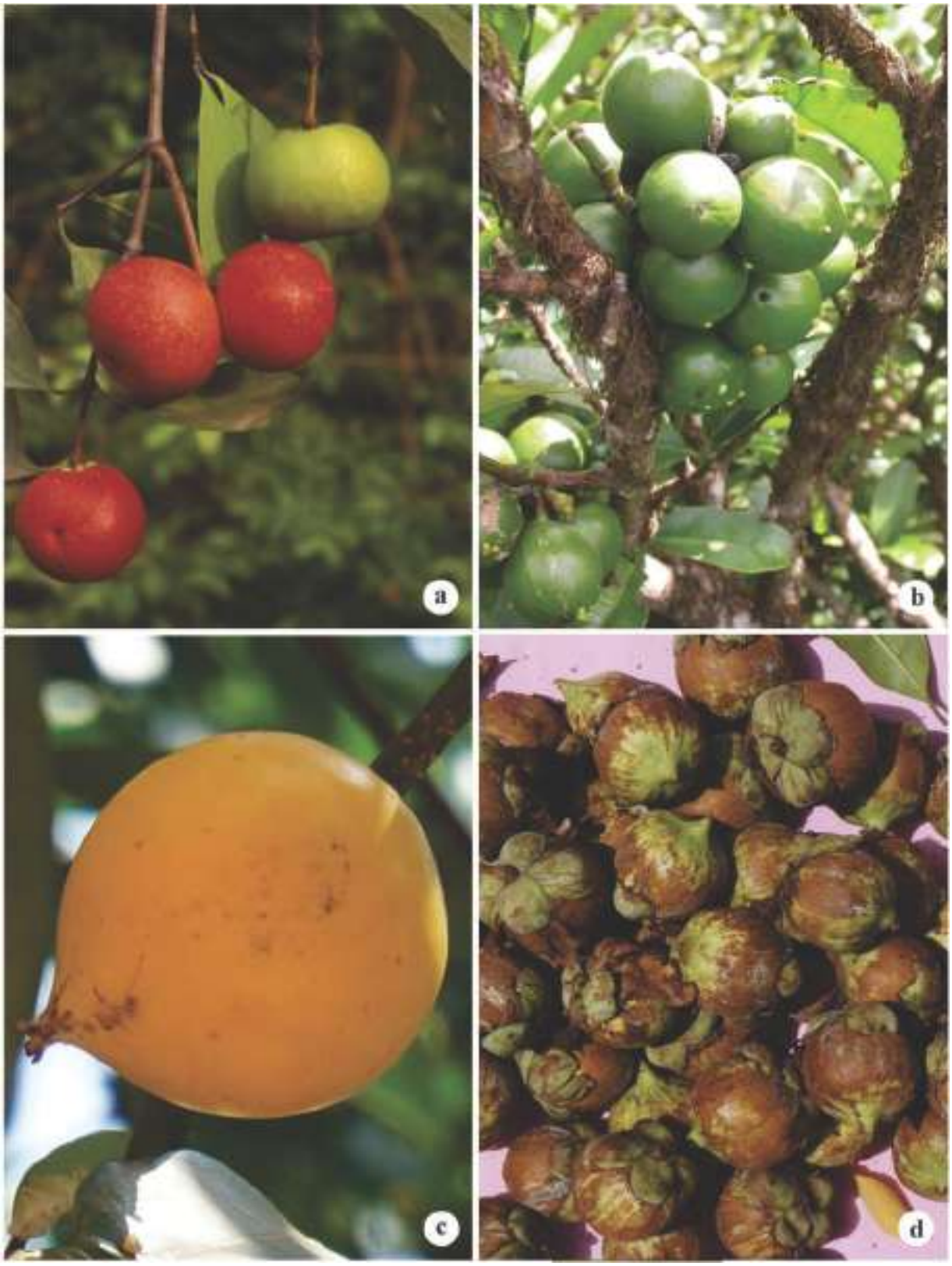


Plate- XVI: a. Garcinia indica, b. Garcinia talbotii, c. Garcinia xanthochymus, d. Mesua ferrea

Annexure 2

Seed Germination Methods

Artocarpus hirsutus Lam.

Family: Moraceae

Artocarpus hirsutus Lam. belongs to family Moraceae. There are eighteen species of *Artocarpus* reported in India but *Artocarpus hirsutus* is the only endemic species. The tree is native to tropical Asia, found in evergreen forests of Western Ghats. It is considered as one of the 'key stone' species of evergreen forests of Western Ghats. It occurs in sandy and rocky habitat with 1500 mm average rainfall. The Indian subcontinent represents the species in states like Kerala, Karnataka, Tamil Nadu and Maharashtra (Sindhudurg). The tree is locally known by various names viz. Lakucha (Sanskrit) Vadahar (Hindi) Anjili (Malyalam) Hebbalasu (Kannada) Wild jack (English). The fruits are eaten by giant squirrel, monkeys, and Slender Loris. It has economic as well as medicinal value. It is traditionally used to cure ulcers, diarrhea, anorexia, pitta and burning sensation.

Status: Endemic to Western Ghats.

Botanical Description:

Tree up to 75 m tall; young shoots appressedly hairy; leaves broadly ovate, subacute, coriaceous, glabrous except midrib and nerves beneath; flowers on pedunculate receptacles; sorosus yellow, globose, spinous, seeds white, embedded in edible pulp, recalcitrant.

Fls. & Frts.: January – May

Fruit and seed collection and their processing:

Seeds were collected from ripened fruits from the evergreen forests. The fruits were collected at the end of March. After collection seeds were extracted from the fruits, washed with water and dried in shade for few hours. Because of recalcitrant nature of seeds, they need rapid sowing after harvesting. Seed dressed with boric powder were stored in plastic jar.

Nursery Techniques:

Natural regeneration by seeds is scanty due to darkness in the forest and seeds require sunlight for germination. The seeds were sown immediately after collection. The seeds were soaked in water for 2 hrs. The pre-treated seeds were sown in polythene bags at the depth of 2 cm. The seedling emergence starts after 35 days of sowing and continued for 60 days. The pre-treated seeds show germination up to 90%. This method is useful for rapid regeneration of the species. The seedlings were watered regularly at an interval of a day.

The infection to the seeds sown in the polythene bags is usually low but seedlings may get infected by leaf spot caused by *Colletotrichum* during rainy season which get reduced after the end of rainy season. The application of Carbendazim (50%) at the interval of 15 days was effective control measure.

Calophyllum inophyllum L. (syn. *Balsamaria inophyllum* (L.) Lour.)

Family: Clusiaceae

It is native from East Africa, southern coastal India to Malaysia and Australia. It is sacred tree in Pacific Island traditions. Indian subcontinent represents species in states like Kerala, Karnataka, Orissa, Tamil Nadu and Andaman & Nicobar Islands, Maharashtra (Sindhudurg, Ratnagiri). It is commonly known as Nag Champa (Sanskrit); Sultan Champa (Hindi); Undi (Marathi); Punnai (Tam.) Alexandrian Laurel (English).

Status: Lower Risk / Least Concern

Botanical Description:

Large, evergreen trees; leaves 15 x 10 cm, coriaceous, broadly elliptic-oblong, obtuse or retuse at apex, rounded at base, mid rib prominent on lower side; flowers in terminal or axillary lax racemes, white, sepals 4, ciliolate, petals 4, orbicular, stamens numerous, yellow, filaments irregularly united in 4 bundles; drupes 3 cm across, globose, smooth, yellow when ripe, stones hard, seeds recalcitrant.

Fls. & Frts.: March – April.

Seed collection and processing:

The ripened fruits were collected from trees in the month of March – April. The fruits were kept in shade. The seeds were extracted by breaking stony endocarp. Care was taken that seed should not be injured. The intact seeds with endocarp dressed with boric acid powder can be stored in plastic jars up to 6 months.

Nursery technique:

The endocarp was cracked before sowing. The seeds were sown at the depth of 4-5 cm in polybags. They were watered regularly at an interval of a day. Seedling emergence takes place after 30 days. The germination was 70 %. The cracking of endocarp shows better germination. The seedlings were kept in shade and watered regularly as per requirement.

In nature, fruits are eaten by bats and seeds are disseminated.

Dysoxylum binectariferum Hook. f. ex Bedd.

Family: Meliaceae

It occurs in moist deciduous forests. It occurs in India, Bangladesh and Sri Lanka. In Maharashtra it is found in districts like Kolhapur, Pune, Raigad, Ratnagiri, Sindhudurg. It is commonly known as Kavathi, Yerandi (Marathi); Akil (Mal). The seeds were eaten by Malabar Pied Hornbill and sometimes by other frugivores. It is a rich source of Rohitukine which has anti-inflammatory and immuno-modulatory activities. It is floral emblem of Bali.

Botanical Description:

Tree 30 ft. tall; young parts puberulous; leaves imparipinnate, leaflets 5-9, alternate; flowers in axillary or supra-axillary subglabrous panicles, shorter than leaves; capsules 2 – 2.5 in. across, obovoid or subglobose, grooved, glabrous, orange when ripe, 4-celled, seeds large, nearly 1 in. long, purplish brown, shining, recalcitrant.

Fls. & Frt.: March- May

Status: Data Deficient

Fruit and seed collection and their processing:

The ripe fruits were collected from the standing tree with the help of hook or stick by shaking or beating the branches. The fallen fruits and seeds were also collected if not eaten by animal or infected by any fungi. Mature fruits were spread in shade where they dehisce after three to four days. After five days seeds can be extracted by just pressing the fruit longitudinally. Dried seeds dressed with boric acid powder can be stored in muslin bags for few days.

Nursery Technique:

The seed coat is removed before sowing. The seeds were sown horizontally near to the soil surface in polythene bags. The seeds sown with seed coat get fungal infection immediately. The seed germination occurs after 20 – 25 day of sowing. The germination is epigeal type. The seedlings were kept in open situations and watered at an interval of a day.

Erinocarpus nimmonii Grah. ex Dalz.

Family: Tiliaceae

Erinocarpus Nimmo ex J. Graham (Malvaceae) is monotypic endemic tree genus of Western Ghats. It occurs along streams, river and on hill slopes in dry as well as moist deciduous forests of Western Ghats. In Maharashtra it occurs in districts such as Bombay, Kolhapur, Nasik, Pune, Raigad, Ratnagiri, Satara, Sindhudurg, and Thane. It is commonly known as Chira, Cher, Moduvakh, Varing etc. Its bark is used for rope making and seeds are eaten as famine food.

Botanical Description:

Trees 5-m high; leaves orbicular, 5-7 lobed, base cordate; flowers in lax terminal panicles, yellow, sepals narrowly linear, fulvous, tomentose outside, petals obovate, margins ciliate; capsules indehiscent, woody, 1-4 celled, winged on angles, spinescent, seeds 1 in each locule, orthodox.

Fls. & Frt.: September - December

Status: Low risk

Fruit and seed collection and their processing:

The ripe fruits were collected from standing tress by beating or shaking the branches during January to March. The fallen fruits were also collected. Fruits were air dried in shade. Seeds were extracted by cutting the fruit at the septa with the cutter which is a very difficult task. Seeds can be stored at room temperature dressed with boric acid powder. Fruits also can be stored in plastic bags for 1 year.

Nursery Technique:

Intact fruit were sown in month of June which germinates after 23 days and continues for more than 8 months. Seeds were pre-treated with various methods i.e. hot water, boiling water, H_2SO_4, NaOH, mechanical scarification by nail cutter & sand paper. The seeds pre-treated with H_2SO_4 and NaOH shows high germination percentage. The pre-treated seeds were sown at the depth of 1 cm. Seedling emergence occurs after 7 days of sowing and continues for 13 days in case of pre-treated seeds. Seedlings raised by intact fruits have less mortality as compared to seedlings raised by seed. Seedlings can get infected during early stage by virus but it gets recovered soon. It does not require any control measures. The seedlings were kept at open situations and watered at interval of a day.

Garcinia gummi-gutta (L.) Robson (syn. *Garcinia cambogia* (Gaertn.) Desr.)

Family: Clusiaceae

It occurs in evergreen and semi – ever-green forests of Southern Western Ghats. It naturally grows in Penninsular India, Sri Lanka and Thailand. It is commonly known by various names like Kodam- puli, Koda-puli, Pinaru (Tamil), Malabar Tamarind, Brindle berry (Eng.). It is rich source of Vitamin C and has been used as a cardio tonic. An extract obtained from the mature fruit rind contains hydroxy citric acid which is used against obesity. India reported to export over 50 tonnes (valued at 17 million rupees) fruits.

Status: Endemic

Botanical Description:

Evergreen trees; leaves15 x 5 cm, coriaceous, elliptic-oblong, apex obtuse or acute, base cuneate, glabrous; male flowers in axillary fascicles, white, sepals 4, orbicular; petals 4, orbicular, stamens in a globular mass; female flowers solitary axillary, sepals and petals

as in male flowers, staminodes numerous, arranged in irregular ring; berries 5 cm in diameter, elliptic-oblong, yellow, 6-8 grooved, seeds 6-8, arillate, recalcitrant.

Fls. & Frt.: January - August

Fruit and seed collection and their processing:

The ripe fruits were collected in the months of June to July. The fruit rind and pulp was removed and seeds were extracted. The seeds were thoroughly washed with water to remove pulp. The seeds can be stored after air drying in shade. Seeds can be stored in ash or dressed with boric powder for few days.

Nursery Technique:

The seeds were soaked in germinator solution for 2 hrs. and sown in polythene bags at the depth of 2 -3 cm. Germination starts after 35 days. The type of germination is hypogeal. The seedlings were kept in shade but in open situations. Seedlings were watered at an interval of a day.

Garcinia indica Choisy

Family: Clusiaceae

Garcinia indica is one of the important indigenous tree species. It is endemic to the Western Ghats region of India occurring mostly along west coast. Out of 35 species found in India, 17 are endemic of which 7 are endemic to Western Ghats. It occurs in evergreen and deciduous forests of Western Ghats. In Maharashtra it occurs in Kolhapur, Raigad, Ratnagiri and Sindhudurg. It is commonly known as Amlavetasa (Sanskrit); Kokam (Hindi); Kokambi, Aamsul, Bhirand (Marathi); Ratamba (Telagu); Penampuli (Mal); Goan Garcinia, Indian gamboges, Kokum butter (Eng.). It is cultivated for edible fruits which are traditionally used to relieve gastric problems like acidity, flatulence, constipation and indigestion. The fruit juice is a healthier and far more refreshing option as compared to commercial bottled drinks.

Status: Endemic

Botanical description:

Tree, 10-20 m. tall, branches drooping; leaves ovate oblong, elliptic-lanceolate, red when young, acute or acuminate, at apex, narrow at base; flowers in axillary or terminal, solitary or fascicled cyme, male flowers 4-8, female flowers solitary, stigma 4-8 rayed; berries globose, 3 cm. across, orange – pink when ripe, seeds 5-8, compressed, arillate, recalcitrant.

Fls. & Frt.: November – February

Fruit and seed collection and their processing:

Fresh, mature fruits were collected during January – February from standing tree by shaking or biting the branches. Fallen fruits were discarded. Fruits were washed and seeds were extracted. The washed seeds were air dried in shade and then stored in muslin bags along with ash for few days.

Nursery technique:

Immediate sowing of seeds is preferred for better germination due to recalcitrant nature. Seeds were soaked in water for 2 hrs. and then sown in polybags at the depth of 1 inch (seeds must not be sown very deep). Germination starts from 30 days and continues up to 60 days. The germination was about 80%. Germination was hypogeal. The seedlings were kept under shade but in open situations. The seedlings were watered at an interval of a day.

Garcinia talbotii Raiz. ex Sant.

Family: Clusiaceae

It occurs in wet semi evergreen to evergreen forests of Western Ghats. It is endemic to Western Ghats. It is commonly known as Limboi, Pansara, Phansada, Tavir (Marathi); Talbot Garcinia, Monkey Fruit tree (English). Yellow coloured gum is extracted from the tree.

Status: Endemic

Botanical description:

Tree, 5-10 m. tall, branches angular; leaves coriaceous, broadly oblong, obtuse, rounded at base, lateral nerves 16-18 pairs, prominent on both surfaces; male flowers short, congested, greenish white, stamens in 5 phalanges, anti-petalous; female flowers in fascicles, ovary globose, stigma 3 lobed; berries 4-6 cm. across, oblong, yellow, seeds recalcitrant.

Fls. & Frt.: December - January

Fruit and seed collection and their processing:

The ripe fruits were collected during December – January. The fruits were collected from standing tree by shaking the branches. Fruits were washed to remove pulp and seeds were extracted. Fallen fruits if not deteriorated can be collected. The seeds were stored in plastic jars dressed with ash for 6 months.

Nursery Technique:

The washed seeds were soaked in germinator solution (20%) for 2 hrs. The pre-treated seeds were sown in polythene bags at the depth of 1 inch. Germination is about 67-70%. Seedlings were kept in shade and watered at interval of a day.

Hardwickia binnata Roxb.

Family: Caesalpiniaceae

It is a native species of tropical south - SE Asia. It is commonly known as Anjan (Marathi); Kamara (Kannada); Acha (Tamil); Yepi (Telagu); papri (Nepali); Indian Blackwood (English). It occurs in dry and hot low lying regions. It is widely cultivated by forest department in dry regions. It yields an extremely hard, heavy and durable timber which has great economic value.

Status: Endemic

Botanical Description:

Trees 6 -7 m tall, deciduous; leaflets 1 pair, 1.5 – 3.1 x 2.0 – 3.4 cm., obliquely ovate, sub-sessile; flowers yellowish green, in axillary and terminal panicle; pods 5-6 x 1.5 – 2.0 cm., strap shaped, veined, narrowed at both ends, seeds solitary, orthodox.

Fls. & Frts.: August – January

Fruit and seed collection and processing:

The ripen pods were collected during April – May. The pods were collected by shacking or biting the branches. The fallen pods were also collected if not damaged. The pods were kept in shade where they dehisce to release seeds. The pods and seeds can be stored for more than two years.

Nursery technique:

The seeds were soaked in cold water for 10 -12 hrs. before sowing. Seeds were sown at the depth of 2 cm. and seedling emergence occurs after 10 days which continues up to 30 days. The germination was 75 -80 %. The germination is epigeal. The seedlings were kept in open sunlight and watered at an interval of a day. Seedlings show infestation by larvae of *Enarmonia palamedes* which defoliate the seedling. In mature tree it feeds on flowers and seed. Larvae of *Pachymerus gonagra* bore into the seed.

Holigarna arnottiana Hook. f.

Family: Anacardiaceae

It occurs in evergreen forests of Western Ghats. In Maharashtra it occurs at Ratnagiri, Sindhudurg and Wardha. It is endemic to Western Ghats. It is commonly known as Ran bibba (Marathi); Chera (Mal); Black Varnish tree (Eng.). The black resin is used in varnish and water proofing the boats and furniture.

Status: Endemic

Botanical Description:

Trees 10 – 25 m tall; leaves 10 -28 x 4 -12 cm, oblanceolate, coriaceous, acute at apex, glabrous; flowers in axillary and terminal panicles, rusty tomentose, flowers 0.3 cm across, greenish yellow; drupes 2.5 x 1.5 cm, obliquely ovoid, completely enclosed in receptacle, brownish – black, resinous, seeds recalcitrant.

Fls. & Frts: January – June

Seed collection and processing:

Fruits were collected in the month of April – May. The fruits were collected by biting or shaking the branches. The fallen fruits were also collected if not attacked by insects or fungi. The extraction of seeds is very difficult because it can cause allergy due to the resin. The intact fruits were washed with water.

Nursery technique:

The washed fruits were soaked in germinator solution for 2 hrs. Then seeds were sown in polythene bags at the depth of 1.5 cm near the soil surface. The germination is about 58 - 60 %. The germination is hypogeal. The seedlings were kept in shade and watered regularly at an interval of a day.

Holigarna grahamii Kurz

A threatened species in semi evergreen forests of Western Ghats. In Maharashtra it occurs at Kolhapur, Pune, Raigad, Satara and Sindhudurg. It is commonly known as Ranbibba, Jangalibibba (Marathi) Black Varnish tree (Eng.). Black resin used in varnish. Wood is suitable for matches and packing cases.

Status: Endemic

Botanical Description:

Trees 10 - 25 m tall; leaves 20 - 40 x 10 - 15 cm, oblanceolate, tomentose, triangular above middle, decurrent into petiole, acute at apex, cuneate at base; flowers in terminal panicles; flowers white, drupes 1.0 - 2.8 x 0.5 - 1.5 cm, obliquely ovoid; seeds exerted, recalcitrant.

Fls. & Frts.: December – June

Seed collection and processing:

The ripen fruits were collected during May – June. The fruits were collected from standing tree by biting the branches. The fallen fruits were also collected. The extraction of seed is very difficult because it can cause allergy. The fruits were washed thoroughly with water.

Nursery technique:

The washed fruits were soaked in germinator solution for 2 hrs. Then seeds were sown in polythene bags at the depth of 1.5 cm near the soil surface. The germination is about 58 - 60 %. The germination is hypogeal. The seedlings were kept in shade and watered regularly at an interval of a day.

Mesua ferrea, L.

(syn. *Calophyllum nagassarium* Burm. f., *Mesua nagassarium* (Burm. f.) Kosterm)

Family: Clusiaceae

It occurs in semi-evergreen forests. It mostly found near temples and in sacred groves. It occurs in Kerala, Tamil Nadu, Maharashtra, Andaman & Nicobar Islands. It is commonly known as Nagkesar (Sanskrit); Gajapushapam (Hindi) Nagchapha, Nagchampa, Thorachampa (Marathi); Cobra's Saffron, Ceylon ironwood (Eng.). It is medicinally very important. It is national tree of Sri Lanka.

Status: Endemic

Botanical description:

A tall tree, oleoresin aromatic, bark ash coloured; leaves elliptic-oblong or lanceolate, pale green above, glaucous beneath; flowers white, 8-10 cm. across, shortly pedicellate, sepal orbicular, 1-2 cm. across, densely pilose, petals 4; stamens numerous, yellow, forming a globose mass; drupes woody, ovoid with conical point, surrounded by enlarged sepals, seeds 1-4, smooth, somewhat angular, endosperm oily, recalcitrant.

Fls. & Frt.: March- May

Fruit and seed collection and processing:

Fresh, healthy and mature fruits were collected during March – May. Fruits were collected by shaking off the branches of standing tree. The fallen fruits were not collected. The infested seeds were discarded. The seeds were extracted and cleaned. Storage of fruits and seeds is not possible due to recalcitrant nature and oily endosperm.

Nursery technique:

Sowing of seeds should be done as early as possible because of attack of insects. Seeds were soaked in germinator solution for 2 hrs. Seeds were sown in nursery beds at the depth of 1 ½ inch. The seed germination starts after 30 – 45 days. Germination is hypogeal type. Germination is about 80-85%. The transfer of seedlings to polybags was done after about 10 months. The seedlings were kept in shade and watered at an interval of a day.

Pterocarpus marsupium Roxb.

Family: Fabaceae

It is native to Sri Lanka. It occurs in dry regions. It is commonly found in Gujarat, Madhya Pradesh, Uttar Pradesh, Bihar and Orissa. It is commonly known as Bivala (Marathi); Bibla (Hindi); Honne bange (Kannada); Venagi (Tamil); Indian Kino tree (Eng.). The bark contains red coloured resin which has medicinal properties.

Status: Vulnerable

Botanical Description:

A large deciduous tree; bark thick, yellowish grey; leaves 6- 9 in. long, rachis glabrous, leaflets 5- 7, coriaceous, obtuse, rounded, truncate at apex, glabrous on both surfaces; flowers in paniculate raceme, usually shorter than leaves; calyx brown pubescent, uppermost larger; corolla pale – yellow, with crisped margins; stamens monadelphous; ovary shortly stalked; pods 1-2 in. in diameter, nearly circular, wings veined, seeds small, solitary, orthodox.

Fls. & Frts.: May – June

Fruit and seed collection and processing:

Ripe pods were collected during May Pods were collected by shaking the branches. Fallen pods were collected. The extraction of seed is very difficult. The air dried pods can be stored in plastic jar for more than a year.

Nursery techniques:

The wings around the seed were removed. The seeds with fibrous covering were soaked in water for two hrs. The seeds were sown in polythene bags. The germination occurs after 15 days. The growth of seedlings was very slow. Seedlings were kept in open and watered at an interval of a day.

Syzygium laetum (Buch.-Ham.) Gandhi

Family: Myrtaceae

Syzygium laetum is endemic to Southern Western Ghats and central and south Maharashtra Sahyadri's. It occurs in evergreen forests. It is commonly known as Dev Jambhul (Marathi), Kollinjaval (Malayalam). The fruits were eaten by monkeys and squirrels.

Status: Endemic

Botanical Description:

Trees 8 – 10 m tall; leaves 5 – 8 x 2 – 4 cm, elliptic – lanceolate, subcoriaceous, punctuate, acuminate at apex, base narrowed; flowers 1.5 – 2.5 cm across, white, solitary or few flowered axillary cyme, calyx conical, petals orbicular; berries 2.5 x 1.6 cm, ovoid to ellipsoid, reddish brown, seed solitary, recalcitrant.

Fls. & Frts.: May

Fruit and seed collection and processing:

Ripe fruits were collected during May. The fruits were collected by climbing over the tree or biting the branches and collecting fallen fruits if not damaged. The fruits were depulped and seeds were removed. The seeds were washed with water to clean thoroughly.

Nursery technique:

The cleaned seeds were immediately sown because they lose viability after 4 -5 days after harvesting. The seeds were soaked in germinator solution for 2 hrs before sowing. The seeds were sown in polybags in shady and cool place. The germination is hypogeal. The seedlings were kept in shade throughout and watered at an interval of a day.

Calophyllum apetalum Willd.

Family: Clusiaceae

Status: Lower Risk / Least Concern

Botanical Description:

Large, evergreen trees; leaves 15 x 10 cm, coriaceous,

broadly elliptic-oblong, obtuse or retuse at apex, rounded at base, mid rib prominent on lower side; flowers in terminal or axillary lax racemes, white, sepals 4, ciliolate, petals 4, orbicular, stamens numerous, yellow, filaments irregularly united in 4 bundles; drupes 3 cm across, globose, smooth, yellow when ripe, stones hard, seeds recalcitrant.

Fls. & Frts.: March – April.

Fruit and seed collection and processing:

Ripe fruits were collected during April-May. The fruits were collected by climbing over the tree or biting the branches and collecting fallen fruits if not damaged. The fruits were depulped and seeds were removed. The seeds were washed with water to clean thoroughly.

Nursery technique:

The seeds wash and remove cover before sowing. The seeds were sown at the depth of 4-5 cm in coco peat. They were watered regularly at an interval of a day. Seedling emergence takes place after 30 days. After seeds germinate transfer seedlings in bags. The germination was 60 %. The cracking of endocarp shows better germination. The seedlings were kept in shade and watered regularly at an interval of a day.

Syzygium stocksii (Duthie) Gamble

Family: Myrtaceae

Syzygium stocksii is endemic Western Ghats. It occurs in evergreen forests. It is commonly known as Jambhul (Marathi).

Status: Endangered

Botanical Description:

Trees, branches tetragonous leaves membranous, elliptic oblong, obovate, shortly acuminate seed solitary, recalcitrant. A large lofty tree with small flowers in branched axillary cymes.

Fls. & Frts.: May

Fruit and seed collection and processing:

Ripe fruits were collected during April-May. The fruits were collected by climbing over the tree or biting the branches and collecting fallen fruits if not damaged. The fruits were depulped and seeds were removed. The seeds were washed with water to clean thoroughly.

Nursery technique:

The cleaned seeds were immediately sown because they lose viability after 3 - 4 days after harvesting. The seeds were soaked in germinator solution for 1-2 hrs before sowing. The seeds were sown in coco peat. Seeds are germination started after 10-12 days. The germination is hypogeal. The seedlings were kept in shade throughout and watered at an interval of a day.

Garcinia xanthochymus Hook.f. ex T.Anderson

Family : Clusiaceae

Garcinia xanthochymus is one of the important indigenous tree species. It is distributed to the Western Ghats region of India. It occurs in evergreen forests of Western Ghats. In Maharashtra it occurs in Ahmednagar, Ratnagiri, Sindhudurg, Goa, Karnataka – Chikmanglur, Coorg, Hassan, Mysore, N. Kanara, Shimoga, Tamil Nadu – Coimbatore, Nilgiris, Kerala – Throughout. It is commonly known as Mysore Gamboge, Sour mangosteen, False Mangosteen Hindi: Dampel, Malayalam: Anavaya, Bhaviyam, Thamalam, Marathi: Dharambo Kannada: Deavkai, Devagarige Tamil: Kulavi, Mukki, Tamalam It is cultivated for similar to *Garcini indica*. The ripe fruit is used as a tonic, invigorator, alexipharmic, good in heart complaints and biliousness. Fruits are given to reduce excess body weight.

Status: Indigenous

Botanical description:

Trees upto 10 m high, brachlets angular. Leaves oblog lanceolate, 16-36 X 3-12, acute or acuminate, smooth, shining. Male flowers fascicled on old wood, 2 cm long, sepals 5, ciliate, fleshy, orbicular, concave, persistent; petals 5, orbicular; stamens many in 5 bundles. Hermaphrodite flowers similar to male. Ovary ovoid, pointed; stigma 5-lobed, oblong, spreading. Fruit large of a middle sized apple, smooth, deep yellow when ripe. Seeds 1-1804, oblong.

Fls. & Frt.: January to July

Fruit and seed collection and their processing:

Fresh, mature fruits were collected during January – February from standing tree by shaking or biting the branches. Fallen fruits were discarded. Fruits were washed and seeds were extracted. The washed seeds were air dried in shade and then stored in muslin bags along with ash for few days.

Nursery technique:

Immediate sowing of seeds is preferred for better germination due to recalcitrant nature. Seeds were soaked in water for 5-6 hrs. and then sown in cocopeat at the depth of 7-10 cm. Germination starts from 25-30 days and continues up to 80 days. The germination was about 70%. Germination was hypogeal. The seedlings are kept in shade but in open. The seedlings are watered at an interval of a day.

Hopea ponga (Dennst.) Mabb.

Family : Dipterocarpaceae

Garcinia ponga is one of the important endangered tree species. It occurs in evergreen forests of Western Ghats.

Karnataka- Chikmangalur, Coorg, Hassan, Mysore, N. Kanara & S. Kanara, Shimoga, Goa, Kerala – Throughout, Tamil Nadu – Tirunelveli. It is commonly known as Kannada: Bilahagelu, Haiga, Marathi: Kalhoni, Kavsi, Malayalam: Ilapongu, Irumbakam, Pongu, Tamil: Ilapongu. Wood is used in building construction and also for making posts and cart wheels.

Status: Endangered

Botanical description:

Large trees, 15-20 m tall; branchlets pubescent. Leaves 15-25 X 4-8 cm, alternate, elliptic-oblong, apex acute or obtuse, base rounded; petiole 0.8-1 cm long, swollen. Flowers 5-6mm long, pinkish-white, in axillary or terminal panicles; peduncle upto 18 cm long; pedical short. Calyx reddish, united at base; lobes 5, unequal, 2 enlarged, wing-like in fruits. Petals 5, free, hairy without. Stamens about 15; filaments dilated at base; anthers 2-celled. Ovary 3-locular; ovules 2 in each locule; style short. Fruit indehiscent, 1-seeded, 2-winged; wings 4 X 1 cm, oblong, emarginated.

Fls. & Frt.: May-June

Fruit and seed collection and their processing:

Fresh, mature fruits were collected during March to September from standing tree by shaking or biting the branches. Fallen fruits were collected.

Nursery technique:

Immediate sowing of seeds is preferred for better germination due to recalcitrant nature. Seeds were soaked in water for 5-6 hrs. and then sown in cocopeat at the depth of 3-5 cm. Germination starts from 15-20 days and continues up to 40 days. The germination was about 60%. The seedlings were kept under shade. The seedlings were watered at an interval of a day.

Vateria indica L.

Family : Dipterocarpaceae

Vateria indica is one of the important critically endangered tree species. It occurs in evergreen forests of Western Ghats. Maharashtra – Tillari, Sindhudurg, Goa, Karnataka – Chikmagalur, Coorg, Hassan, Mysore, N. Kanara & S. Kanara, Shimoga, Malayalam: Payana, Painimara, Payin Kannada: Bilidupa, Dhoopa, Saldhupa; Marathi: Dhup; Tamil: Attam, Kukkil, Vallei. The resin is applied in hemicrania and tuberculous glands, boils. Smoke is given to the pregnant women and also in rheumatism. The bark is used as alexipharmic, cures cough, anemia, ear diseases, urinary discharges, skin eruptions, ulcers and wounds, useful in dysentery, leprosy and itch..

Status: Critically Endangered

Botanical description:

Large trees, 20-30 m high, bark white, branches clothed with stellate hairs. Leaves elliptic oblong, shortly pointed or obtuse, cordate or rounded at the base, glabrous. Flowers remote, in large terminal panicles, 15-20 cm long. Calyx divided nearly to the base, lobes oblong lanceolate, hairy on both surfaces, not enlarged in fruit, deflexed. Petals obtuse, white. Stamens numerous, anther connective adnate to apex, produced into subulate point; ovary pubescent, stigma small. Capsule oblong, 2-4 cm long, fleshy, 3-valved, valves 1 seeded.

Fls. & Frt.: May-June

Fruit and seed collection and their processing:

Fresh, mature fruits were collected during May-June. Fallen fruits near the plants. After collecting fruits wash thoroughly.

Nursery technique:

Immediate sowing of seeds is preferred for better germination due to recalcitrant nature. Seeds were soaked in water for 3-4hrs. and then sown in cocopeat at the depth of 1-2 inch. Germination starts from 20-40 days and continues up to 70 days. The germination was about 70%. The seedlings were kept under shade but in open situations. The seedlings were watered at an interval of a day.

Pterospermum reticulatum Wight & Arn.

Family : Malvaceae Juss.

Pterospermum reticulatum is one of the important endemic tree species. It occurs in evergreen-semi evergreen forests of Western Ghats, Karnataka- North Kanara, Kerala – Throughout, Tamil Nadu – Coimbatore, Tiruchirappalli, Malayalam: Malaviriam,Tamil: Mulipolavu, Thopuli. Wood is good timber.

Status: Vulnerable

Botanical description:

Large tree, to 25 m tall; young branches rusty, stellate-pubescent. Leaves 13-15 X 4-7cm, alternate, oblong, entire or coarsely toothed towards the apex, base oblique, sub cordate or rounded, basal nerves 3-4, prominent beneath, glaucous and stellately grey-hairy beneath, petiole 1.2 cm long; stipules caduceus. Bracteoles trichotomously lobed, laciniate. Capsule 7 X 3 cm, axillary, solitary, cylindrical or oblong, apex acute, narrowed at base, 5-valved; with papery, obliquely obtuse at apex; stalk 1 cm long; calyx persistent, 3.5 cm long.

Fls. & Frt.: March-May

Fruit and seed collection and their processing:

Fresh, mature fruits were collected during April. Fallen fruits near the plants.

Nursery technique:

Immediate sowing of seeds is preferred for better germination. Seeds were sown in coco peat at the depth of 3-4 cm. Germination starts from 12-20 days and continues up to 30 days. The germination was about 80%. The seedlings were watered at an interval of a day.

Arenga wightii Griff.

Arenga wightii is one of the important endemic palm. This palm commonly grows in the evergreen forests of the Western Ghats. It is a clustering palm.

Status: Vulnerable

Botanical description:

Stem grows up to a height of 10 m and a diameter of 30 cm. The stem is densely clothed with fibrous remains of leaf sheaths. The pinnate leaves are 4-7 m long and the leaflets are dark green above and white beneath, with two auricles at the base and small teeth and lobes along the margins. The leaflets spread in almost a flat plane on either side of the rachis. Inflorescences are produced among the leaves; flower branches are simple and pendulous, to 110 cm long, flowers are arranged in triads, 2 lateral males and one central female flower. Fruits are nearly round, bluish green to black when ripe.

Fls. & Frt.: March-May

Fruit and seed collection and their processing:

The palm flowers once in its lifetime. Several inflorescences are produced from apex downwards and when the last inflorescence matures, the palm dies. The fruits contain Calcium oxalate crystals and should be handled with care.

Nursery technique:

A shade loving palm. It prefers well drained soil**.** Seeds are slow to geminate and the germination percentage also is very low, 50%.

Bentinckia condapanna *Bentinckia condapanna* is one of the important endemic palm. It is distributed to the Western Ghats of India. This palm commonly grows in the evergreen forests of the Western Ghats. This palm is endemic to the southern parts of the Western Ghats. It occurs in the evergreen forests at 1000-1400 m elevation, generally found in less accessible, steep, rocky slopes. The generic name is after William Henry Cavendish Bentick, Governor General of the East Indies during 1774-1839. The specific name comes from its local name, Condapana. Conda is the word used to describe a characteristic, rather casual hair style, commonly worn by women of South India. The similarity between the 'conda' hair style and the just opened inflorescence of the palm is striking even from a distance. Pana means palm.

Status: Vulnerable

Botanical description:

This is a solitary, unarmed, pinnate leaved palm. Stem is slender, ringed and reaches up to 10 m in height and about 15 cm in diameter. Leaves are 1-1.5 m long, somewhat arching to spreading, becoming pendulous, neatly abscising. The thick and tubular leaf sheaths form a conspicuous crown shaft. Leaflets are in 30-40 pairs, 60 x 2.5-4 cm, basal leaflets sometimes united, tips bifid with small brown scales on both surfaces. Inflorescence is produced below the leaves and is completely covered with two violet coloured bracts. Fruit bright chocolate coloured when ripe, 1.3-1.5 cm in diameter, seed shining brown, conspicuously grooved.

Fls. & Frt.: December

Nursery technique:

Plants require well drained soil in an open area. Propagation is through seeds. Each fruit contains a single seed. The germination and survival percentages are very poor, 10-20%. Very slow growing in the seedling stage. It is a light demander and requires full sunlight in the later stages.

Borassus flabellifer L.

The palmyra palm is best known for its multifarious products and uses. The oldest known use of this palm is probably the use of its leaves for writing purposes. Besides, other products like edible fruits, toddy and jaggery have been known from time immemorial. Several kinds of fibres are extracted out of this palm, especially from the leaf base. The leaves and trunks are used in local construction. Leaves are used for making a variety of fancy items. All parts of the palm are used as fuel.

Status: Least concern

Botanical description:

This is a solitary, fan leaved palm. Male and female plants are separate. Stem attains 10-30 m height and 60 cm diameter, deep grey or black in colour with annular leaf scars. Persistent leaf bases are seen in young trees. Leaves rigid, crown more or less round with evenly projecting leaves; leaf base split at base. Inflorescence is produced among the leaves. Male inflorescence is with stout cylindric branches while female inflorescence is sparingly branched. Fruits globose, 15-20 cm in diameter, deep brown turning black when ripe. Fruit contain one to three large seeds surrounded by a layer of juicy and edible endosperm.

Fls. & Frt.: March to September

Nursery technique:

The seeds are best sown in their permanent position in the garden because, once germinated, the seedlings are

firmly anchored to the ground and it is difficult to take them out without damage. The species is a light demander and very sensitive to cold. It needs excellent drainage. Seeds take two to six-twelve months to germinate.

Caryota urens L.

Caryota urens L. is one of the important indigenous palms. It is distributed throughout India. The palm is solitary and the most distinctive feature is the bipinnate fronds with unusually shaped leaflets. The species is monocarpic, the plants die after fruiting.

Status: Least concern

Botanical description:

Stem is 16-20 m high and to 60 cm in diameter, grey, leaf scars annular. Leaves 3-4 m long, with bright green and shiny leaflets one margin of which is sharply and irregularly toothed and the other produced into a tail; leaf sheath triangular, eroding opposite the petiole into a mass of strong black fibres. Inflorescence carries unisexual flowers of both sexes. The first formed inflorescence is from the axil of the terminal leaflet. The remaining inflorescences are produced from apex downwards. Inflorescence branches are simple, very long, pendulous, level topped resembling a huge docked horse tail. Fruit globose, 1.8-2 cm in diameter, red at maturity, the fleshy part is with irritant needle like crystals.

Fls. & Frt.: The palm flowers once in its life time and dies once the fruits on the lower most inflorescence, which is the youngest, mature.

Fruit and seed collection and their processing:

Since the fruits contain calcium oxalate crystals, they should be handled with care. Several inflorescences are produced from apex downwards and when the last inflorescence matures, the palm dies.

Nursery technique:

Germination percentage is about 90 and once established the palm is fast growing. They will tolerate sun and require deep rich soil for good growth. Fresh seeds germinate within 2- 6 months after sowing. The palm is very fast growing.

Corypha umbraculifera L.

The generic name is from the Greek *coryphe* – summit or hill top, probably a reference to the spectacular terminal inflorescence. The open inflorescence looks like an open umbrella, hence the specific name

Status: Data deficient

Botanical description:

This is a huge, solitary, monocarpic palm with dark grey stem with distinct leaf scars. Stem 10-15 m long and to 90 cm in diameter, leaf base persistent from middle to upper part of the stem. Leaves costapalmate, very large, about 5m across, divided to the middle into 80-100 segments; leaf sheath is having a triangular cleft below the petiole; petiole is about 3 m long and massive. Inflorescence is produced terminally. Flowering plants are an impressive sight with a terminal inflorescence of more than 6m high and bearing millions of tiny cream coloured flowers. Fruits take about 12 months to mature. Ripe fruits are pale green, globose, 3 cm in diameter.

Fls. & Frt.: The palm flowers once in its life time when 40-50 years old.

Fruit and seed collection and their processing:

The palm flowers once in its lifetime. Fallen fruits were collected.

Nursery technique:

The seeds are best sown in their permanent position in the garden because, once germinated, the seedlings are firmly anchored to the ground and it is difficult to take them out without damage. The palm is very slow growing. Once established, plants are very hardy and can tolerate adverse climatic conditions.

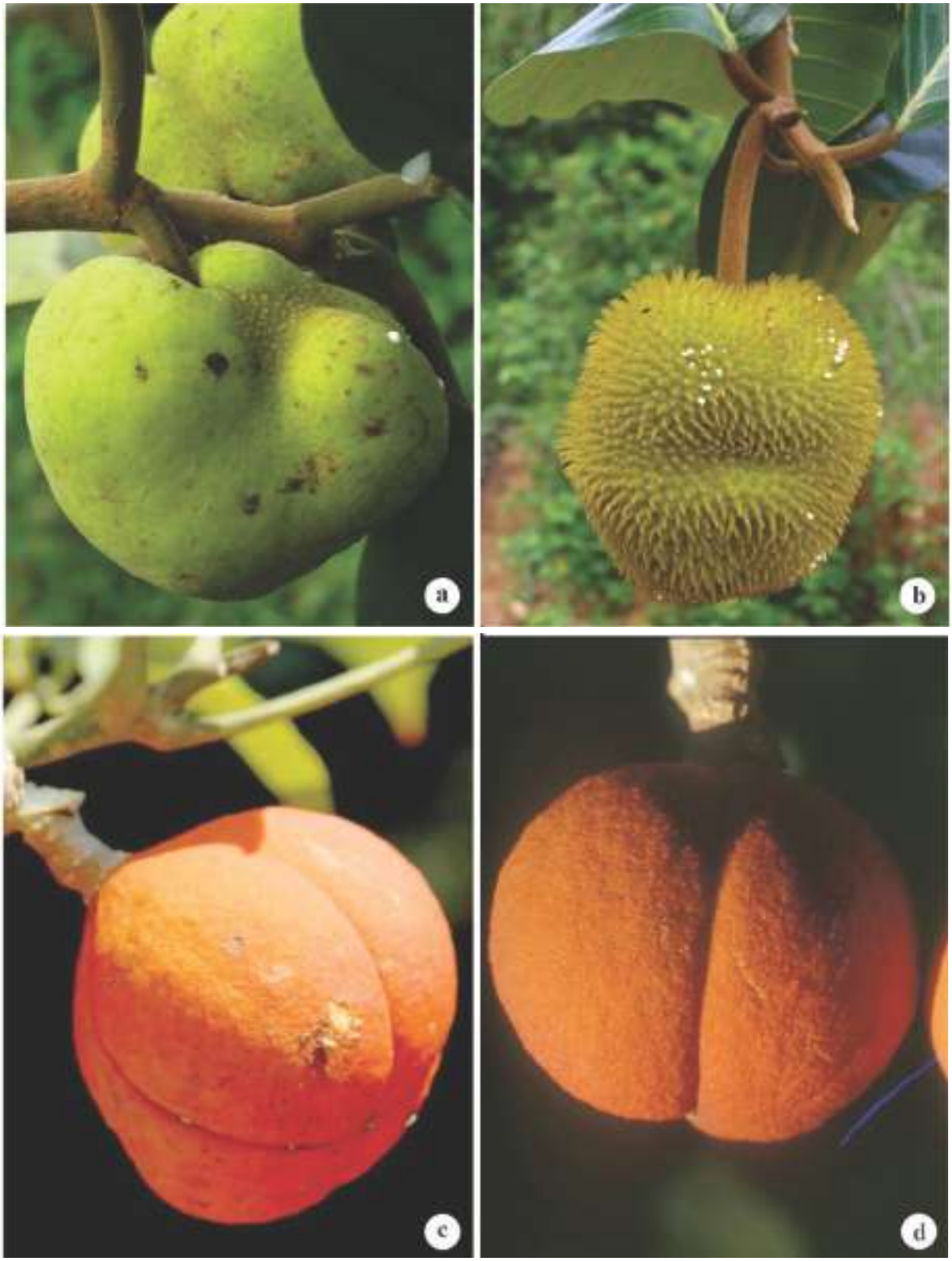


Plate- XVII: a. Artocarpus lakoocha, b. Artocarpus hirsutus, c. Dysoxylum binectariferum, d. Dysoxylum malabaricum

Plate- XVIII: a. Hydnocarpus pentandrus, b. Canarium strictum, c. Dipterocarpus indicus, d. Vateria indica

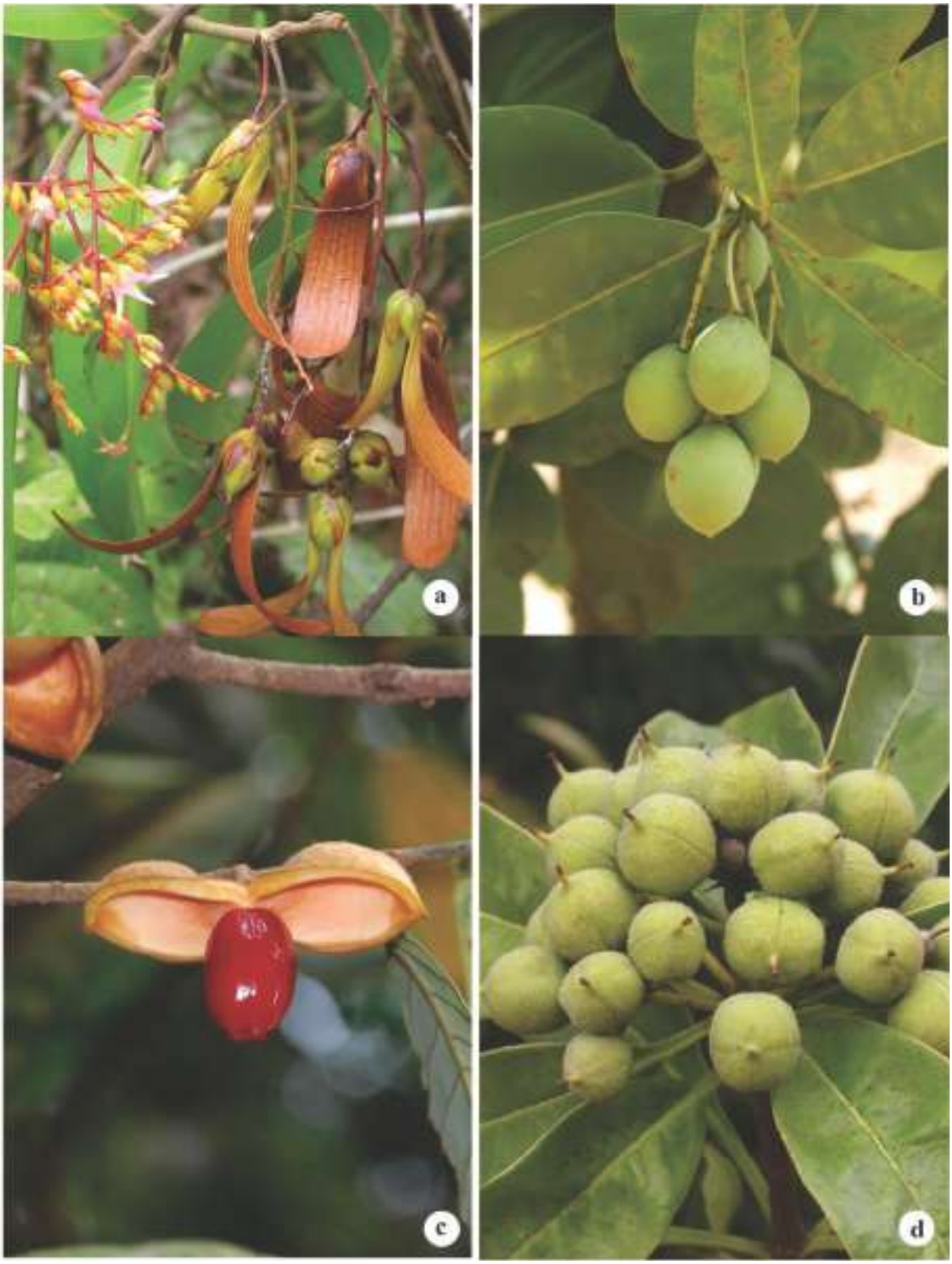


Plate- XIX: a. Hopea ponga, b. Calophyllum inophyllum, c. Knema attenuata, d. Pittosporum dasycaulon

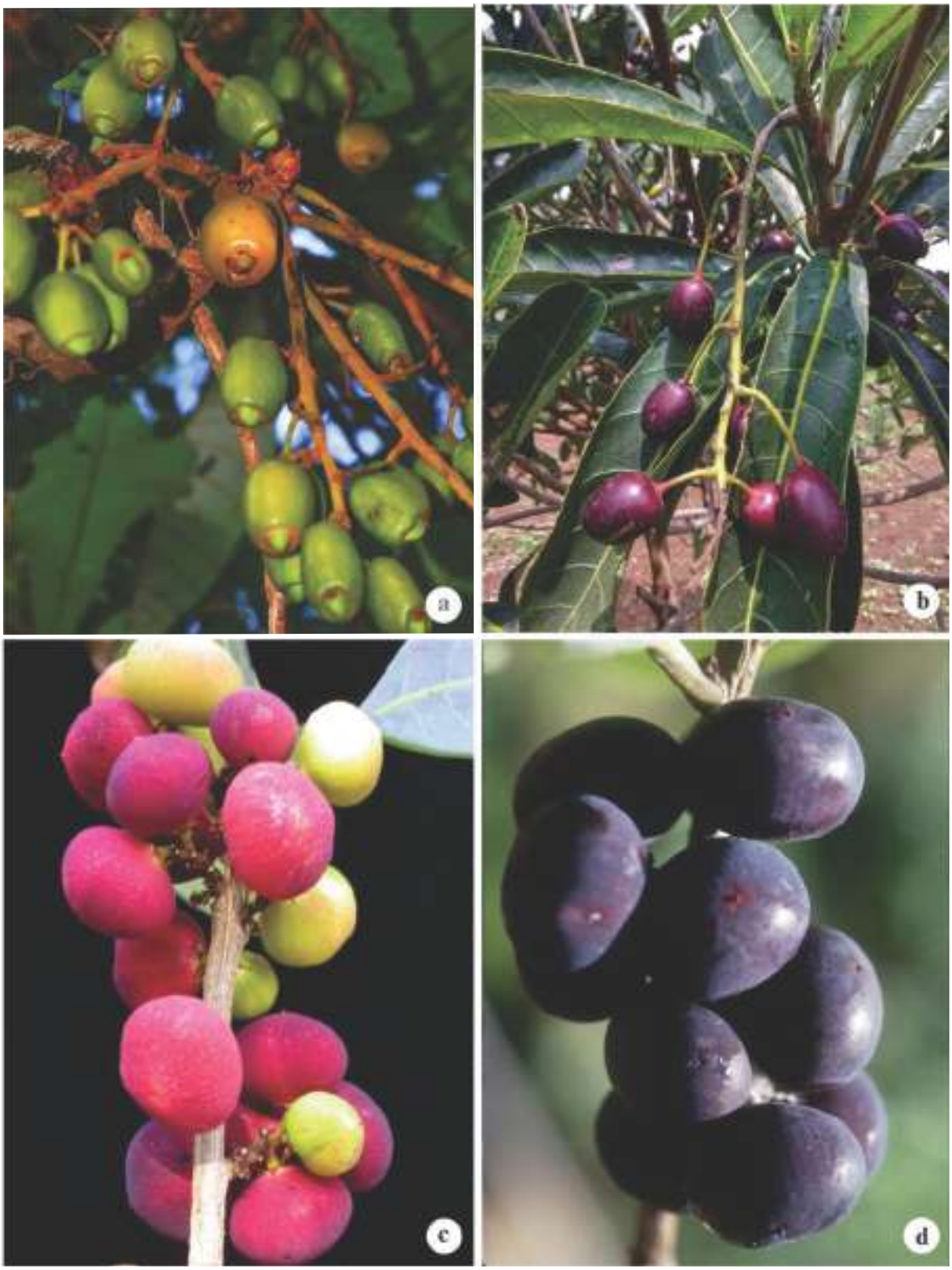


Plate- XX: a.Holigarna grahamii, b. Holigarna arnottiana, c. Nothopegia racemosa, d. Nothopegia castaneifolia

Annexure 3

Plantations of Arboretum

Sr. No.	Name of the species
1	*Anthocephalus cadamba* (Roxb.) Miq
2	*Aglaia barberi* Gamble
3	*Ailanthus triphysa* (Dennst.) Alston
4	*Annona squamosa* L.
5	*Artocarpus gomezianus* Wall. ex Trécul
6	*Artocarpus heterophyllus* Lam.
7	*Artocarpus hirsutus* Lam.
8	*Artocarpus incisus* (Thunb.) L. f.
9	*Atalantia racemosa* Wight & Arn.
10	*Barringtonia speciosa* J.R. Forst. & G. Forst.
11	*Beilschmiedia dalzellii* Kosterm.
12	*Buchanania lanzan* Spreng.
13	*Calophyllum apetalum* Willd.
14	*Calophyllum inophyllum* L.
15	*Cananga odorata* (Lam.) Hook. f. & Thomson
16	*Canarium strictum* Roxb.
17	*Carpentaria acuminata* (H. Wendl. & Drude) Becc.
18	*Caryota urens* L.
19	*Cassia siamea* Lam.
20	*Castanospermum australe* A. Cunn. & C. Fraser
21	*Chrysophyllum roxburghii G.Don*
22	*Chrysophyllum cainito L.*
23	*Cochlospermum religiosum* (L.) Alston
24	*Combretum coccineum* (Sonn.) Lam.
25	*Corypha umbraculifera* L.
26	*Cycas circinalis* L.
27	*Delonix regia* (Bojer ex Hook.) Raf.
28	*Dillenia indica* L.
29	*Dillenia pentagyna Roxb.*
30	*Diospyros discolor Willd.*
31	*Diospyros embryopteris Pers.*
32	*Durio zibethinus Rumph. ex Murray*
33	*Dysoxylum binectariferum (Roxb.) Hook. f. ex Bedd.*
34	*Dysoxylum malabaricum Bedd. ex C. DC.*
35	*Elaeocarpus grandiflorus Sm.*
36	*Emblica officinalis Gaertn.*
37	*Ensete glaucum (Roxb.) Cheesman*
38	*Entada rheedei Spreng.*
39	*Erinocarpus nimmonii J. Graham*
41	*Ficus benghalensis L.*
42	*Ficus auriculata Lour.*
43	*Ficus racemosa L.*
44	*Flacourtia montana J. Graham*
45	*Garcinia gummi-gutta Roxb.*
46	*Garcinia indica Choisy*
47	*Garcinia talbotii (Talbot) Raizada ex Santapau*
48	*Garcinia xanthochymus Hook. f.*
49	*Gmelina arborea Roxb. ex Sm.*
50	*Gnetum ula Brongn.*
51	*Grevillia robusta R. Br.*
52	*Grewia umbellifera Bedd.*
53	*Hardwickia binata Roxb.*
54	*Heritiera littoralis Aiton*
55	*Holigarna grahamii Kurz*
56	*Hopea ponga (Dennst.) Mabb.*
57	*Hydnocarpus pentandrus (Buch.-Ham.) Oken*
58	*Ixora coccinea L.*
59	*Jaquinia keyensis Mez*
60	*Khaya senegalensis (Desr.) A. Juss.*
61	*Lophopetalum wightianum Arn.*
62	*Macaranga peltata Boivin ex Baill.*
63	*Mammea suriga (Buch.-Ham. ex Roxb.) Kosterm.*
64	*Mesua ferrea L.*
65	*Muntingia calabura L.*
66	*Musa sp.*
67	*Nothopegia colebrookiana (Wight) Blume*
68	*Olea dioica Roxb.*
69	*Oroxylum indicum (L.) Kurz*

Sr. No.	Name of the species
70	*Persea macrantha (Nees) Kosterm.*
71	*Pterocarpus marsupium Roxb.*
72	*Pterospermum reticulatum Wight & Arn.*
73	*Pterospermum rubiginosum B.Heyne ex Wall.*
74	*Putranjiva roxburghii Wall.*
75	*Ravenala madagascariensis Sonn.*
76	*Salacia chinensis L.*
77	*Sapindus laurifolia*
78	*Saraca asoca (Roxb.) De Wilde*
79	*Schefflera elliptica (Blume) Harms*
80	*Shorea robusta Gaertn.*
81	*Simarouba glauca DC.*
82	*Spondias mangifera Willd.*
83	*Sterculia gutata Roxb.*
84	*Strychnos nux-vomica L.*
85	*Swietenia macrophylla King*
86	*Swietenia mahagoni (L.) Jacq.*
87	*Syzygium travancoricum Gamble*
88	*Terminalia catappa L.*
89	*Vateria indica L.*
90	*Adonidia merrillii (Becc.) Becc.*
91	*Aiphanes caryotifolia (Kunth) H.Wendl.*
92	*Areca triandra Roxb. exBuch.-Ham.*
93	*Arenga wightii Griff.*
94	*Bentinckia condapanna Berry ex Roxb.*
95	*Borassus flabellifer L*
96	*Calamus nagabettai*
97	*Calamus thwaistii*
98	*Carpentaria acuminata (H. Wendl. &Drude) Becc.*
99	*Caryota urens*

Sr. No.	Name of the species
100	*Caryota mitis Lour.*
101	*Coccothrinax argentata (Jacq.) L.H. Bailey*
102	*Corypha umbraculifera L.*
103	*Dypsis decaryi (Jum.) Beentje& J. Dransf.*
104	*Dypsis lutescens (H. Wendl.) Beentje& J. Dransf.*
105	*Elaeis guineensis Jacq.*
106	*Hyphaene dichotoma(White) Furtado*
107	*Licuala grandis H. Wendl. ex Linden*
108	*Licuala peltata Roxb.*
109	*Licuala rumphii Blume*
110	*Licuala spinosa Wurmb*
111	*Livistona jenkinsiana Griff*
112	*Mascarina* sp.
113	*Nypa fruiticans*
114	*Phoenix pusilla*
115	*Phoenix robellenii*
116	*Phoenix sylvestris (L.) Roxb.*
117	*Pinanga dicksonii*
118	*Pritchardia pacifica Seem. & H. Wendl.*
119	*Ptychosperma macarthurii (H. Wendl. ex H.J. Veitch) H. Wendl. ex Hook. f.*
120	*Roystonea regia*
121	*Sabal palmetto (Walter) Lodd. exSchult. &Schult. f.*
122	*Syagrus romanzoffiana (Cham.) Glassman*
123	*Thrinax parviflora Sw.*
124	*Trachycarpus fortunei (Hook.) H. Wendl.*
125	*Trachycarpus martianus (Wall. ex Mart.) H. Wendl.*
126	*Trachycarpus takil*
127	*Wallichia disticha*
128	*Washingtonia filifera*
129	*Wodyetia bifurcata A.K. Irvine*

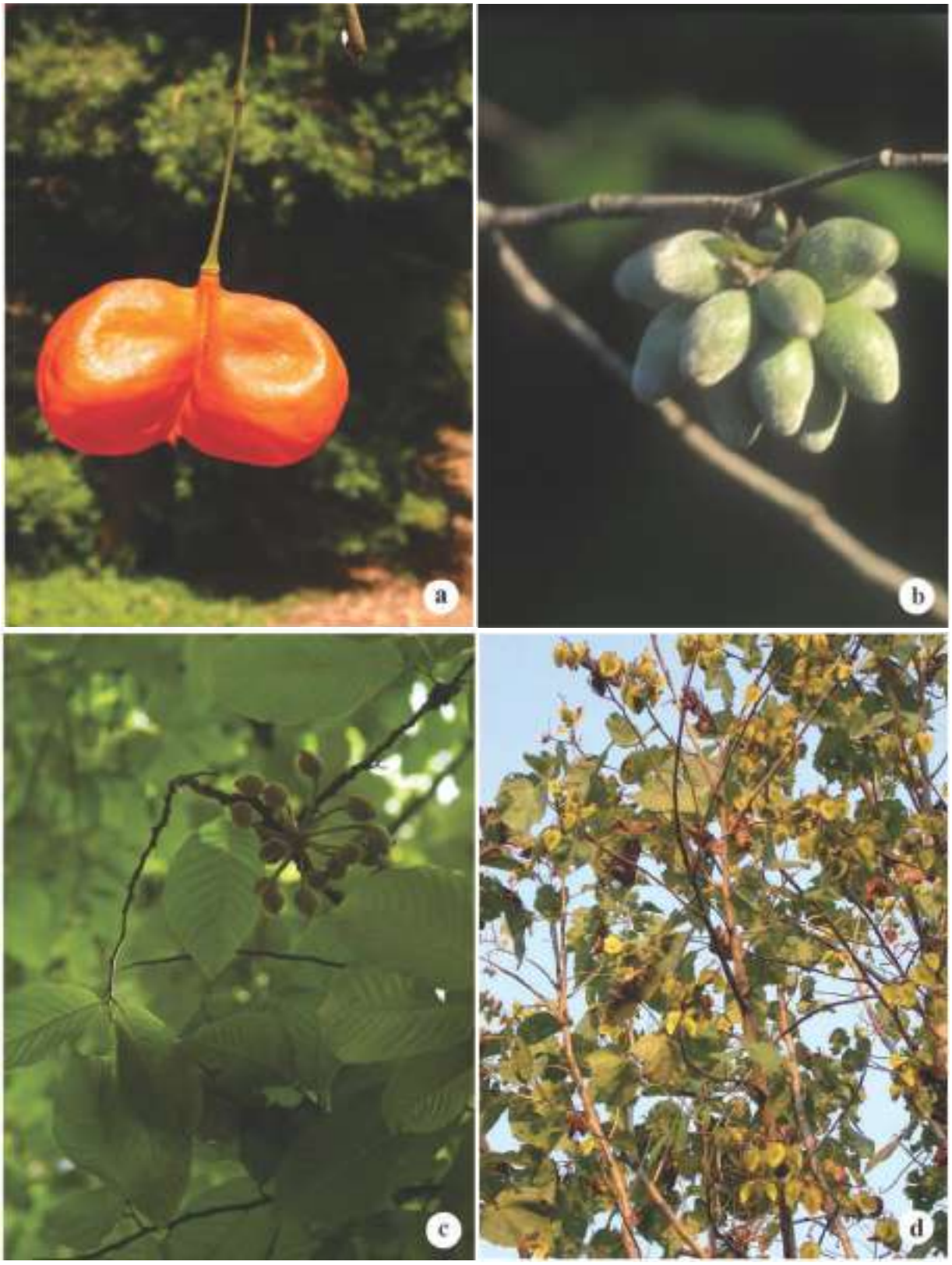


Plate- XXI: a. Harpullia arborea, b. Meiogyne pannosa, c. Polyalthia fragrans, d. Erinocarpus nimmonii

Plate- XXII: a. Hardwickia binata, b. Pterospermum reticulatum, c. Cullenia exarillata, d. Lophopetalum wightianum

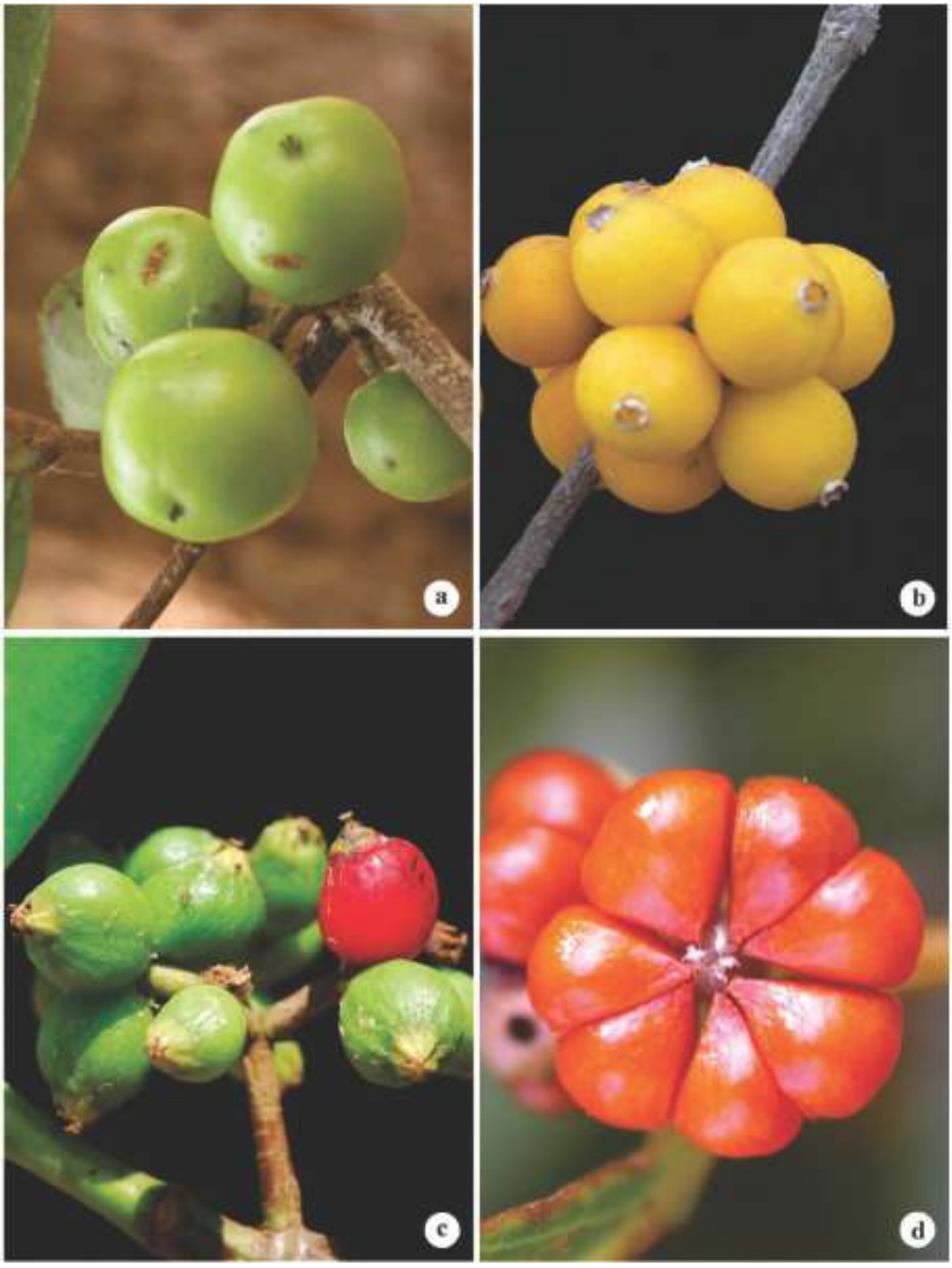


Plate- XXIII: a. Flacourtia montana, b. Memecylon talbotianum, c. Carallia brachiata, d. Glochidion ellipticum

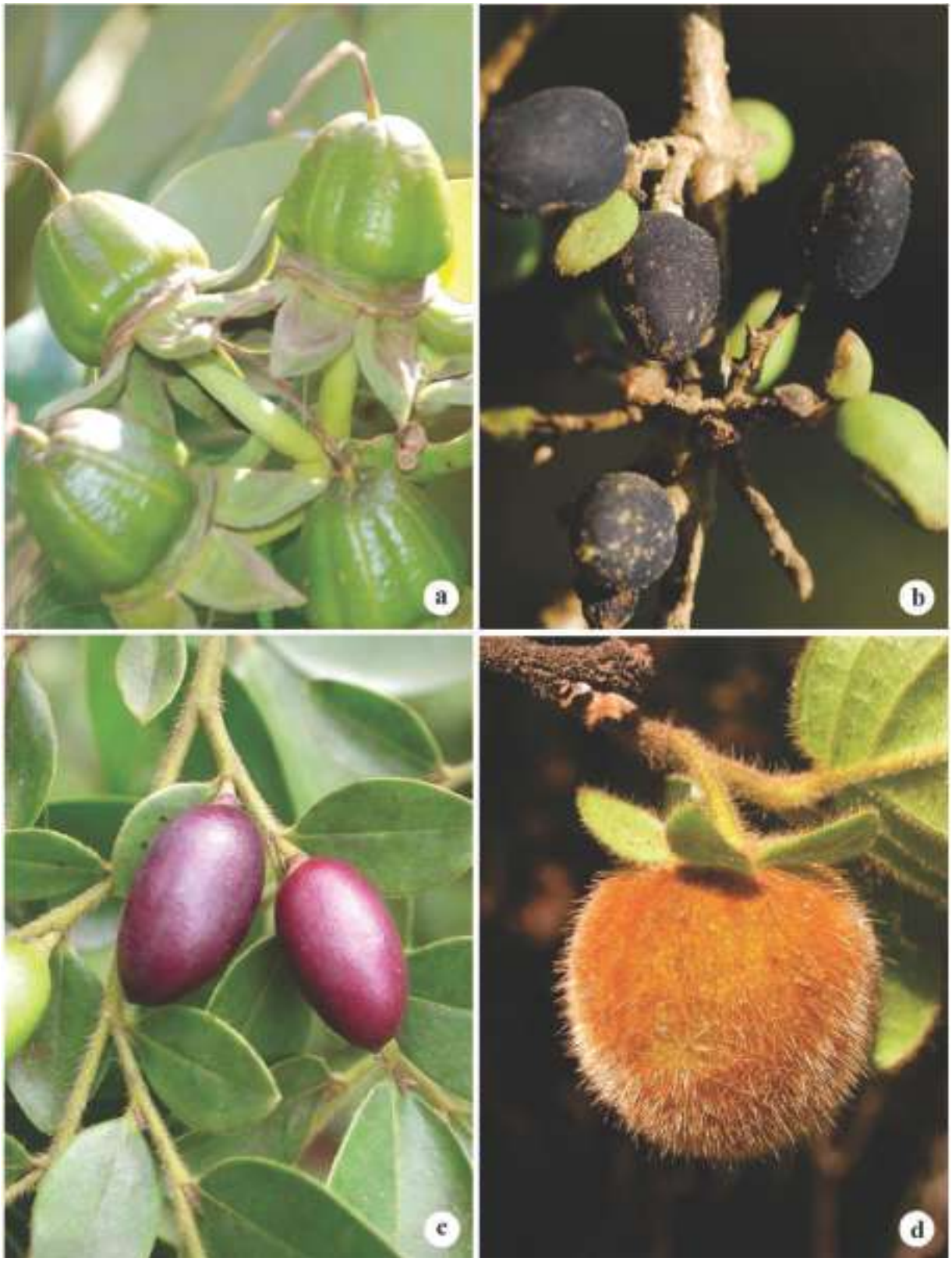


Plate- XXIV: a. Duabanga grandiflora, b. Chionanthus mala-elengi c. Diospyros buxifolia, d. Diospyros saldanhae

Annexure 4

List of Species in Nursery

Sr. No.	Name of Species	Family
1.	*Acacia concinna* (Willd.) DC.	Mimosaceae
2.	*Acacia farnesiana* (L.) Willd.	Mimosaceae
3.	*Adenanthera pavonina* L.	Mimosaceae
4.	*Aegle marmelos* (L.) Correa	Rutaceae
5.	*Aglaia barberi* Gamble	Meliaceae
6.	*Alangium salviifolium* (L. f.) Wangerin	Alangiaceae
7.	*Albizia amara* (Roxb.) Boivin	Mimosaceae
8.	*Annona muricata* L.	Anonaceae
9.	*Antiaris toxicaria* Lesch.	Moraceae
10.	*Aphanamixis polystachya* (Wall.) R. Parke	Meliaceae
11.	*Artocarpus gomezianus* Wall. ex Trécul	Moraceae
12.	*Artocarpus heterophyllus* Lam.	Moraceae
13.	*Artocarpus hirsutus* Lam.	Moraceae
14.	*Atalantia racemosa* Wight & Arn.	Rutaceae
15.	*Azadirachta indica* A. Juss.	Meliaceae
16.	*Barleria grandiflora* R. Br.	Acanthaceae
17.	*Barringtonia acutangula* (L.) Gaertn.	Barringtoniaceae
18.	*Bauhinia phoenicea* B. Heyne & Wall.	Caesalpiniaceae
19.	*Beilschmiedia dalzellii* Kosterm.	Lauraceae
20.	*Bombax ceiba* L.	Bombacaceae
21.	*Bombax insigne* Wall.	Bombacaceae
22.	*Boswellia serrata* Roxb. ex Colebr.	Burseraceae
23.	*Buchanania lanzan* Spreng.	Anacardiaceae
24.	*Butea monosperma* (Lam.) Taub	Fabaceae
25.	*Calophyllum apetalum* Willd.	Clusiaceae
26.	*Calophyllum inophyllum* L.	Clusiaceae
27.	*Canarium strictum* Roxb.	Burseraceae
28.	*Carallia brachiata* J. Graham	Rhizophoraceae
29.	*Careya arborea* Roxb.	Lecithydaceae
30.	*Cassia fistula* L.	Caesalpiniaceae
31.	*Cassine glauca* Kuntze	Celastraceae
32.	*Castanospermum australe* A. Cunn. & C. Fraser	Fabaceae
33.	*Chloroxylon switinia*	Flindersiaceae
34.	*Clausena anisata* (Willd.) Hook. f. ex Benth.	Rutaceae
35.	*Cochlospermum religiosum* (L.) Alston	Cochlospermaceae
36.	*Dillenia indica* L.	Dilleniaceae

Sr. No.	Name of Species	Family
37.	*Dillenia pentagyna* Roxb.	Dilleniaceae
38.	*Diospyros cordifolia* Roxb.	Ebenaceae
39.	*Diospyros crumenata* Thwaites	Ebenaceae
40.	*Diospyros paniculata* Dalzell	Ebenaceae
41.	*Dysoxylum binectariferum* (Roxb.) Hook. f. ex Bedd.	Meliaceae
42.	*Dysoxylum malabaricum* Bedd. ex C. DC.	Meliaceae
43.	*Elaeocarpus glandulosus* Wall. ex Merr.	Elaeocarpaceae
44.	*Elaeocarpus grandiflorus* Sm.	Elaeocarpaceae
45.	*Elaeocarpus tuberculatus* Roxb.	Elaeocarpaceae
46.	*Entada rheedei* Spreng.	Mimosaceae
47.	*Erythrina mitis* Jacq.	Fabaceae
48.	*Garcinia gummi-gutta* Roxb.	Clusiaceae
49.	*Garcinia indica* Choisy	Clusiaceae
50.	*Garcinia morella* Desr.	Clusiaceae
51.	*Garcinia pictoria* Buch.-Ham.	Clusiaceae
52.	*Garcinia talbotii* (Talbot) Raizada ex Santapau	Clusiaceae
53.	*Heritiera littoralis* Aiton	Malvaceae
54.	*Heterophragma quadriloculare* (Roxb.) K. Schum.	Bignoniaceae
55.	*Hiptage benghalensis* (L.) Kurz	Malphighiaceae
56.	*Holigarna arnottiana* Hook. f.	Anacardiaceae
57.	*Holigarna grahamii* Kurz	Anacardiaceae
58.	*Hopea parviflora* Bedd.	Dipterocarpaceae
59.	*Hopea ponga* (Dennst.) Mabb.	Dipterocarpaceae
60.	*Jacquinia keyensis* Mez	Theophrastaceae
61.	*Khaya senegalensis* (Desr.) A. Juss.	Meliaceae
62.	*Knema attenuata Warb.*	Myristicaceae
63.	*Lophopetalum wightianum* Arn.	Celastraceae
64.	*Madhuca latifolia* (Roxb.) J.F. Macbr.	Sapotaceae
65.	*Majidea zanguebarica* J. Kirk ex Oliv.	Sapindaceae
66.	*Mammea suriga (Buch.-Ham. ex Roxb.) Kosterm.*	Clusiaceae
67.	*Mangifera indica* L	Anacardiaceae
68.	*Manilkara littoralis* (Kurz) Dubard	Sapotaceae
69.	*Memecylon umbellatum* Burm. f.	Melastomaceae
70.	*Memecylon talbotianum* D.Brandis	Melastomaceae
71.	*Mesua ferrea* L.	Clusiaceae
72.	*Moringa concanensis* Nimmo	Moringaceae
73.	*Moullava spicata* (Dalzell) Nicolson	Caesalpiniaceae

Sr. No.	Name of Species	Family
74.	*Muntingia calabura* L.	Elaeocarpaceae
75.	*Myristica dactyloides* Gaertn.	Myristicaceae
76.	*Nothapodytes nimmoniana* (J. Graham) Mabb.	Icacinaceae
77.	*Nothopegia colebrookiana (Wight) Blume*	Anacardiaceae
78.	*Olea dioica* Roxb.	Oleaceae
79.	*Operculina tansenensis*	Convolvulaceae
80.	*Operculina turpethum* (L.) Silva Manso	Convolvulaceae
81.	*Oroxylum indicum* (L.) Kurz	Bignoniaceae
82.	*Otonephelium stipulaceum* Radlk.	Sapindaceae
83.	*Palaquium ellipticum* (Dalzell) Baill.	Sapotaceae
84.	*Persea macrantha* (Nees) Kosterm.	Lauraceae
85.	*Polyalthia fragrans* (Dalzell) Benth. & Hook. f.	Anonaceae
86.	*Polyalthia longifolia* (Sonn.) Thwaites	Anonaceae
87.	*Pongamia pinnata* (L.) Pierre	Fabaceae
88.	*Premna coriacea* C.B. Clarke	Verbenaceae
89.	*Prunus ceylanica* Miq.	Rosaceae
90.	*Pterocarpus dalbergioides* Roxb.	Fabaceae
91.	*Pterocarpus marsupium* Roxb.	Fabaceae
92.	*Pterospermum acerifolium* Willd.	Sterculiaceae
93.	*Pterospermum reticulatum Wight & Arn.*	Sterculiaceae
94.	*Pterospermum rubiginosum*	Sterculiaceae
95.	*Putranjiva roxburghii* Wall.	Euphorbiaceae
96.	*Sageraea laurifolia* (Graham) Blatt.	Anonaceae
97.	*Salacia chinensis* L.	Celastraceae
98.	*Santalum album* L.	Santalaceae
99.	*Sapindus laurifolius* Vahl.	Sapindaceae
100.	*Schleichera oleosa* (Lour.) Oken	Sapindaceae
101.	*Shorea robusta* Gaertn.	Dipterocarpaceae
102.	*Simarouba amara* Aubl.	Simaroubaceae
103.	*Spondias pinnata* (L. f.) Kurz.	Anacardiaceae
104.	*Sterculia gutata* Roxb.	Sterculiaceae
105.	*Strychnos nux-vomica*	Loganiaceae
106.	*Swietenia mahagoni* (L.) Jacq.	Meliaceae
107.	*Syzygium cumini* (L.) Skeels	Myrtaceae
108.	*Syzygium laetum* (Buch.-Ham.) Gandhi	Myrtaceae
109.	*Syzygium zeylanicum* (L.) DC.	Myrtaceae
110.	*Tamarindus indica* L.	Fabaceae

Sr. No.	Name of Species	Family
111.	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Combretaceae
112.	*Terminalia belerica* Roxb.	Combretaceae
113.	*Terminalia catappa* L.	Combretaceae
114.	*Terminalia elliptica* Willd.	Combretaceae
115.	*Thunbergia mysorensis* (Wight) T. Anderson	Thunbergiaceae
116.	*Uvaria narum* Blum.	Anonaceae
117.	*Vateria indica* L.	Dipterocarpaceae
118.	*Xantolis tomentosa* (Roxb.) Raf.	Sapotaceae
119.	*Zizypus species*	Rhamnaceae

Palms

Sr. No.	Name	Family
1	*Adonidia merrillii* (Becc.) Becc.	Arecaceae
2	*Aiphanes caryotifolia* (Linden) Burret	Arecaceae
3	*Areca catechu L.*	Arecaceae
4	*Areca triandra* Roxb. ex Buch.-Ham.	Arecaceae
5	*Arenga wightii* Griff.	Arecaceae
6	*Bentinckia condapanna* Berry ex Roxb.	Arecaceae
7	*Bentinckia nicobarica (Kurz) Becc.*	Arecaceae
8	*Carpentaria acuminata* (H. Wendl. & Drude) Becc.	Arecaceae
9	*Caryota mitis* Lour.	Arecaceae
10	*Caryota obtusa Griff.*	Arecaceae
11	*Caryota urens L.*	Arecaceae
12	*Coccothrinax argentata* (Jacq.) L.H. Bailey	Arecaceae
13	*Corypha umbraculifera* L.	Arecaceae
14	*Dypsis decaryi* (Jum.) Beentje & J. Dransf.	Arecaceae
15	*Dypsis lutescens* (H. Wendl.) Beentje & J. Dransf.	Arecaceae
16	*Elaeis guineensis* Jacq.	Arecaceae
17	*Hyphaene dichotoma (White) Furtado*	Arecaceae
18	*Licuala grandis* H. Wendl. ex Linden	Arecaceae
19	*Licuala peltata* Roxb.	Arecaceae
20	*Licuala rumphii Blume*	Arecaceae
21	*Licuala spinosa* Wurmb	Arecaceae
22	*Livistona jenkinsiana Griff*	Arecaceae
23	*Nypa fruticans Wurmb*	Arecaceae
24	*Phoenix dactylifera L.*	Arecaceae
25	*Phoenix loureiroi Kunth*	Arecaceae

Sr. No.	Name	Family
26	*Phoenix pusilla Gaertn.*	Arecaceae
27	*Phoenix roebelenii O'Brien*	Arecaceae
28	*Phoenix sylvestris (L.) Roxb.*	Arecaceae
29	*Pinanga gracilis Blume*	Arecaceae
30	*Pinanga manii Becc.*	Arecaceae
31	*Pinanga dicksonii (Roxb.) Blume*	Arecaceae
32	*Pritchardia pacifica* Seem. & H. Wendl.	Arecaceae
33	*Ptychosperma macarthurii* (H. Wendl. ex H.J. Veitch) H. Wendl. ex Hook. f.	Arecaceae
34	*Sabal minor (Jacq.) Pers.*	Arecaceae
35	*Sabal palmetto* (Walter) Lodd. ex Schult. & Schult. f.	Arecaceae
36	*Syagrus romanzoffiana* (Cham.) Glassman	Arecaceae
37	*Saribus rotundifolius (Lam.) Blume*	Arecaceae
38	*Thrinax parviflora* Sw.	Arecaceae
39	*Trachycarpus fortunei* (Hook.) H. Wendl.	Arecaceae
40	*Trachycarpus martianus* (Wall. ex Mart.) H. Wendl.	Arecaceae
41	Wallichia disticha T.Anderson	Arecaceae
42	Wallichia oblongifolia Griff.	Arecaceae
43	*Wodyetia bifurcata* A.K. Irvine	Arecaceae

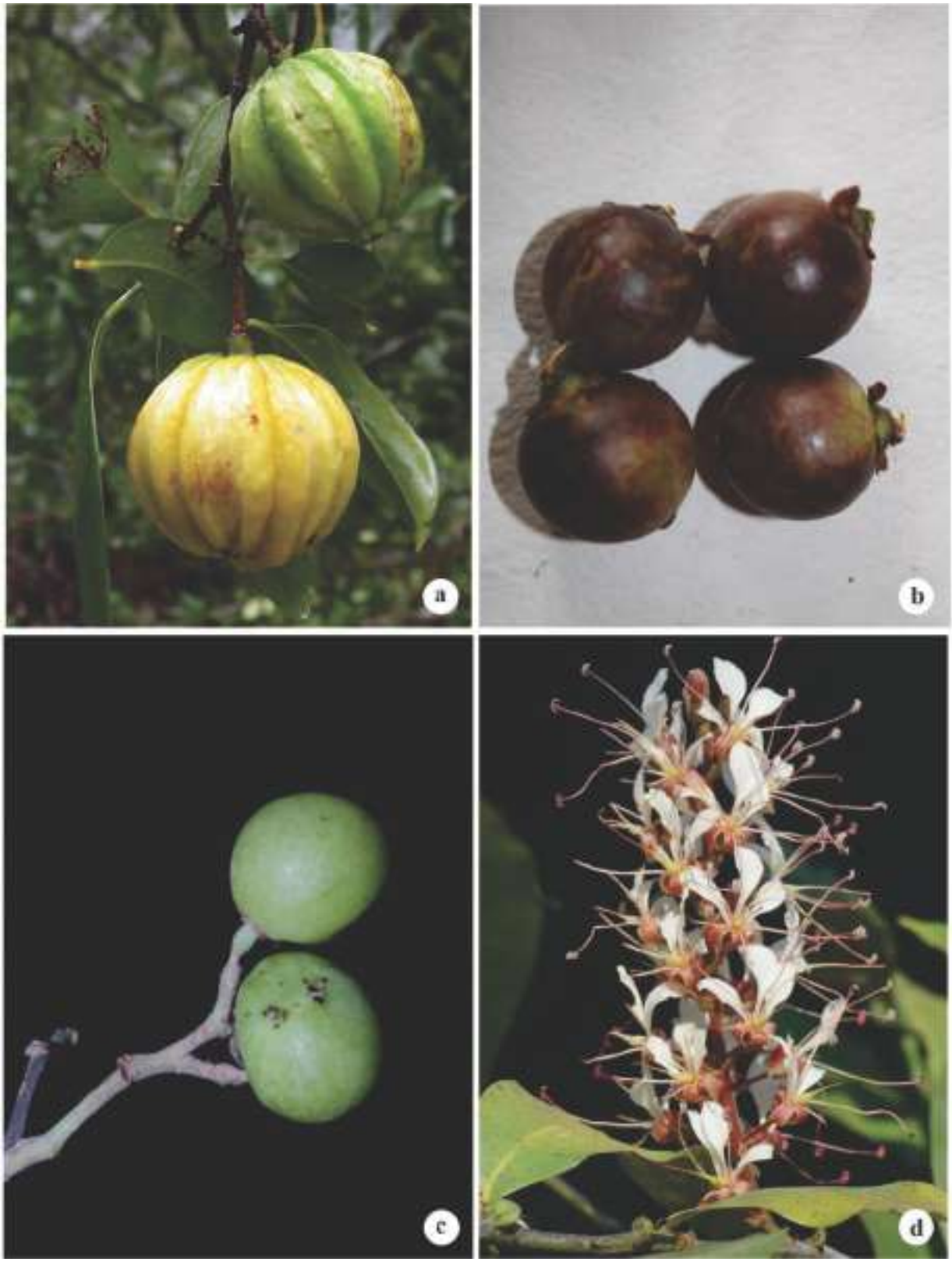


Plate- XXV: a. Garcinia gummi-gutta, b. Garcinia morella, c. Garuga pinnata, d. Humboldtia bourdillonii

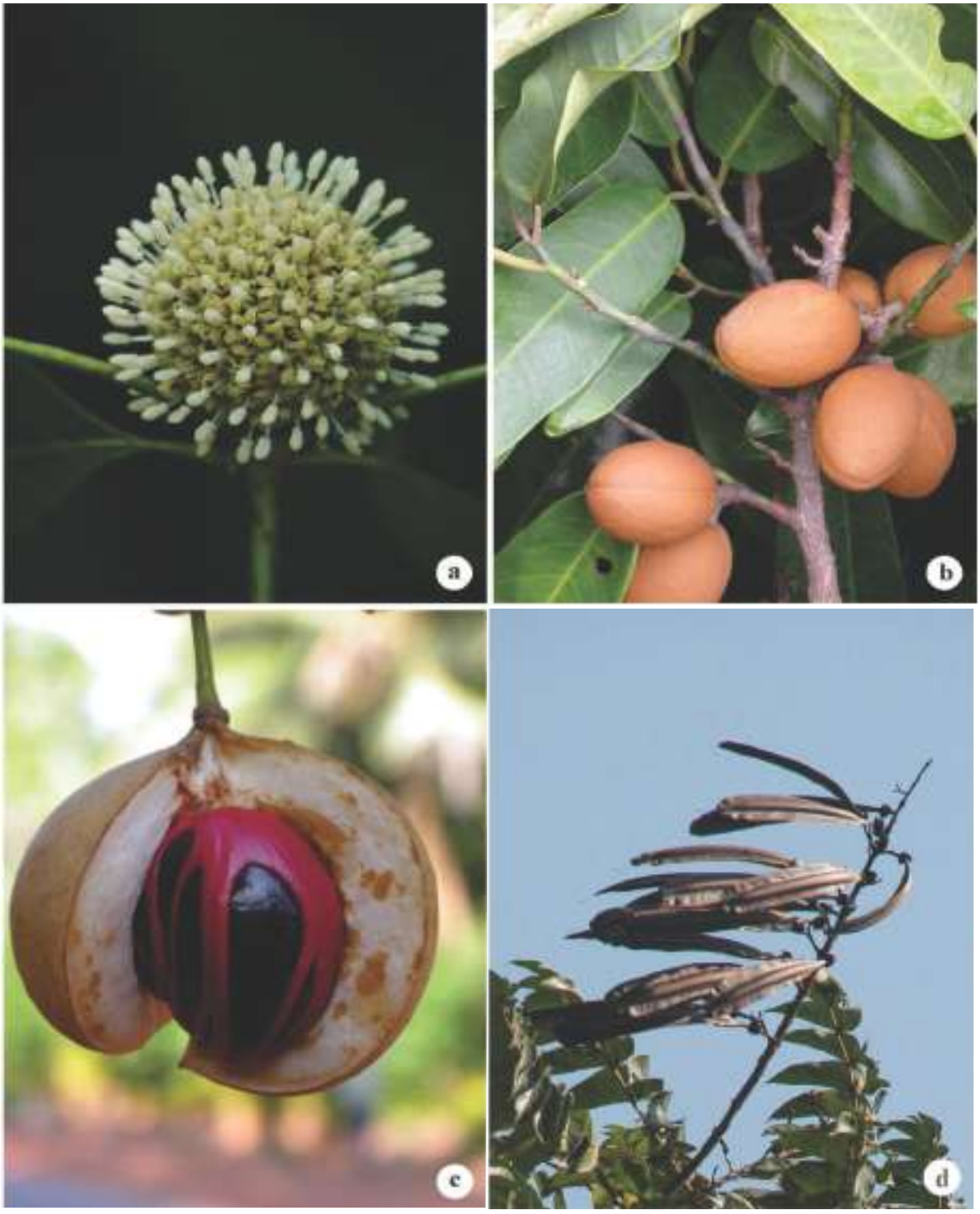


Plate- XXVI: a. Mitragyna parvifolia, b. Myristica dactyloides, c. Myristica malabarica, d. Pajanelia longifolia

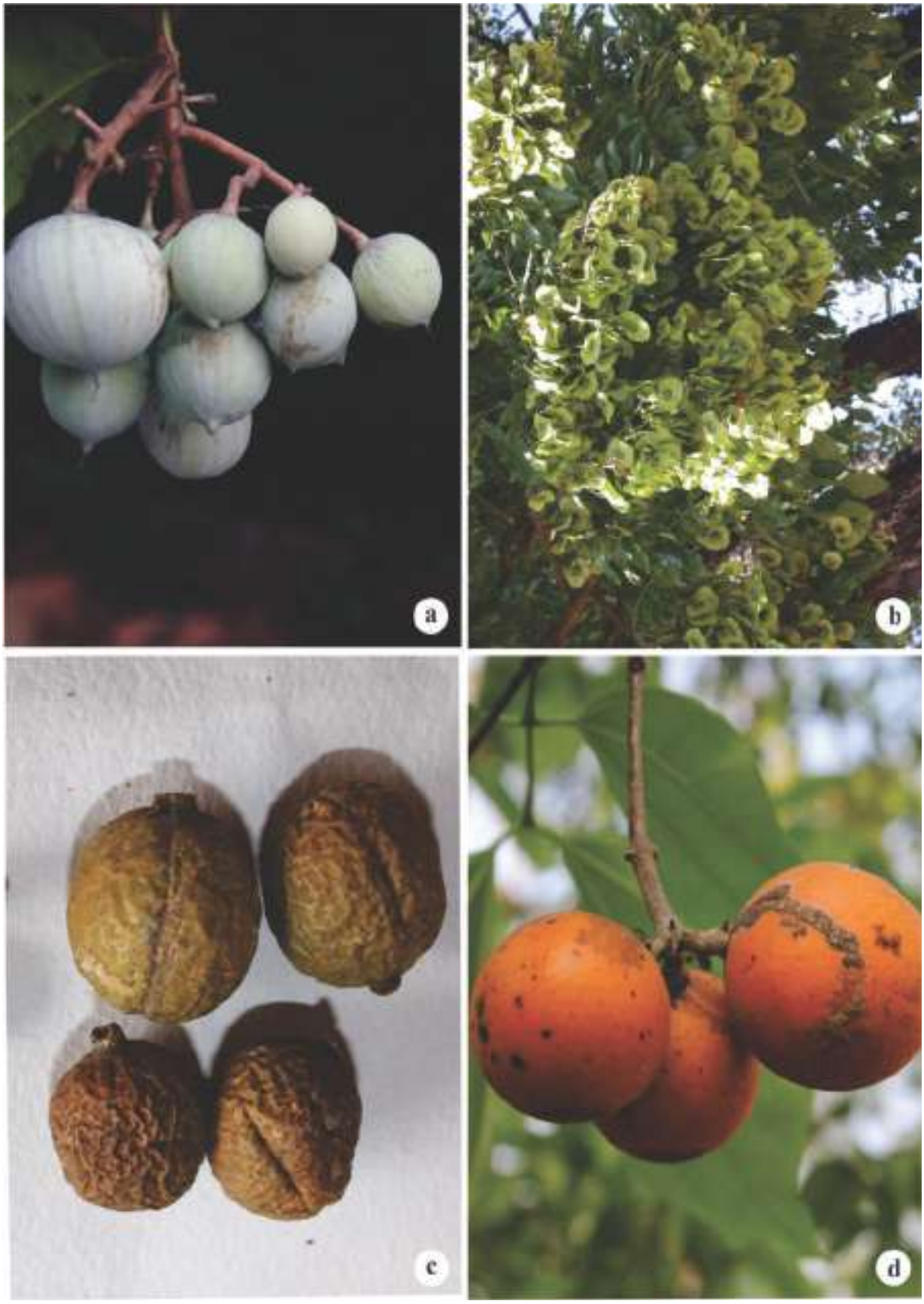


Plate- XXVII: a. Poeciloneuron indicum, b. Pterocarpus marsupium, c. Sageraea laurifolia, d. Strychnos nux-vomica

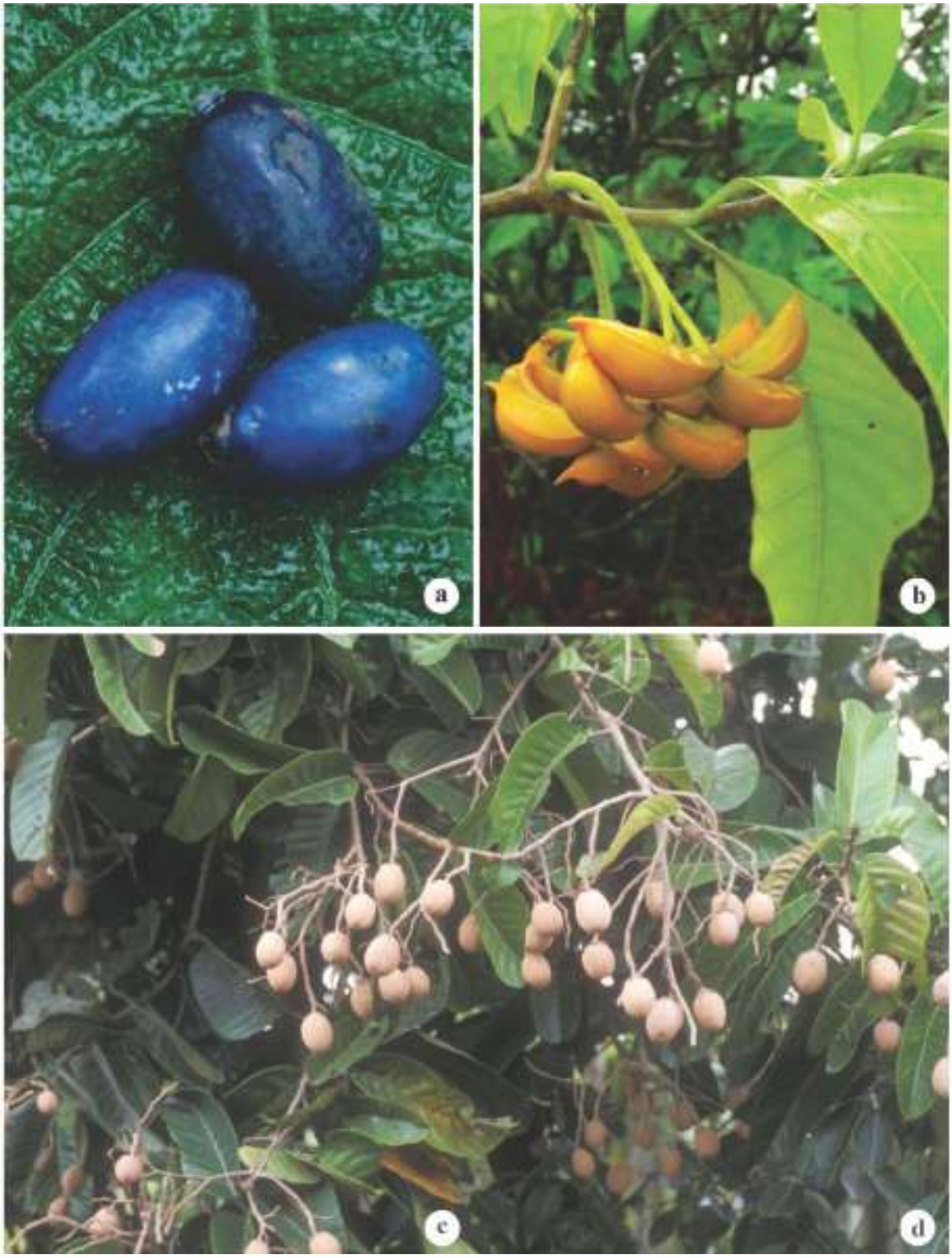


Plate- XXVIII: a. Symplocos racemosa, b. Tabernaemontana heyneana, c., d. Vateria indica

Plate- XXVIV: a. Holigarna arnottiana, b. Polyalthia fragrans, c. Mesua ferrea

Plate- XXX: a. Calophyllum inophyllum, b. Holigarna arnottiana, c. Aphanamixis polystachya

Plate- XXXI: a. Nothopegia castaneifolia, b. Diospyros malabarica, c. & d. Manilkara littoralis

Plate- XXXII: a. Terminalia bellirica, b. Artocarpus hirsutus, c. Flacourtia Montana, d. Dysoxylum binectariferum

Plate- XXXII: a. Calophyllum apetalum, b. Syzygium stocksii, c. Pterospermum reticulatum, d. Chloroxylon swietenia

Plate- XXXIV: a. Corypha umbraculifera, b. Bentinckia condapanna, c. Arenga wightii, d. Hyphaene dichotoma

Plate- XXXV: a. & b. Garcinia xanthochymus, c. & d. Hopea ponga

Plate- XXXVI : a. & b. Garcinia indica, c. Chloroxylon swietenia, d. Mimusops elengi

Plate- XXXVII: a. Chloroxylon swietenia, b. Meiogyne pannosa, c. Hyphaene dichotoma, d. Borassus flabellifer

Plate – XXXVIII: a. Bentinckia condapanna, b. Caryota urens, c. Corypha umbraculifera, d. Phoenix sylvestris

Water Bodies and Roads

Plate : XXXX: Trench and Land preparation

Annexure 5

Sapling Distribution March 2015-March-2018

Sr. No.	Name and Address	No. of species	No. of saplings
1	Raman Kulkarni, Kolhapur	18	134
2	Bharati Vidyapeeth Yashwantrao Mohite College, Pune-38	19	38
3	Sanjay Nangare, Radhanagari	16	32
4	Suresh Shamrao Jadhav	22	43
5	Forest Department, Panhala	7	14
6	Municipal Corporation Kolhapur	different plant species	5000
7	Mahavir Garden, Kolhapur	11	46
8	Kurneshwar Trust, Satara	53	108
9	Sayaji Shinde, Post-Vele-Kamti, Satara	15	52
10	Suhas Waygankar Deshapand Infra, Kolhapur	27	130
11	Mani Agriculture Private Limited, Kolhapur	25	60
12	Alandi Trust, Pune	36	119
13	Dr. Kumbhar, Shahu College Kolhapur	7	20
14	Dr. Nandikar NGCPR Pune	19	38
15	Tatysaheb Athalye Arts & Ved. S.R. Sapr Commerce College Ratnagiri	15	19
16	Dr. C. B. Salunkhe, Karad	6	7
17	Devachand College, Arjunjagar	29	58
18	Dhananjay Shirur, Pune	8	16
19	Tatyasaheb Kore Institute, Warananagar	12	24
20	Dr. Bachulkar, Peth Vadgaon	18	36
21	Dr. Ashok Wali, Nisarga Mitra, Kolhapur	7	14
22	Babasaheb Deshmukh College, Atpadi	16	38
23	Dr. N. B. Gaikwad	5	50
24	Dr. Ashok Wali	9	9
25	Dr. C. B. Salunkhe	9	16
26	Forest Department Phaltan	5	14
27	GKVK, Banglore	7	14
28	Dr. M. Y. Kambale Botanical Survey of India, Yercaud (T. N)	16	85
29	Nisarga Mitra, Kolhapur	10	22
30	Dr. Patil, Ahmednagar	11	22
31	S. S. V. P. S. Science College, Dhule	1	2
32	Rajaram College, Kolhapur	40	80
33	Forest Department, Panhala	38	84
34	Nehru Vidhya Mandir Kotoli	18	36
35	Gardens Club, Kolhapur	4	15

Distribution March 2017-March-2018

Sr. No.	Name and Address	No. of species	No. of saplings
1	Department of Technology, Shivaji University, Kolhapur	1	3
2	Dr. Mayur Kamble, BSI, Yercaud	11	68
3	Parag Mahajan	3	450 seeds
4	Dr. K.N. Dhumal, Pune	5	5
5	Prof. S.S. Kamble	1	10
6	S.J. Ghukikar	1	10
7	Vaishali Kamble	1	10
8	K. Kotresha	22	38
9	Miss. Sandhya Chougule, Y.C. College Satara	34	34
10	Mrunal S. Surve	3	6
11	Sanket Surve, Mumbai	7	7
12	Mayur Nandikar	15	15
13	C.U. Kulkarni	*19*	35
14	Koushalya Vikas	1	1
15	Prabhunath Shukla D.C.F. Kolhapur	22	34
16	Mayur Kamble	2+3	10 +100 seeds
17	Akshay Nuesery Halial Road, Dharwad	78	156
18	Rushabh Chaudhari	4	5
19	A.B. Vetale	1	20
20	Baliram Khot, Kotholi	10	50
21	Narendra A. Rajadnya	1	2
22	Kishor Shinde	1	7
23	The Revenue Cooperative Housing Society, Kolhapur	20	128
24	Chandrapur	30	60
25	Rajashri Chatrapati Shambhuraje, Govt. Medical College, Shendapark, Kolhapur	2	8
26	Maharashtra Udaygiri Mahavidylaya, Udgir	53	250
27	Dr. C.B. Salunkhe, Krishna Mahavidyalaya, Rethare	8	10
28	Examination Building Shivaji University, Kolhapur	9	33
29	D.P. Singh CGST, Kolhapur	17	32
30	Madhukar Mehta	1	1
31	Vishal Waghmode, Atpadi	10	30
32	Lingayat Wani Samajseva Foundation	9	9
33	Smita Hiremath, Ujalaiwadi	7	8
34	Dr. Gaikwad	1	3
35	Savitribai Phule Pune University, Pune	32	63

Sr. No.	Name and Address	No. of species	No. of saplings
36	Gurunath Kulkarni Grampanchayat, Basarge	21	565
37	Dr. Wali	5	15
38	Mahavir Garden, Kolhapur	14	63
39	Dr. Kishor Rajaput, M. S. University, Baroda.	14	47 +30 seeds
40	BSI, Pune	12	12
41	Sarvottam Aswale	3	9
42	Dunung Industries Private Ltd, Pethvadgaon	20	40
43	Nitesh M. Karanje	16	29
43	Shivraj Mahavidylaya, Gadhinglaj	31	40
44	Mukund Kambale, Sarnobatwadi	1	35
45	Pracharya Adhyapak Mahavidyalaya, Ratnagiri	10	10
46	Ashitosh Hardikar	18	58
47	Kiran Abitkar	5	16
48	Swarup Kasar	1	6
49	Department of English, Shivaji University Kolhapur	6	17
50	Shahu College, Kadamwadi, Kolhapur	29	39
51	Dr. C.B. Salunkhe	8	8
52	Rajaram College, Kolhapur	3	6
53	New English School	5	7
54	Bapuji Salunkhe College, Miraj	13	13
55	Van-vibhag Karvir, Kolhapur	40	220
55	Dr. Chavan	5	5
56	A.S.P.College, Devruk	11	22
57	Library and Information Science, Shivaji University, Kolhapur	1	2
58	Charulata Rout	8	8
59	Manorama Patil	2	3
60	Willingdon College, Sangli	10	10
61	Manjashree M. Davari	5	15
62	G.K.V.K. Bangalore	5	8 + 30 seeds
63	Main Garden Section, Shivaji University, Kolhapur	8	56
64	Dr. C.R.Patil	3	15
65	Dr. Dangat	8	300
66	Vipin Rout	2	4
67	Turag Aurvedik Shakti Shala	57	115
68	Sambhaji Parit, Padal	2	35
69	Forest Department, Kolhapur	18	18

Sr. No.	Name and Address	No. of species	No. of saplings
70	Dr. C.B.Salunkhe	2	3
71	Dr. Ranjana Mane	24	79
72	Prasad Nagekar	23	55
73	Mohan Nandikar	8	26
74	Sandip Kambale	2	3
75	Department of Physics, Shivaji University, Kolhapur	9	29
76	Arvind Dedhpande	10	150
77	Dr. M.M. Sardesai	7	25
78	Library and Information Science, Shivaji University, Kolhapur	1	1
79	Nature Forever, Nashik	33	2010
	Exchange basis		
01	Dharwad University Dharwad	9	10
02	G.K.V.K. Bangalore	18	66

Conservation, Management and Revival of Local Resources

Report

7.1

Conservation Management and Revival of Local Resources I - Crop Genetic Diversity

BAIF Institute for Sustainable Livelihood and Development (BISLD)
Dr. Manibhai Desai Nagar, Warje, Pune, Maharashtra
BISLD is an associate organization of BAIF development Research Foundation, Pune.

Background

Maharashtra state is known for diverse flora and fauna, mainly varieties of crops, livestock and plant genetic resources. The diverse agro climatic zones and many more microhabitats within these agro climatic zones have allowed the existence and diversity of genetic resources. Each of these zones represents unique habitat, having its own physical and climatic conditions, which allows growth of region-specific plants and crops and animal types, which have adapted to these conditions for years together. Number of these crop, animal and plants have also been maintained and conserved by groups such as farmers, pastoralists, tribal and community groups who are traditionally dependent on these resources for their livelihood and survival. Some of these valuable genetic types are however under serious threat of extinction and also under the process of erosion due to various factors like modernization of agriculture, growing demands of increased population, process of conversion of natural habitats for agriculture, residential purposes, and process of industrialization etc.

Landraces of cereals, pulses, oil seeds, wild tubers and local herbs, which used to be a good source of nutrition and food security for tribal and rural communities are also getting eroded. Realizing the importance of maintaining the biodiversity for future research, food security, livelihood and risk mitigation ability of small farmers and future generations, policy makers have initiated few steps. Maintaining a seed bank /seed repository at institution level is one such programme promoted for conservation of germplasm. However, these gene banks in reality have served very limited purpose and are acting as mere repositories which are beyond the reach of common farmers. Further, the farmers are away from entire process of conservation initiatives, thus affecting their traditional role as seed keepers, seed selectors and seed preservers.

Even though due to its remote locations the area has retained relatively rich diversity in rice, finger millet, little millet, barnyard millet, maize, sorghum, beans, vegetables etc. gradual erosion of indigenous biodiversity has been observed over the last two decades.

Tribal communities in India face characteristic travails of poverty - lack of choice and absence of hope. Although tribals represent over 9% of the total population in the country, there are certain hilly regions where they represent over 40-50% of the population, living on the edge of the forests, collecting minor forest produce for their food security and most of them have been compelled to migrate for their survival. A majority of the tribals having small and marginal land holdings are practicing rainfed agriculture with rice, millets and pulses, barely enough to meet the needs of the family. Severe shortage of drinking water in summer, poor access to health care, education and other basic services make the tribal communities vulnerable to disease and acute poverty.

With this background, agro-biodiversity conservation programme was initiated by BAIF during the year 2008. The BAIF programme aims at checking the erosion of valuable genetic resources and knowledge associated with it as these are directly linked to food security, livelihood, and risk mitigation capacity of rural and tribal communities staying in remote areas.

Key issues addressed

- Lack of interest of the farmers for cultivation of traditional varieties / landraces
- Increased pest and disease occurrence
- Non-availability of quality seed of traditional varieties at community level
- Non-assurance of sustainable crop yield
- Decrease in soil fertility
- Climate adversities: increased temperature and erratic rainfall
- Lack of proper seed storage at community level
- Depleting resilient indigenous crop cultivars and narrow genetic base resulting in crop failure.
- Highly prevalent mono-cropping and mono-varietal cropping.
- Market dependence and lack of seed sovereignty
- Loss of traditional knowledge on agrobiodiversity
- Negligence of nutritional aspect in agriculture.
- Lack of market linkages for surplus and unique crop produce.
- Negligible actions for securing and safeguarding ITK related to indigenous crop cultivars

Objectives

- To design and undertake detailed participatory appraisals for diverse crops that exists in diverse agro climatic zones in the state.
- To plan and introduce activities for region-wise *in-situ* and *ex-situ* conservation.
- Conservation, management and revival of selected local crops
- Capacity building and motivation of local communities to participate and manage the programme

Programme Approach

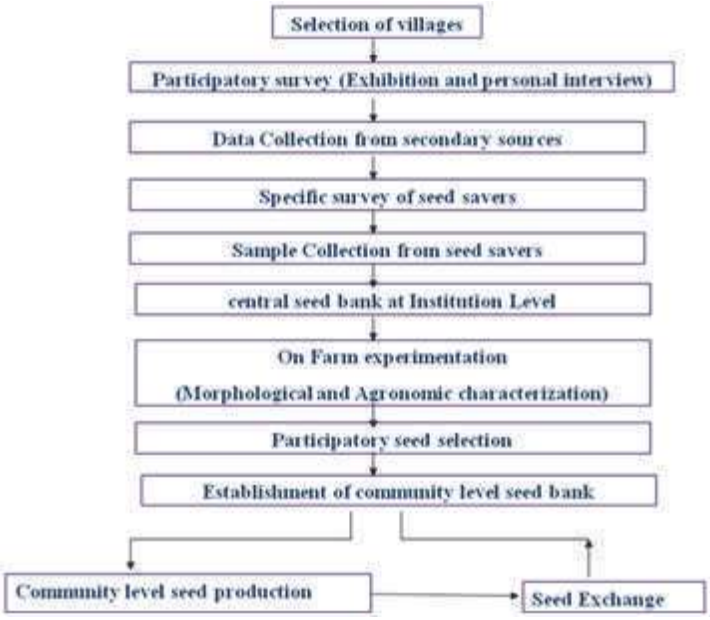
- Documentation of crop diversity and associated knowledge in diverse agro-climatic zones
- Germplasm collection, characterization, evaluation and participatory seed production
- *In-situ* conservation with active involvement of local community
- Community level processes including networking, establishing community seed banks and participatory events

Programme coverage: 60 villages in six clusters (Annexure 1)

Sr. No.	Districts	Clusters	No. of villages	Focused Crops
1	Palghar	Jawhar	11	Rice, Finger millet, Little millet and cowpea
2	Nandurbar	Dhadgaon	12	Sorghum, Maize, Barnyard millet and Foxtail millet
3	Pune	Junner	6	Rice
4	Ahmednagar	Akole	10	Rice & Hyacinth Bean
5	Gadchiroli	Etapalli	15	Rice & Hyacinth Bean
6	Sindhudurg	Kudal	6	Rice

Sampling Methods

Based on the initial surveys through Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD), villages were selected for conservation of crop diversity. PRA was done in all 60 villages for understanding crop diversity and associated knowledge. Then base line data and germplasm collection was done from seed savers who are conserving crop landraces of focused crops. Farmers who are cultivating the landraces were randomly selected for collection of data on cropping pattern, productivity etc. People's perception on the value, use, specific properties and reasons for extinction of landraces were documented. The data collected has been further validated with valuable findings collected by means of seed exhibitions and fairs, personal interviews, group meetings etc. The surveys have been completed in 60 villages in specific blocks of six districts of Maharashtra. This work has been done in a participatory manner by involving knowledgeable farmers. This approach helped in validating the authenticity of crop landraces conserved by seed keepers, determine their specific traits and map the traditional knowledge associated with their cultivation and use in terms of farmer's practices and methods of seed selection and upgradation. Community-level crop germplasm conservation model is a unique approach for conservation, revival and sustainable use of crop diversity. Capacity building of seed savers and farmer groups for participatory seed selection, production and exchange, is a critical aspect of the programme. The process development and methodology adopted are given below:



Major Work Done Under MGBP

- Germplasm of nine focus crops and other crops along with baseline data collected and maintained.

Table 1. Crop wise germplasm accessions

Sr. No.	Crops	Accessions
1	Rice	173
2	Finger Millet	27
3	Little Millet	16
4	Foxtail millet	7
5	Barnyard Millet	3
6	Maize	25
7	Sorghum	19
8	Hyacinth bean	54
9	Cow pea	26
10	Other pulses	50
11	Oil seed crops	26
12	Vegetables & Other crops	154
13	Tubers and roots	6
	Total	587

Central Seed Bank at Jawhar

Crop diversity exhibition

- Established six community seed banks at selected six clusters and one central seed bank at Jawhar. Gene Bank with a cold storage facility with a storage capacity of 2 MT is established at Urulikanchan for *ex-situ* conservation of plant genetic resources. This facility houses 539 accessions of different crops.
- Total of 53 landraces (Rice-33, Maize-5, and Sorghum-5) have been submitted for registration with Protection of Plant Varieties and Farmers Right Authority, New Delhi. **Five landraces (Chikni Lal - Loose panicle, Mothi Safed Juwar, Mothi Mani Juwar, Chikani lal and Lahan mani juwar) have received registration certificate (Annexure 2).**
- 150 landraces of rice, finger millet, little millet, maize, and sorghum have been deposited in NBPGR for IC number. IC numbers for 94 rice landraces received from NBPGR.
- Documented cluster-wise crop diversity, traditional agriculture practices, agriculture implements, pest and disease management practices, traditional food recipes, festivals of agro- biodiversity and traditional seed and grain storage methods, medicinal uses of indigenous crop landraces, etymology, reason behind existence and disappearance of crop landraces.
- Prepared inventory of wild edible plants (175) with information on habitat, edible parts, method of preparation, preservation methods, present status and medicinal importance.
- 350 landraces of focus crops maintained by establishing 25 *in-situ* conservation centers at farmers' fields across 6 clusters.
- Community level seed production and sale of 56.5 MT of 40 cultivars of six crops which includes rice, little millet, finger millet, maize, sorghum, and hyacinth bean
- Promoted improved crop cultivation practices like SRI method in rice, and ridge and furrow method in millet crops, line sowing practice and use of organic input production techniques.
- Promotion of indigenous crop cultivars of vegetable crops through nutrition gardens in which 8538 families participated.
- Morphological characterization of 281 landraces, nutritional analysis of 109 grain samples and 140 straw samples, molecular studies of 86 genotypes covering rice, finger millet, little millet, maize, sorghum, hyacinth bean, cow pea crops was undertaken.
- Initiated marketing of produce from indigenous crop cultivars under "*Farming Monk*" brand. Sold 15 MT of rice (Khadakya, Kalbhat, Ambemohar and Juna 57, Jirvel, Valay).
- Formed three seed saver committees, one seed saver

organization and one farmer producer company for conservation and management of crop landraces.

- Community mobilization and awareness through village level seed exhibitions, wild food recipe competitions and training and exposure (342 events).
- "Empowering Communities Through Miracle Grains" Promotion of Finger millet for Nutritional Security & supplementary Livelihood initiated with Khusi Nagli snacks making Group, Vanganpada, Standardized Finger millet Laddu product and sold worth 1.5 lakh Rupees.
- Formed 16 eco-clubs in schools for creating awareness and promotion of biodiversity base activities. Organized 66 events like exposure visits, thali, exhibitions, forest walk, 3 days Students-Teachers workshop (Anand shala) with CEE. 25750 students from 16 schools- participated
- Mrs. Rahibai Soma Popere, popularly known as "Seed mother" has been awarded Nari Shaki Awaid 2019 and Padmashri 2019 award by Govt of India.

Database

BAIF has designed formats for crop diversity programme of the MGB project. Data has been collected on crop diversity (6 clusters), accession data (587), morphology data (281 landraces), traditional food recipes (293 landraces), Etymology (261 landraces), traditional cultivation practices (52), reason behind existence and disappearance (263 landraces), medicinal uses (243 landraces), festivals of agrobiodiversity, traditional seed and grain storage systems and also wild edible plant species database covering habitat, edible parts, method of preparation, preservation methods, present status, and medicinal importance aspects. All these data have been incorporated in Relational Data Base Management System for further uploading on MGB web site.

Qualitative impact of the work

The process of purification of landraces and agro-morphological characterization work undertaken for last three years has resulted in genetic improvement and availability of quality seed at village level through community seed banks. The application of improved cultivation practices in many crops under study has resulted in yield as well as quality enhancement. The promotion of cultivation of superior landraces at farmer's field has made available the quality grain produce in ample quantity for marketing which has also resulted in attractive remuneration to the community. The nutritional evaluation of worthy landraces in laboratory helped in knowing the nutritional content and quality of the grains. The promotion of kitchen gardens involving the traditional vegetable crops made available quality and nutritionally rich food and addressing the food security. Seed exhibitions helped in community awareness about crop diversity and wild edible plants. The community led approach of seed conservation has been adopted by many NGO's and individual farmers in different parts of Maharashtra.

Quantitative impact of the work

Quantitative achievements during the project period are given in Result Based Management (RBM) framework in Annexure 2.

Germplasm evaluation

The germplasm of focused crops was collected from the farmers across all six clusters and was evaluated for agro-morphological characters for three years.

Table 2. Germplasm selected for purification and agro-morphological characters

Sr. No.	Crops name	Cluster name					
		Jawhar	Akole & Junner	Dhadgaon	Etapalli	Kudal	Total
1	Rice	59	13	0	58	30	160
2	Hyacinth bean	0	18	0	14	0	32
3	Maize	0	0	19	0	0	19
4	Sorghum	0	0	17	0	0	17
5	Finger Millet	21	0	0	0	0	21
6	Little millet	10	0	0	0	0	10
7	Cowpea	11	4	0	0	7	22
	Total	**101**	**35**	**36**	**72**	**37**	**281**

Purification and Characterization of crop Landraces

Purification and agro-morphological characterization of 281 landraces of seven crops namely Rice, Finger millet, little millet, Maize, Sorghum, Hyacinth bean and cowpea were undertaken through in-situ conservation centers (Table 2). Standard DUS guidelines of Protection of Plant Varieties and Farmer's Rights Authority (PPV & FRA), New Delhi were adopted for the evaluation. The community claims were validated through the nutritional evaluation of the selected landraces. Molecular study of 68 rice landraces and 18 maize landraces was also undertaken to know the genetic diversity among the crop landraces. DNA of 83 rice landraces is stored in laboratory at -70 ^{0}C.

Rice in-situ conservation center

Morphological characterization of rice landraces

Yield enhancement through improved cultivation methods

System of Rice Intensification (SRI) in rice, and cultivation of finger millet and little millet in ridges and furrow method was introduced for yield enhancement in the selected villages. Different techniques were also promoted like nursery raising by using raised bed, seed treatment methods, soil fertility management practices, preparation and use of soil microbial activity enhancer, pest and disease management techniques (Garlic-chilly-ginger extract, neem leaf extract, neem-garlic-cow urine extract) and organic input production techniques (bio dung composting). Practical hands on training and field demonstrations were undertaken for farmers.

Improved rice cultivation

Central seed banks and *ex-situ* gene Bank

A central seed bank has been established at Jawhar and database of crop landraces collected from various locations is being maintained. This has helped in easy access of seeds for farmers, establishment of demonstration plots and maintaining purity of landraces. A permanent accession code has been provided to each landrace collected. The samples collected in the central seed bank have gone through a series of experiments to check morphological characters for scientific validation and preparing a detailed database of individual landrace. Well dried seed samples are being stored in glass jars, earthen pots and plastic boxes. Gene Bank with a cold storage facility (5^{0} C temperature and 33% relative humidity) with a storage capacity of 2 MT is established at Urulikanchan for *ex-situ* conservation of plant genetic resources, where 539 accessions of different crops are deposited.

Highlights of research studies

Variability of Mineral Composition of Rice Landraces Collected from Maharashtra

Micronutrient malnutrition is one of the burning issues in rice-based diet regions throughout the world. Present study was aimed at evaluation of mineral composition of 77 rice landraces collected from various agro-climatic zones of Maharashtra. The hand mill processed rice grains were analyzed for eight (Na, Mg, K, Ca, Mn, Fe, Co, Cu and Zn) minerals. The iron content ranged from 2.05 to 12.2 mg/100g, calcium content from 39.2 to 238.47 mg/100g, manganese content from 1.53 to 7.54 mg/100g, copper content from 0.54 to 3.03 mg/100g and zinc content ranged

from 2.65 to 11.62 mg/100g. The other minerals like magnesium ranged from 81.72 to 278.56 mg/100g, sodium content from 4.73 to 274.34 mg/100g and potassium content from 148.05 to 670.74 mg/100g. This analysis showed that most of the genotypes tested had wide range of variation, in minerals and could be valuable source for bio-fortification of minerals through breeding.

Table 3. Mineral content (mg/100g) of selected rice landraces

Landraces	Iron	Sodium	Magnesium	Potassium	Calcium	Manganese	Copper	Zinc
Ambemohar	7.24	156.81	253.52	624.45	109.55	6.14	1.61	6.50
Hali Kolamba	5.90	136.74	268.94	560.47	102.80	5.00	1.80	7.08
Kirtibhat	5.16	172.10	198.52	476.46	138.24	6.65	1.58	9.32
Sonphal	7.73	21.84	237.76	531.05	79.18	3.50	3.03	9.57
Tulshya	8.08	144.28	278.56	670.74	94.88	7.43	1.79	7.25
Khadkya	11.51	274.34	228.51	517.83	238.47	5.30	1.87	11.62
Kalbhat	12.21	125.21	205.80	524.31	92.94	5.16	1.70	5.45
Varangal	4.20	170.46	169.30	311.38	179.92	3.90	1.72	7.68
Malghudya	8.52	137.67	147.51	290.64	139.41	2.54	0.93	5.23

Nutritional status of crop residues of landraces as fodder resource in Maharashtra

Crop residues are main fodder source for maintaining the livestock especially in remote areas. In the present study, 67 fodder samples of rice, maize and sorghum were collected from farmers' field at Jawhar, Junnar and Dhadgaon blocks in Palghar, Pune and Nandurbar districts of Maharashtra. The nutritional analysis was undertaken at BAIF Urulikanchan during 2016-17 to evaluate the nutritional status of crop residues. The nutritional analysis revealed that the crude protein ranges from 2.7 to 6.12%, the crude fiber from 19.13 to 33.53%, the ether extract from 0.19 to 2.56%, ash content from 3.38 to 26.02% and, silica content ranged from 1.25 to 23.58%.The results indicated that the crop residues of rice, maize and sorghum can fulfil partial nutrition requirements of the animals and further supplemented with concentrate feed or fortification of straw for productivity enhancement. The study also indicated that some of the rice and sorghum landraces have desirable fodder traits like high CP, EE, optimum CF and lesser silica content. However, their grain and straw yield potential needs to be studied for further promotion.

Table 4. Nutritional evaluation of rice straw

Rice Landraces	Crude Protein %	Crude Fiber %	Ether Extract %	Ash %	Silica %
LRC1	3.14	29.72	1.34	19.56	12.76
LRC2	3.36	26.97	1.73	16.78	11.49
LRC3	4.09	28.15	1.26	18.45	12.20
LRC4	3.50	28.16	1.05	17.79	12.14
LRC5	4.21	25.90	0.97	19.73	12.61
LRC6	3.99	23.61	0.84	17.97	11.65
LRC7	2.70	23.12	0.81	18.61	12.47
LRC8	4.64	23.01	1.02	22.00	13.44
LRC9	4.18	24.74	1.18	18.62	12.97
LRC10	4.06	21.38	1.14	20.89	15.47
LRC11	3.62	23.42	1.19	16.46	12.31
LRC12	4.29	26.43	1.21	17.32	12.01

Rice Landraces	Crude Protein %	Crude Fiber %	Ether Extract %	Ash %	Silica %
LRC13	3.01	27.18	1.14	18.11	11.87
LRC14	3.67	27.46	1.17	23.01	13.13
LRC15	3.78	28.68	1.21	15.15	9.24
LRC16	3.61	29.10	1.46	19.23	12.72
LRC17	4.05	25.51	1.16	14.32	9.70
LRC18	3.32	24.51	0.86	16.72	13.64
LRC19	3.60	25.39	1.08	15.19	10.14
LRC20	5.87	22.09	2.13	20.85	12.63
LRC21	3.04	25.47	2.14	15.95	11
LRC22	3.22	28.13	2.49	20.62	12.37
LRC23	3.49	25.47	1.82	18.16	11.18
LRC24	3.64	26.05	2.28	16.92	12.64
LRC25	3.77	26.56	2.32	16.87	11.75
LRC26	4.48	27.36	2.01	13.57	9.25
LRC27	3.08	26.01	2.56	18.08	12.24
LRC28	3.02	28.11	1.45	11.69	8.57
LRC29	6.12	22.6	1.36	19.90	12.60
LRC30	5.26	25.33	1.05	21.34	12.17
LRC31	3.49	27.51	1.04	16.88	11.21
LRC32	3.41	29.78	1.13	18.53	12.40
LRC33	3.54	28.48	2.07	16.91	8.87
LRC34	3.80	26.69	1.69	16.55	10.34
LRC35	3.19	25.81	0.47	17.24	11.26
LRC36	3.72	26.14	1.13	17.03	10.47
LRC37	3.45	27.05	1.71	16.49	9.36
LRC 38	2.73	29.58	0.24	17.34	15.16
LRC 39	3.36	30.89	0.23	14.46	9.98
LRC 40	4.07	30.84	0.22	12.78	9.16
LRC 41	3.41	25.46	0.25	20.79	18.08
LRC 42	3.88	25.74	0.23	19.37	16.63
LRC 43	3.12	28.73	0.21	15.60	13.52
LRC44	4.06	27.03	0.19	21.40	15.72
LRC 45	3.28	30.07	0.23	22.54	19.19
LRC 46	3.81	24.10	0.22	26.02	23.58
LRC 47	5.03	23.93	0.21	12.56	11.52
LRC 48	3.07	28.73	0.22	18.03	16.18
LRC 49	2.82	23.84	0.27	23.02	22.03
LRC 50	3.56	25.74	0.23	21.02	20.07

Table 5. Nutritional Evaluation of Sorghum stover

Sorghum Landrace	Crude Protein %	Crude Fiber %	Ether Extract %	Ash %	Silica %
LRC 1	4.11	27.93	1.48	5.32	2.47
LRC2	4.02	33.53	2.34	7.16	3.12
LRC3	4.46	29.44	2.36	5.7	3.09
LRC4	4.1	26.86	1.52	7.76	3.11
LRC5	3.71	30.43	2.26	5.18	2.35
LRC6	3.69	26.68	2.16	6.49	2.33
LRC7	3.35	24.04	0.92	3.38	1.25
LRC8	5.33	24.78	0.84	6.12	2.20
LRC9	5.37	29.21	0.74	5.56	3.09
LRC10	4.42	26.05	0.61	6.15	2.85
LRC11	4.61	20.6	0.52	6.57	3.09
LRC12	4.38	19.13	0.79	5.56	2.19

Table 6. Nutritional Evaluation of Maize stover

Maize Landraces	Crude Protein %	Crude Fiber %	Ether Extract %	Ash %	Silica %
LRC 1	4.57	28.81	0.67	9.01	5.43
LRC 2	4.42	26.87	0.81	7.24	4.29
LRC 3	3.51	28.97	0.76	8.31	5.08
LRC 4	3.60	27.05	0.84	7.75	4.71
LRC 5	4.26	26.79	0.60	6.80	4.05

Diversity of Wild Edible Plants in Dhadgaon Block of Nandurbar District in Maharashtra

Survey and documentation of wild edible plants (WEPs) in Dhadgaon/Akrani region of Nandurbar district is the first attempt to document WEPs used by local communities in Nandurbar district. Data on about 91 wild edible plant species belonging to 69 genera of 40 families was recorded. Majority of WEPs belongs to family Fabaceae (11 species), followed by Araceae (7), Asparagaceae (6), Malvaceae (6), Amaranthaceae (5), Apocynaceae (5), Asteraceae (4), Dioscoriaceae (4), Rubiaceae (4) and Cucurbitaceae (3). The genera represented by the highest number of species are *Chlorophytum* (5 species) followed by *Dioscorea* (4), *Amaranthus* (3) and 2 species each from *Amorphophallus, Arisaema, Bauhinia, Cassia, Launea, Moringa, Smithia, Sterculia, Vigna and Ziziphus*. Most of the species are consumed as leafy vegetable (46 species) or fruits (34 species). More than one plant part is used from 14% of the species. These wild edible plants are sources of food security for local people, especially those living in remote rural areas. Some species are wild relatives of crops that could be used for crop improvement program in future. Several species have potential value for further domestication and commercial exploitation which will help in biodiversity conservation and sustainable utility.

Morphological characterization of sorghum landraces

Sorghum landraces collected from Dhadgaon and Akkalkua block of Nandurbar district were studied to assess the diversity among these landraces. An experiment was conducted at village level *in-situ* conservation center during kharif season of 2016 and 2017. Morphological characterization of 13 landraces of sorghum was undertaken for 25 characters as per DUS guidelines. Traits such as anthocyanin colored coleoptiles (53.85%), white colored leaf midrib (38.46%), yellow coloration on stigma (84.62%), grayed orange colored dry anther (53.85%), yellow white colour of glumes (30.77%), semi-compact density of panicle (53.85%), symmetrical type ear (69.2%), grayed orange coloured seeds (53.85%) were dominant in studied landraces. The results of present

study showed that panicle branch length was most diverse trait (22.93%), followed by 1000 grain wt. (17.23%) and stem diameter (19.71%) whereas leaf width showed the lowest variation (6.16%) among studied lines. Analysis of variance showed that all the characters were highly significant among the landraces.

Agro-Morphological Characterization of Maize (*Zea mays* L.) Landraces

Agro-morphological characteristics of 19 maize landraces collected from tribal area of Nandurbar district were evaluated. A field experiment with 19 maize landraces was conducted in village level *in-situ* conservation center during Kharif season of 2016 and 2017. Data was recorded for 17 quantitative characters related to growth and yield performance and 20 qualitative characteristics. Most of landraces showed dark green coloured leaves (95%), straight attitude of leaf blade (78.9%), anthocyanin coloured anthers and silk (78.9%), conico-cylindrical ears (58%), yellow coloured grains (37%) and flint type (94.7%). Among the plant growth characteristics plant height (157.4 to 208.9 cm), stem diameter (2.12 to 3. 94 cm), leaf length (69.06 to 95.56 cm), leaf width (7.28 to 11.38 cm), ear length (14.to 22.22 cm) ear diameter (16.74 to 12.22 cm), number of rows per ear (12.4 to 15.6.) contributed most to overall variability among maize landraces under study. Analysis of variance showed that all the characters were highly significant among the landraces.

Variability study in hyacinth bean [*Lablab purpureus* (L.) Sweet] landraces

Morpho-agronomic characters of 33 landraces of hyacinth beans collected from farmers residing in tribal blocks of Maharashtra were evaluated at *in-situ* conservation centers at Akole in Ahmednagar district and BAIF Central Research Station, Urulikanchan, Pune during the year 2016-17. The results of the study revealed that the indeterminate growth habit (93.9%), green stem colour (48.5%), terminal inflorescence (54.5%), white flower colour (57.6%), straight pods (42.4%), green colour pods (51.5%), round and oval shaped seeds (27.3%) and reddish brown seed colour (42.4%) were dominant characters in evaluated landraces. Analysis of variance indicated that variations in all the characters were highly significant among the landraces. The study revealed significant variation in flowers per inflorescence (9.4- 82.8), pods per inflorescence (1.4- 12.0), pod length (3.7-18.1 cm) and 100-seed weight (16.7-75.9 g). This diverse gene pool of hyacinth bean landraces is valuable resource in future for promotional and varietal improvement program.

Evaluation of Finger Millet (*Eleusine coracana* (L.) Gaertn.) Accessions

The study was conducted at village level *in-situ* center, Jawhar block of Palghar district of Maharashtra during the year 2017 and 2018 to characterize 20 accessions of finger millet. Data was collected on morphology, plant growth and yield contributing characters. Traits like erect growth habit (80%); semi-compact ear (60%); partially enclosed seeds by glumes (60%) and light brown colour of seed (75%) was found dominant among studied accessions. The results indicated variability in finger number (6 to 14), finger length (7 to 16 cm) and maturity days (85 to 117). The results of study also showed that productive tiller number was most varied trait (29.37%), followed by ear head length (21.98%) and finger number (19.42%). Among the studied traits, finger width showed the lowest variation (7.65%). Analysis of variance showed that all the characters were highly significant among the accessions. This potential gene pool needs to be conserved and may be explored for crop improvement in future.

Morphological characterization of little millet landraces

The study was conducted at village level *in-situ* center, Jawhar block of Palghar district of Maharashtra during the year 2017 and 2018 to characterize 10 accessions of little millet. Data was collected on morphology, plant growth and yield contributing characters. Traits like decumbent growth habit (80% landraces), non-lodging (80% landraces), non-pigmented leaf sheath (40% landraces); glabrous leaves (70% landraces), arch shaped inflorescence (80% landraces); unbranched culms (70% landraces), compact panicle (60% landraces) and golden yellow grain colour (50% landraces) was found dominant traits. The results indicated variability in flag leaf length (20.2- 31.2 cm), peduncle length (10.6-18.1cm), panicle length (27.9 - 34.9 cm), plant height (176- 209.3 cm) and days to maturity (119- 137).

Evaluation of Cowpea Germplasm for Agro-Morphological Characters

Cowpea (*Vigna unguiculata* L.) accessions collected from various households of western Maharashtra were characterized by using morphological traits. The field experiments were conducted at BAIF-CRS Urulikanchan, during Kharif 2018 and summer 2019. The experiments were arranged in row design with minimum 10 individuals of each accessions spaced at 60 x 30 cm. Recommended package of practices were adopted throughout experimentation. Traits such as semi-prostrate habit (41.9%), determinate growth (77.4%), straight pod (51.6%), smooth seed (71.0%), elliptic shape (67.7%) and yellowish-white seed colour (37.6%) were dominant in studied accessions. Time for first flowering ranged from 28 to 65 days; pod length ranged between 9.60 cm to 27.48 cm; seeds per pod observed between 7.20 to 16.40; 100-seed weight ranged between 12.00 to 36.00 g. Analysis of variance showed that all the characters were highly significant

among the accessions. Results revealed that studied accessions are valuable germplasm for future breeding programs.

Genetic diversity studies of maize accessions

Sixteen maize accessions along with three checks were used for genetic diversity analysis using ISSR markers. The dendrogram was constructed using Jaccard's coefficient and 1000 bootstraps. Accession Tapkiri Mukai formed outgroup followed by check Trupti 4040. Another check DHM7341was found to be associated with M91. Accession M81 and M22 was found to be very closely associated with each other at high bootstrap values. M88 and M92 were also found associated with each other at 99 bootstrap values. ISSRs could differentiate the maize accessions and produce higher number of loci. Accession M-90 was found to be genetically distinct than all other accessions. No seed color-wise separation and distinct grouping were observed.

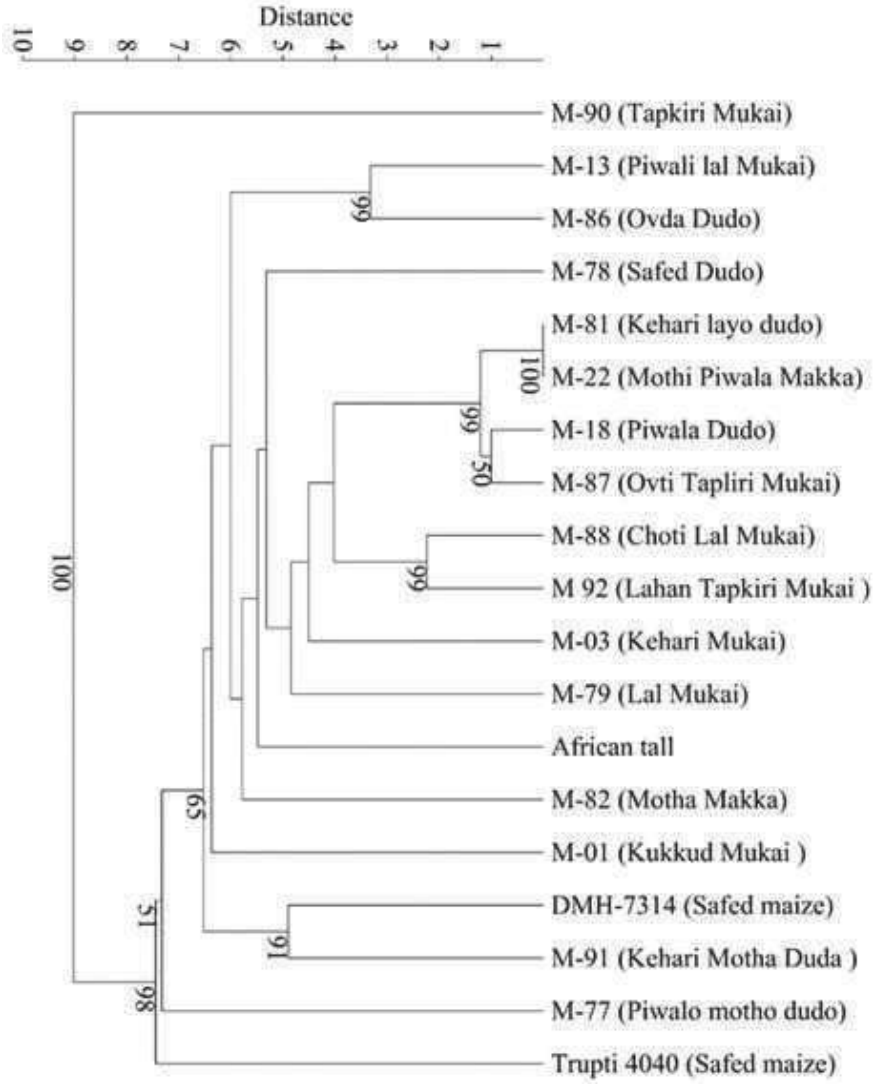


Fig. 1. Dendrogram constructed of 16 maize accessions along with three check varieties using binary data scored from 4 ISSR primers by using Jaccard's coefficient.

Genetic diversity studies of rice accessions

DNA was extracted from 118 rice landraces using CTAB method. Forty-eight rice accessions were analyzed for genetic diversity using ISSR markers. Dendrogram constructed using Neighbor Joining method showed Mal Kolamba is forming out group to all suggesting genetic distinctness, followed by Sadhana bhat and Dangi (R). Two main clusters are visible at 0.5% similarity. Ambemohor, Juna 57 and Khadkya are close to each other. Raibhog from Jawhar and Junnar are genetically distinct. Landraces collected from Junnar are observed in both clusters.

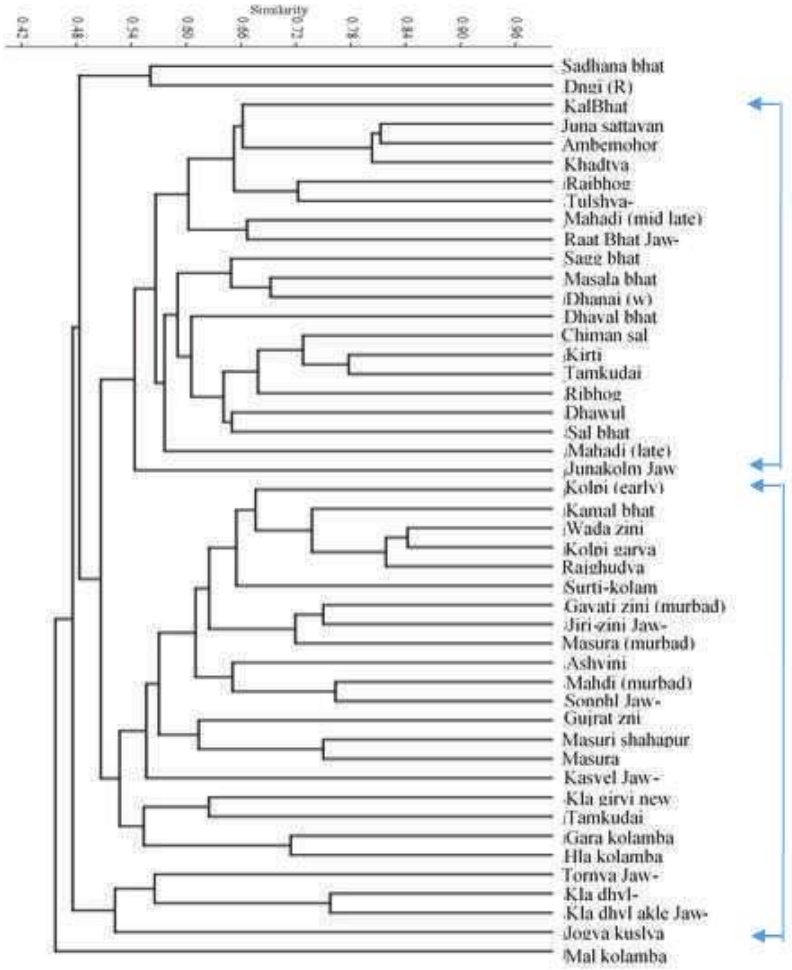
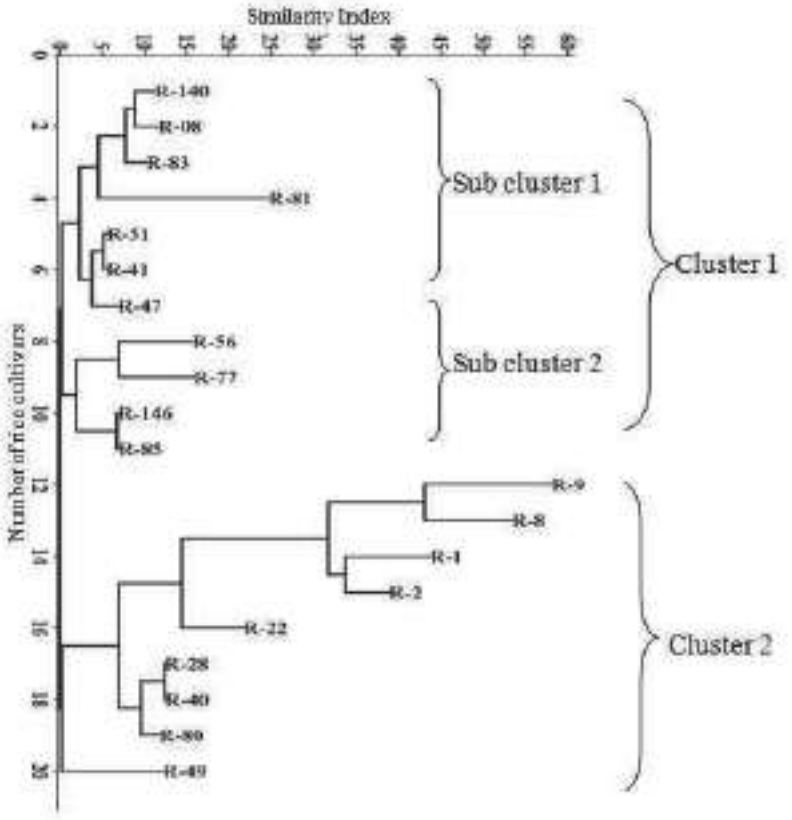


Fig. 2. Dendrogram constructed using Neighbor Joining method. Scale showing genetic similarity between landraces



Selected 10 SSR markers associated with iron and zinc content in the seeds has been standardized and 4 showed polymorphism. Further, standardized primers used to study diversity of 20 landraces. Landraces distributed in two main clusters as per figure above.

Study of Traditional agriculture practices and cropping pattern in Jawhar block of Palghar District, Maharashtra

This study was focused on cropping pattern and cultivation practices followed in Jawhar block of Palghar district, Maharashtra, along with economics of growing crops like rice, finger millet and Little millet. The evaluation of cultivation practices prevailing in the area was documented and possibilities of exploring various options for introduction of low cost sustainable cultivation practices. It has revealed that rice and millets are the major crops grown during the monsoon and the own food security is being fulfilled. Farmers are also adopting improved techniques of cultivation with minimum chemical inputs and thereby conserving the ecological balance. Rabb method for raising seedlings of Rice, Finger millet and little Millet is time consuming and requires huge labour. For late sowing option of Utta method is used in which seeds are sown directly in ploughed field. The main field preparation is generally followed at onset of monsoon. Plant debris, grasses and straw of previous year is buried under soil for rotting. Seedlings are transplanted at a close distance with high density that resulted into poor crop growth. Majority of farmers are not applying any kind of manure or fertilizer to any crop except in Rabb during rice nursery preparation. Only few farmers having livestock apply some FYM. Pest and disease infestation is increasing day by day which may be due to changing environmental conditions. Farmers are aware about the loss caused by pests and diseases. However only few farmers are adopting chemical control measures. Through this study, it has been shown that benefit cost ratio is very low-- for Rice (1.57), Finger Millet (1.03) and Little Millet (1.23).

The traditional practices associated with crop cultivation, biodiversity conservation etc. have great value in changing climate, environmental problems, food and nutritional security. So there is urgent need to focus on such promising practices, techniques and tribal wisdom through facilitation for designing of sustainable agriculture models by revisiting crop based useful traditions and traditional agricultural systems. The efforts have to be focused for identification, trait analysis, documentation, value-assessment, revitalization, community institutionalization and improvement of these traditional practices and genetic resources related practices and systems, introduction of crop yield improvement techniques like SRI in rice, ridges and furrow method in Finger millet and Little Millet cultivation, and participatory crop improvement methodologies for seed security of tribal communities.

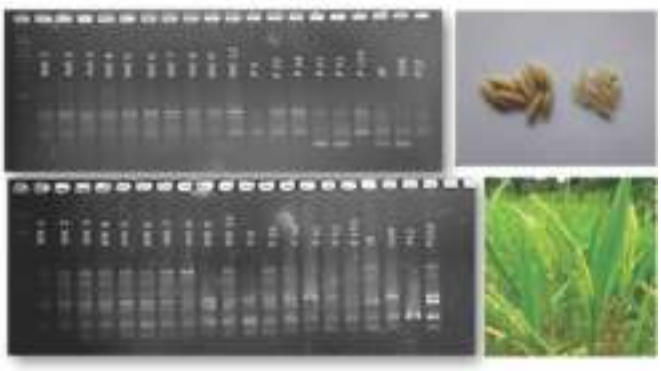
Evaluation of Individual plant selections(IPs) in finger Millet & Little Millet at Jawhar, Palghar District

During Kharif 2019 and 2020, study was initiated for finger millet and little millet crop improvement at Jawhar, Palghar District. Individual plants were selected in both crops and data collected as per DUS characters. The purpose of this work was to identify best suitable genotypes on the basis of grain yield, land type, pest and disease resistance, lodging susceptibility etc. This work will be continued with community for further selection as need-based programme.

#	Crop	Kharif 2018		Kharif 2019	
		No accessions	IPS selected	No of accessions	IPS selected
1	Finger millet	25	165	19	55
2	Little millet	10	40	9	20

Morphological and Genetic Evaluation of Wada Kolam Rice in Palghar District, Maharashtra

18 accessions of Wada Kolam were collected from Thane and Palghar districts morphological evaluation was initiated by establishing *in-situ* center as per DUS guidelines and compared with improved varieties like Gold 88 (G-88) & Jordar (JR) which are popular varieties in the region. Also, 18 accessions of Wada Kolam were analyzed by using two primers. Initial results showed that P41, P51, JR, G98, P9, P12 have different patterns than WK-1, WK-2, WK-3, WK-4, WK-5, WK-6, WK-7, WK-8, WK-9, WK-10. Further validation about variability is needed by using different markers.



Potential Yield studies

Potential yield study of Rice landraces from four blocks of Maharashtra

This study had been conducted at four locations across Maharashtra on Worthy rice landraces like Kolpi (Early), Kamal, Ashwini (Jawhar), Valay Lal (Kudal), Godal, Phitris (Etapalli), Kalbhat, Gari Kolpi and Raibhog (Akole), along with check variety (Popular variety under cultivation at each location) with three replications and with spacing of 25 cm x 25 cm. Data was collected on growth parameters like plant height at maturity (cm), no of tillers/seedling and yield contributing characters' panicle length (cm), grain & straw yield (q/ha).

In Jawhar cluster early landrace like Kolapi and Rajgudya produced 44.6 and 44.7 q/ha grain yield which was 9.1 and 9.3% lower yield than improved variety MTU. Midlate varieties Kamal, Ashwini, Javayachi gundi produced grain yield 38.54, 41.9 and 43.4 q/ha respectively, which was 20.5%, 10.8% and 10.8% lower than yield of improved variety Daftari.

In Akole cluster early landrace Kalbhat grain yield was 44.6 q/ha as against early improved variety Punam 59.8 q/ha which indicated 25.3% higher yield in improved variety. Midlate variety Raibhog has grain yield of 38.15 q/ha while improved variety Daftari grain yield of 62.8 q/ha which indicated 16% higher yield than landrace. Late duration variety Gari-kolapi grain gave yield of 45.2 q/ha and improved variety 1008 produce 63.5 q/ha grains which was 28.9% higher in improved variety.

In Etapalli cluster midlate varieties Godal and Pitris yielded 42.24 and 41.38 q/ha respectively; improved variety Balwan yielded 46.8 q/ha grains which was 9.1% and 11.0% higher than landraces.

In Kudal cluster late duration variety Walay-lal produced 36 q/ha grain yield which is 3.3% higher than improved variety Vaishnavi (34.8 q/ha).

Performance of Finger Millet and Little Millet landraces from Jawhar, Tribal block of Palghar district of Maharashtra

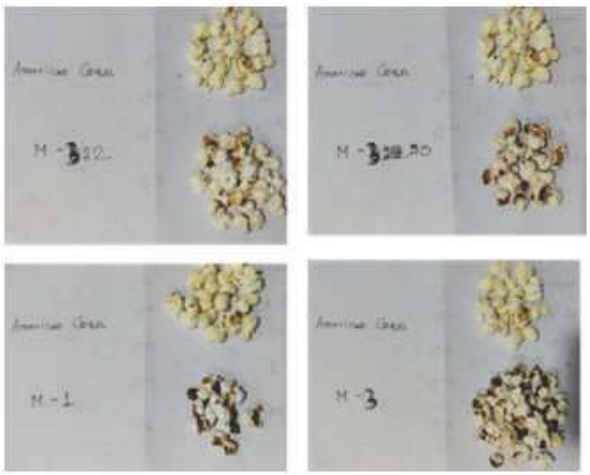
Performance of Finger Millet (2) and Little Millet (2) was evaluated for growth and yield contributing characters at Jawhar block of Palghar district with spacing of 25 cm x 30 cm by ridge and furrow method and data collected on plant height, no of tillers/plant, grain and biomass yield. The results of the study revealed that the finger millet landrace Kalperi recorded grain and straw yield of 27.57 q/ha and 44 q/ha, respectively. The landrace Shitoli gavegrain and straw yield of 27.39 q/ha and 43 q /ha. The little millet landrace Ghoshi gave grain and straw yield of 27.62 q/ha and 44.20 q/ha, respectively. The landrace Dudhmogara yielded grain and straw 27.74 q/ha and 43.54 q /ha, respectively.

Economics of cultivation of landraces

The economics of cultivation of seven rice landraces from Jawhar (Palghar), Kudal (Sindhudurg), Etapalli (Gadchiroli) clusters was studied to understand the cost of cultivation of the indigenous crop varieties and returns. Data on cost of cultivation, grain and straw yield and prevailing market price was collected through specially designed format during 2019. It was observed that most of the farmers followed traditional cultivation practices and rice and millets were the major crops grown under rainfed conditions. The crop economics indicated that the benefit cost ratio was 1.06, 1.77 and 2.36 in rice, finger millet and little millet, respectively. The returns are mostly depending upon the crop yield and prevailing market price and the benefits will be more attractive if the farmers get premium market price. Moreover, there is a scope to increase the crop yield by adopting improved package of practices in cultivation of these crops.

Maize Poppiness testing

M-1, M-3, M-22 Maize accessions from Nandurbar district were tested for Poppiness character and compared with American corn. This has been done in collaboration with Sidhivinayak Industries, Chakan, Pune. Also Finger Millet landraces are under testing for poppiness.



Community participation in MGBP process

During MGBP implementation, major focus was always towards participation of community at every stage from baseline data collection, participatory research to establishing community organizations

Participatory Rural Appraisal: Participatory rural appraisal process was carried out in 60 villages of six blocks. The key sub-activities under this were:

a) Village-wise meetings of different stakeholders (Women, Youth, Knowledgeable persons)

b) Focus group discussions with knowledgeable persons.

c) Field visits to understand existing status of crop cultivars and wild edible plants.

d) Organized seed festivals, exhibitions at Cluster level to capture Traditional Knowledge

Establishment of on farm demonstration centers

Field survey for selection of locations for *in-situ* conservation centers. The key sub-activities undertaken as per below:

a) Selection of fields for *in-situ* center establishment in villages.

b) Plantation of collected germplasm as per crop-wise guidelines by involving knowledgeable-farmers

Participatory seed selection

Participatory seed selection is very important for maintaining genetic purity and yield improvement of crop landraces. Participatory varietal selection provides scope for cost-effective varietal selection from farmers' own resources while enhancing their access to crop varieties, production alternatives and thus assuring food security of their choice.

For the purpose of participatory seed and varietal selection, farmers have been organized into groups. Seed selection was undertaken in groups of 5-10 members at *in-situ* conservation centers of rice, finger millet, little millet, maize, and sorghum. Groups have interacted with each other after observing the crop performance and finally they assigned a score value based on criteria for selection of landrace such as grain and fodder yield, resistance to pests, crop stand, disease tolerance, plant strength, panicle length, effective tillers, lodging susceptibility, maturity days, suitability to land, drought tolerance, end use etc. Participation of farmers for selection of varieties was undertaken at three stages i.e. vegetative growth, flowering and crop maturity. Elite crop landraces are selected on the basis of farmers' participation and scientific data, then seeds of these selected landraces were given to selected farmers for seed production.

Participatory seed selection in Little millet, Finger millet and Rice

Community level seed production and Management

Elite crop landraces selected by participatory seed selection method were given to the farmers for further multiplication. The selected farmers assigned their land for seed production and plots were monitored by technical staff to ensure good quality seed production. The produced seed was then deposited in community seed banks for further supply to farmers. Germination and physical purity testing was done at Seed bank level and then quality seed of different crop landraces were made available and seed banks have generated revenue.

Community awareness and up-scaling the production

Seed production and seed selection were popularized by the seed committee through field training programmes to educate farmers about maintaining seed purity in different crops. Along with that, demonstrations on suitable methods of cultivation are organized and farmers were trained on using a package of sustainable practices from sowing to harvesting.

Institutional Building

Community level institutional building was carried out by identifying seed savers and formed seed savers groups and seed saver organizations and provided facilitation support for handing of germplasm, seed bank activities, and record keeping.

Management of Seed Banks by community

Sustainability of seed conservation programme requires a mechanism at the community level for seed selection, seed production and exchange, and to establish an independent seed supply system at the village level. Six community seed banks have been established to ensure easy access for local farmers. Farmers interested in growing such landraces in their fields can obtain seed from the Seed bank. Five seed saver committees were

formed to ensure quality seed production, management of seed exchange and establish market linkages. The seed saver committee has an authority of monitoring seed plots for quality seed production. Use of Grain pro bags was also initiated for safe seed and grain storage at community level.

Community level seed storage and seed distribution

Agrobiodiversity and Wild food resources conservation and management through Schools

- School level agro-biodiversity awareness and field programmes were organized by establishing eco clubs in 16 schools at three clusters i.e. Jawhar, Dhadgaon and Kudal.
- Jayeshwar Vidya Mandir, Dengachimeth, Jawhar block is in conservation of rice, vegetables, beans diversity since 2016 and conserved 21 rice landraces, 15 vegetable landraces by establishing on farm conservation center and students are trained in SRI method of rice cultivation, soil testing, seed germination testing etc. Established seed bank at school campus for production and exchange of seed diversity.
- Children Biodiversity Register (CBR) prepared in three schools in Sindhudurg district.
- Thali (Food plate) exercise, exposure to *in-situ* conservation sites, seed banks, seed exhibitions, forest walk (25750 students from 16 schools- 66 events).
- Three wild food exhibitions organized at schools to aware students on wild food plants and their recipes.
- Two students participated in District level science exhibition focusing their project on Rice diversity –Importance of conservation and Revival.
- Participated and exhibited during State level Marathi Vigyan Parished organized at Vasundhara Vigyan Kendra, Kudal, Sindhudurg (16-17th Dec 2017)
- Organized 3 days Students-Teachers workshop (Anand shala) with CEE at Jawhar along with field exposure in 2016 and 2017 (10 teachers and 25 students)
- Seed germination testing training at four schools- 304 students participated; also established rice diversity Centre (21 landraces)
- Promotion of indigenous vegetables through kitchen gardens (415 students)

Seed germination testing

Understanding rice diversity

Exposure visit to Seed Banks

Wild food diversity

Beneficiaries and benefits

The participating farmers in the various activities like seed production, *in-situ* conservation, seed banks, kitchen garden kits and farmers involved in promotional activities exposure visits, training, exhibitions etc. are the direct beneficiaries and they received quality input and technical support, knowledge building and livelihood options for income generation. Some of the benefits are short-term like input support during the project duration. The long-term benefits consist of availability of quality seeds through seed banks, market access to the produce and nutritional benefits. The knowledge gained through training and capacity building is a long-term benefit for the community. Seed producer farmers started sale of seeds and grain which will continue in long term as day by day demand is increasing for indigenous produce. Steps were taken towards safeguarding rights of farmers on crop genetic resources and deposited 150 crop landraces of rice, finger millet, little millet, maize and sorghum to NBPGR, New Delhi and 53 applications submitted for registration of varieties to PPV & FRA, New Delhi, Till now IC numbers are received from NBPGR for 94 accessions(Annexure 3).

Measures to reassure that benefits to the community continue even after conclusion of MGBP

The formation of seed saver groups, Biyane Samvardhan Samiti, Farmers' producer company at various project locations will be able to manage the conservation programme. The operation of community seed bank, seed production, collective marketing of grain and seed could be handled by the trained community personnel.

Peoples' selection criteria

The landraces suitable for the particular soil type, climate resilient, nutritionally rich, resistance to pest and diseases, market potential, taste, fodder value, end use are the some of the criteria preferred by the community for selection of particular landraces. This data was collected through PRA and FGD, exposure visits to in situ conservation centers at crop maturity stage, assessment of crop diversity and documentation of people preferences through ranking system. The blending of traditional and improved cultivation practices adopted by many farmers has resulted in yield enhancement and income.

Relationship with PPVFRA and NBPGR

- Total of 53 landraces were applied for registration with Protection of Plant Varieties and Farmers Right Authority (PPV and FRA), New Delhi. Applications were submitted during the 2015-16. Out of 53 applications, five sorghum landraces (Chikni Lal - Loose panicle, Mothi Safed Juwar, Mothi Mani Juwar, Chikani lal and Lahan mani juwar) have received registration certificates recently.
- Seed samples and passport data of 150 landraces of rice, finger millet, little millet, maize and sorghum were submitted to NBPGR, New Delhi for allotment of IC numbers. 94 landraces of Rice, Finger Millet, Little Millet, Maize and sorghum received IC numbers from NBPGR.
- Correspondence with NBPGR, New Delhi was made for training of project staff in gene bank management and handling the germplasm.

List of Publications and presentations at conferences etc.

Research Paper Published

1) Sanjay Patil, Ketki Patil, Prafulla Sawarkar, D. K. Kulkarni (2015) Germplasm Conservation of millets and vegetables in Dhadgaon and Akkalkuwa tribal block of Nandurbar district, Maharashtra. *Science Research Reporter Journal*, 5 (2):137-146, 2015

2) Ashwini Chothe, Sanjay Patil and D. K. Kulkarni (2014) Unconventional food resources- Conservation, Domestication and Standardization of Recipe for wild food resources. *Bioscience Discovery*, 5(1):19-23

3) Vitthal Kauthale, Dilip Kulkarni, Lilesh Chavan, Sanjay Patil and Anjali Nalawade (2017). Diversity of wild edible plants in Dhadgaon block of Nandurbar district in Maharashtra (India).*Int.J. Curr.Res. Biosci.Plantbiol.* 4(6): 62-73

4) Kauthale V.K., Patil S.M., Nalawade A.D., Chavan L.L. And Navale Y. P. 2018. Nutritional Status of Crop Residues of Landraces as Fodder Resource in Maharashtra, India, International Journal of Agriculture Sciences, 10(7): 5755-5757.

5) Chavan L. N, S.M. Patil, V.K. Kauthale and A.D. Nalawade (2018) Morphological characterization of Sorghum [*Sorghum bicolor* (L.) Moench] Landraces using DUS descriptor Agric. Sci. Digest., 38(3) 221-224

6) Patil S. M., V. K. Kauthale, Y. P. Navale and A. D. Nalawade (2018) Variability study in hyacinth bean [*Lablab purpureus* (L.) Sweet] landraces from tribal blocks of Maharashtra, India Crop Res.53 (5 & 6)252-256

7) Sanjay Maruti Patil, Lilesh Nateshwar Chavan, Vitthal Keshav Kauthale and Anjali Dnyaneshwar Nalawade (2018). Agro-Morphological Characterization of Maize (*Zea mays* L.) Landraces from Tribal Block of Nandurbar District in Maharashtra (India). International Journal of Applied and Pure Sciences

8) Patil S. M., V. K. Kauthale, Y. P. Navale and A. D. Nalawade (2018).Variability of Mineral Composition of Rice Landraces Collected from Maharashtra, India

Asian Journal of Dairy and Food Research, 38 (3): 242-246.

9) Sanjay Patil, Vitthal Kauthale, Santosh Aagale, Mavanji Pawar and Anjali Nalawade. Evaluation of finger millet [*Eleusine coracana* (L.) Gaertn.] accessions using agro-morphological characters" Indian Journal of Agricultural Research, 53 (5) 624-627.

10) Nalawade A. D, S. M. Patil, P. R. Rajwade and V. K. Kauthale 2020 Evaluation of Cowpea Germplasm by Using Agro-Morphological Characters. Indian Journal of Agricultural Research, 55 (3) : 364-368.

Research Papers Published online

1) Ashwini Chothe and Sanjay Patil (2014) Conservation, preservation and domestication of wild edible plants for food security and livelihood in Jawhar (thane) district of Maharashtra, paper presented in Indian Biodiversity Congress (IBC 2014) held at SRM University, Chennai during 17-20 December 2014.

2) Sanjay Patil (2014) Seed Sovereignty for Food Security and Livelihood Improvement" -Community Led Efforts in Conservation and Revival of Indigenous Crop Diversity in Jawhar, Tribal Block in Thane District of Maharashtra, Indian Biodiversity Congress (IBC 2014) held at SRM University, Chennai during 17-20 December 2014.

3) Sanjay Patil, Santosh Agale and Vitthal Kauthale (2015). Study on traditional cultivation practices and cropping pattern in tribal Block of Jawhar in Palghar district of Maharashtra. presented in 3rd International Symposium on Underutilized Symposium Plant Species, TNAU, Madurai

4) Sanjay Patil, Lilesh Chavan, Manoj Meshram, and Vitthal Kauthale (2015). Preservation methods and usage pattern of wild food resources in Palghar, Nandurbar and Gadchiroli tribal blocks of Maharashtra, presented in 3rd International Symposium on Underutilized Symposium Plant Species, TNAU, Madurai.

5) Sanjay Patil, Lilesh Chavan, Vitthal Kauthale (2015). Germplasm collection, diversity mapping and conservation of Millets in Tribal Belt of Palghar and Nandurbar Districts in Maharashtra. presented in 3rd International Symposium on Underutilized Symposium Plant Species, TNAU, Madurai**.**

6) Sanjay Patil. 2017. Community led seed conservation, Community seed banks and farmer's rights-BAIF Experiences in Maharashtra, India, Published in Proceedings of National Seed Workshop held at MPKV Rahuri.

7) Sanjay Patil, Santosh Agale and Vitthal Kauthale "Study of Traditional agriculture practices and cropping pattern in Jawhar block of Plaghar District" published in "International Society for Horticultural Science" Paper presented in 3rd International symposium on underutilized plant species at Madurai, Tamil Nadu (India) 2017.

8) Sanjay Patil (2017) 'Community seed banks and farmer' srights' in World Organic Congress 2017, New Delhi (Oral presentation)

9) Sanjay Patil. 2017 Community led agro biodiversity conservation-BAIF experiences in Maharashtra, paper presented in "The Sustainable Indigenous Seed Innovation" workshop organized by University of Leeds(UK) and Art of Living, Banglore (15th Sept 2017)

10) Sanjay Patil Community seed banks and seed sovereignty, presented in National seed workshop organized by MPKV Rahuri, Maharashtra (4th Aug 2017)

11) Kauthale, V.K., Sanjay Patil and Lilesh Chavan. Mapping and morphological characterization of maize diversity in tribal block of Nandurbar district of Maharashtra, paper presented in 3rd Indian Biodiversity Congress (IBC-2017), 10-12 March 2017, Puducherry.

12) Sanjay Patil Traditional knowledge associated with rice (Oryza sativa) diversity in tribal blocks of Maharashtra.' Paper presented in National conference on Vrikshaurveda and organic farming organized by Asian Agri History Foundation, Udaipur, 6-8 March 2017

13) Sanjay Patil (2018) 'Role of women led agro-biodiversity conservation' during workshop on role of women in Agriculture, organized by ITC at Navi Mumbai. (Oral presentation)

14) Sanjay Patil (2018) BAIF's programme on agrobiodiversity conservation and issues related to seed acts. Workshop of organic farming & Agririan crisis by Centre for Science &Environment, Delhi, 12-13th Feb 2018

15) PatilS., S. Agale and V. Kauthale (2019) Study on traditional cultivation practices and cropping pattern in tribal block of Jawhar in Palghar District of MaharashtraActaHortic. 1241. ISHS 2019. DOI 10.17660/ActaHortic.2019.1241.50 Proc. III International Symposium on Underutilized Plant Species Eds.: C. Ravindran et al.

16) Monali C Rahalkar, Sanjay Patil, Prashant K Dhakephalkar, Rahul A Bahulikar (2018) Cultivated methanotrophs associated with rhizospheres of traditional rice landraces from Western India belong to Methylocaldum and Methylocystis*3 Biotech*. 2018 Jun; 8(6):281. doi: 10.1007/s13205-018-1306-z.

Participation in various workshops / conferences

1) Participated in workshop on Indo-German Bilateral Co-operation in Seed Sector" organized by PPV & FRA, New Delhi (23-24th May 2016)

2) Attended International Agro biodiversity congress, New Delhi (6-9 November 2016) and presented community led agro-biodiversity conservation work in

Maharashtra, also exhibited seed diversity. Received Best exhibition stall award (Consolation prize).

3) National conference on social Innovation 2016 at Pune (16-17th Nov 2016) organized by Pune International Centre. Two MGB participants" innovators Smt. Rahibai Popere & Mr. Sunil Kamadi presented their work on agro biodiversity conservation.

4) Participated and exhibited during State level Marathi Vigyan Parished organized at Vasundhara Vigdyan Kendra, Kudal, Sindhudurg (16-17th Dec 2017).

5) Participated in PPV & FR awareness programme on Millets organized by IIMR, Hyderabad and PPV & FRA New Delhi, 27th Jan 2018.

6) Participated in workshop on Sustainable Rural Development-2 on 9th January 2018 at DLLE, University of Mumbai.

7) Participated in National Seed Diversity Festival-2017 organized at Anna University, Chennai in joint collaboration with Alliance for Sustainable and Holistic Agriculture (ASHA) and Bharath Beej Swaraj Manch along with Safe Food Alliance (Tamil Nadu) and Sahaja Samrudha with an objective of conserving and reviving our rich heritage seeds. (9th to 11th June 2017)

8) Mrs. Mamtabai Bhangre, Grass root seed saver from Akole Block attended National Grass Root Innovators conference at IIM Ahmedabad organized by NIF and SRISTI Ahmedabad, Presented Agrobiodiversity conservation experiences (Feb 2019).

9) Participated in workshop "Research Agenda on sustainable seed innovation – University of Leeds UK and Art of Living Agriculture Foundation, Bengaluru (Aug 2019).

10) National conference on social Innovation 2019 at Pune (Nov 2019) organized by Pune International Centre. Khusi Nagli snacks making women group, Vanganpada Felicitated during conference.

11) Shrimati, Mamtabai Bhangre, Seed saver, Akole Attended International Women Scientists Conference at Kolkota. (Nov 2019)

Popular articles / case studies published

1) Maharashtra's tribal farmers revive traditional crops. Published in Village square, Aug 25, 2017.

2) Seed Mother Rahibai's Story: How She saved over 80 Varieties of Native Seeds! Published in Village square, Sept 2017.

3) Traditional Method of Irrigation (Diversion Based Irrigation) Through Tribal community in Satpuda (18th sept 2017) in Sakal Agrow.

4) Attaining food sovereignty by building access to local seeds, LEISA March 2017, Vol 19.

5) गावरान वाणांचे संवर्धन, संरक्षण, पुनरुत्पादन व शाश्वत वापर– काळाची गरज in Vasundhara magazine.

6) **Articles published in Agrowan:** 3 articles on Traditional seed storage systems (Oct 2019).

7) "Shudhh Bijapoti" Article in Tarun Bharat, Mumbai, 23th March 2020.

8) BAIF's work on Indigenous Crop diversity and Wild edible plants conservation published in Krishi Jagran. April 2020.

Networking with other MGBP groups

BAIF has organized training programme on participatory seed selection method and characterization of crop landraces at Jawhar for other MGB partners engaged in crop diversity conservation. Other MGB partners like Lokpanchayat-Sangamner, Gramin Yuva Pragtik Mandal (GYPM)-Bhandara, Sanskruti Savardhan Mandal (SSM)-Nanded, IIRD-Aurangabad, SPKS-Sangli are working on diverse crops focusing on conservation and revival of agricultural biodiversity with community participation in respective regions of Maharashtra. These NGO's are working with farming communities since long and they have their own strengths in specific area of conservation of agricultural biodiversity. Networking with all these partners was useful in getting specific insights like 1) Real understanding of registration of farmer varieties under PPV & FRA and its complications, community benefits, 2) Open source seed systems for promotion of Region-specific crop diversity, 3) Community understanding about Crop diversity and ITK, 4) Organic Bazzar concept for developing livelihood opportunities through cultivation of crop landraces in crop diversity conservation programme. The laboratory facility of BAIF were made available to some partners for nutritional analysis of grain and straw samples. The RBM framework was prepared with technical facilitation of BAIF staff.

BAIF has coordinated for MGBP crop diversity component and RDBMS database of crop diversity partner organizations for further submission to IISER.

BAIF has received help from below mentioned NGOs in respective areas

- GYPM Bhandara: Biodiversity register preparation and knowledge building about Biodiversity Act and related aspects.
- SPKS –Sangli: Krishi Diary for recording of farm economics and activities.

Outreach

Connection with people beyond beneficiaries

Programme on 'Agro biodiversity for sustainable development' have reached to different stake holders beyond direct beneficiaries through awareness programmes, public talks, exhibitions, trainings and field exposures etc.

#	Particulars	Stakeholders
1	Awareness programmes and seed exhibitions	RYK college, and K. K. Wagh collage, Nashik, Vidya Prathisthan, Baramati, KVK Baramati, MPKV Rahuri, Sustainable stores-Pune, Organic farming study group-Pune,ISKCON-Palghar district
2	Field trainings on seed conservation	Dhavle Memorial trust-Vikramgad, Praj Foundation, Sahyadri school, Rajgurunagar
3	Workshops organized	National seed savers workshop at Jawhar, MGB crop diversity theme workshop and field Training
		Finger Millet Conservation, Cultivation and Value addition in collaboration with HPT college Nashik which is attended by NGOs –Pragati Abhiyan, Kalsubai Millets, Lokpanchyat, KVK Nashik, students from HPT college, Farmers from Palghar, Nashik, Ahmednagar District exhibited Millet diversity. (May 2019)
4	Exposure visits	Farmer groups from Madhya Pradesh, Gujarat, Karnataka, school students from Orchid school, Nashik ISKCON school, Wada,Vanrai Pune etc.

Policy level interventions/recommendations

Related to Research

- In-depth research is required for identifying specific traits like stress tolerance, nutritional status, medicinal properties, any other trait that communities find useful etc. for many crop landraces.
- Genetic diversity study using molecular markers needs to be done to understand diversity among the landraces.
- The approach of participatory varietal selection involving local community may be adopted for identification and genetic improvement of locally suitable crop diversity.
- Mapping of crop diversity across diverse bio geographic regions and collection of eroding germ-plasm should be important research agenda.
- Need to expand the work of *in -situ* conservation of region's agro biodiversity and crop cultivars in different crop-wise native tract in the state and in India as a whole.
- Need to have multi stakeholder, multi partner effort in future around indigenous crops by focusing on all aspects of food production from collection of germ-plasm up to storage and innovative marketing.
- Need to study in depth the role of local crops and wild food resources in vital and essential part of human's food system.

Related to Livelihood Security

- Community level seed production and seed banks concept may be adopted for seed sovereignty and to facilitate self-reliance in seeds which is the soul of farming.
- Community led enterprises for production and sale of kitchen garden seeds and grains produced has good livelihood potential and also ensure less dependence on outsider agencies for important seed supply.
- Promotion of selected landraces for cultivation among the farmers through various schemes implemented by state agriculture department needs to be considered as this can lead to further multiplication of eroding base of worthy crop cultivars.
- Inclusion of local cultivars and landraces in seed production system and food system is pertinent.
- It is important to focus on registration of traditional varieties for its commercial use.

Related to Food and Nutrition Security

- A relook is necessary at region's agro biodiversity and food resources which are potential sources of nutrition including micro nutrients. Even key players in agriculture research, extension and crop promotion and varietal release need to focus on promotion of nutritionally rich crop varieties for nutritional security (Ex: ICAR institutes, KVK's, State Agricultural Departments, SAUs, Experts etc.)
- Food and nutritional security by introducing perennial and seasonal, diverse vegetable crops through kitchen garden is very good intervention to ensure household level food and nutrition security. There is need to upscale and replicate this intervention through ongoing and future government programs.
- Linking region's biodiversity with school mid-day meal and other government led nutrition efforts like PDS is important.

Related to Climate Change Resilience Building

- There is need to study various crops to understand their performance under biotic and abiotic stresses.
- There is need to introduce climate resilient crops for sustainable crop production under adverse climatic situations and variabilities.

Gender Dimensions

Women are traditionally custodian of local knowledge and wisdom associated with region's crop diversity and wild food resource. It is necessary to give recognition to rural farm women and ensure their centrality in any future program around agro biodiversity.

National/ international outreach

- Bioversity International- Conservation and broad base of Agrobiodiversity, Documentation of Seed savers. MOU finalized between Bioveristy international and BAIF to develop long term programme for conservation and management of agrobiodiversity.
- Indian Institute of Technology (IIT), Mumbai and Godrej -Design and development of seed storage system for community based seed banks.
- ICRISAT, Hyderabad for germplasm sharing and staff capacity building in seed bank management
- Indian Institute of Millet Research (IIMR) Hyderabad, for millet improvement, germplasm sharing, value addition, farmer exposures and staff training.
- University of Agricultural Sciences, Dharwad for millet improvement, germplasm evaluation, staff and farmer exposures
- India Seed Sovereignty Alliance (*Bharat Beej Swaraj Manch*) –Network of seed savers from 16 states of India.
- PPV & FRA, New Delhi for registration of farmer varieties under PPV & FR act.
- NBPGR, New Delhi- Registration of crop landraces.
- National Agri-Food Biotech Institute (NABI), Mohali Punjab for nutritional evaluation of rice, Millet, Maize and sorghum genotypes.
- Prof. Jayshankar Telangana State Agricultural University, Hyderabad- Value addition in small millets.

Knowledge Outcomes

Interesting / unknown/ unrealized facts during the work which you came across

Seed storage methods in tribal areas of Maharashtra:

Following are the important traditional methods of seed treatment and practiced by tribal farmers.

Seed storage structures made from bamboo

***Kanga /Tatki*:** This structure made from bamboo mostly used for grain storage with capacity 500-1000 kg. Before storage, grains need to get cleaned and well sun-dried. Some farmers used leaves of various plants like Neem (*Azadirachta indica* A. Juss.), Nirgudi (*Vitex negundo* L.), Papaya (*Carica papaya* L.), Kala Kuda (*Wrightia tinctoria* R.Br.) etc. along with grains. After filling grain, the top of Kanga is covered with Sagg leaves and sealed with layer of cow dung. Grain of rice and millets were mostly stored in this structure and remain in good condition for 3 - 4 years.

***Zille*:** *Zille* is similar to Kanga but smaller bamboo structure having storage capacity of 200-300 Kg.

Karndya/muska: Bamboo (10-20) seeds separated from mature pods and kept on roof or mandav in gunny bags which is covered with rice straw. Grain mixed with ash for Black gram, Pigeon pea, and Ground nut pods.

Tipri: The long and hallows bamboo internode which is closed at one end. Cleaned and dried seeds of cucumber, amaranth, bottle gourd, pumpkin etc. were stored in this structure. About 100 g to 1 kg seed may store for 8 months.

Topli: It is U-shaped pot prepared by using bamboo and coated with cow dung. Tubers of Alu (*Colocasia esculenta* (L.) Schott.), Karande (*Dioscorea bulbifera* L.) and other wild tubers were stored for about 8 months. Before storage tubers were covered with rice straw and the pot was sealed by using cow dung and rice straw.

Seed storage structures made from clay

Ghagar: It is clay pot having capacity of 7-10 kg. Before storage, cleaned and sundried seeds were mixed with ash and pot was sealed by using rice straw and cow dung. Seeds of legumes were stored by this method up to next sowing season.

Gadge: It is also clay pot similar to *Ghagar* but smaller in size having storage capacity 0.5-1 kg.

Seed storage structures made from plants

Petya: This round shaped pot prepared for storage of seeds of millet and legume crops. Before storage, legume seeds are mixed with ash and millet seeds with Neem or Nirgudi leaves. The petya are hanged from roof and may store 0.250- 5 kg seeds.

Goni: Goni is gunny bags mainly used as grain storage device for shorter period.

Dodhi: The mature empty bottle gourd is used as seed storage device for niger, sesame, sorghum etc. The seeds to be stored are mixed with ash and vessel sealed with maize cob.

Vetiya: It is weaved structure made from rice straw to store rice.

Vetiya: a rice storage system

Seed stored by hanging or pasting

Tangan: This method used mostly for cowpea, ladies finger, bottle gourd, ash gourd, chilli etc. The mature fruits of these crops are kept hanging from roof.

Sitari: It is also hanging method for seed storage for maize and brinjal. The maize ears are tied and hanged on sticks over *chulha*.

Limpan: Seeds of cucurbits, cucumber and pumpkins are being stored by this method. The seeds extracted from mature fruits are coated with turmeric and jaggery and pasted on wall.

Finger Millet Cropping system

Mixed cropping system in finger millet along with broadcasting of black gram and sorghum is followed after transplantation of finger millet seedlings. After broadcasting of finger millet seeds in nursery, following crops grown at the same place.

#	Local Name	English Name	Botanical Name	Method of sowing
A	**Leafy vegetables**			
1	Math	Amaranth	*Amaranthus tricolor* L	Broadcasting of seeds after mixing with soil or ash
2	Ambadi	Rozelle	*Hibiscus cannabinus* L.	Line sowing of seeds on border of field
B	**Fruit vegetables**			
1	Kakadi	Cucumber	*Cucumis sativus* L	Sowing of seeds at the corners of field
2	Doda	-	*Cucumis melo L. var-momordica*	Sowing of seeds at the corners of field
C	**Vegetables**			
1	Bhendi	Lady Finger	*Abelmoschus esculentus* Moench.	Broadcasting of seeds
2	Dangar	Pumpkin	*Cucurbita maxima* Duch.	Broadcasting of seeds
3	Gavar	Cluster bean	*Cyamopsis tetragonolobus* Taub.	Broadcasting of seeds
D	**Oil seeds**			
1	Til	Sesame	*Sesamum orientale* L.	Broadcasting at border of field
2	Khurasani	Niger	*Guizotia abyssinica* Cass	Broadcasting at border of field
3	Mohari	Mustard	*Brassica juncea* Czern. & coss.	Broadcasting at border of field
E	**Pulse crops**			
1	Chavala	Cow pea	*Vigna unguiculata* Walp.	Broadcasting in main field
2	Udid	Black gram	*Vigna mungo* Hepper.	Broadcasting in main field
3	Kulith	horse gram	*Macrotyloma uniflora* Verdc.	Broadcasting in main field
F	**Cereals**			
1	Jwari	Sorghum	*Sorghum bicolor* Moench.	Broadcasting in main field
2	Makka	Maize	*Zea mays* L.	Broadcasting in main field
G	**Flowers**			
1	Zendu	Marigold	*Tagetes erecta* L.	Broadcasting at border of field
F	**Millet crops**			
1	Rala	Foxtail Millet	*Setaria italica* P. Bauve	Broadcasting in main field

Stories emerged

Seed Keepers

Padmshree Rahibai Soma Popere, Popularly Known as "Seed mother"

Rahibai Soma Popere is a 52-year-old tribal farmer from Mahadeo koli tribal community from Kombalne village of Akole tribal block in Ahmednagar district of Maharashtra. She could not attend school due to poverty and has been supporting her family in agriculture work like agricultural labour and cow rearing since the age of 10 years. She is married to Mr. Soma Popere at the age of 17 years. He is also uneducated. Whole family is dependent on 3-acre rainfed land. She has gained knowledge about agro biodiversity, wild food resources and traditional culture through practice and experience.

While working in Akole block to identify grass root and knowledgeable women seed savers, BAIF officials came across Shrimati Popere conserving 25 indigenous crop cultivars on her own. BAIF established small seed bank at Raibai's house and initiated scientific studies by developing in situ conservation center in her small field. Rahibai was one of the field resource persons for capacity building of self-help group members, farmers and students on seed selection, organic techniques, kitchen garden etc. during 153 training sessions in which more than 2500 farmers participated. Rahibai participated and facilitated farmers during seed melas, exhibitions and awareness programs in different parts of Maharashtra. Raibai conserved and multiplied about 48 indigenous landraces of 17 different crops (Rice, Hyacinth bean, finger millet, Pulses, Oil seeds etc.). She had prepared seedlings of curry leaves, papaya, black berry - 5000 seedlings and distributed as a gift to members of self-help group in 25 villages. She is in promotion of improved crop cultivation practices like SRI method in rice, and use of organic input production techniques. Shrimati Rahibai Popere was felicitated by Nari Shakti Award 2018 by President of India on 8th March 2019. She has also been selected as Most Influencing and Inspiring women in BBC 2018 world ranking. BAIF along with seed savers from Akole Block collected about 114 indigenous crop cultivars from Akole cluster and under conservation through seed bank at Rahibai's place, which was constructed with support from Mr. Chandrkant dada Patil, Ex Agriculture and Revenue Minister, Maharashtra.

BAIF established "Kalsubai Parisar Biyane Savardhan and Vikas Santha" with involvement of seed savers like Rahibai Popere (11 members) for promotion of superior landraces of different crops (Rice, Hyacinth bean, local vegetables) amongst the self-help groups **(1000 farmers).**

Mr. Tukaram Limbaji Diwate- a seed saver

He is a well-known farmer in the vicinity of Pur Village in Junnar cluster, District Pune. He is practicing farming since 3 decades. He is known for his knowledge and innovative fusion of indigenous and modern agriculture practices. He has been maintaining 250 Mango trees and saplings in the vicinity of his house and farmland for years. He has been cultivating Ambemohar and Khadkya rice landraces since last 15 to 20 years. Moreover, he has been cultivating landraces of rice (Raibhog, Jirvel, Kolamba); Finger millet (Safed nachni), Pearl millet (Gavthi bajara); wheat (Kusli gahu), black gram, pigeon pea, hyacinth beans and various tubers.

He has been cultivating local rice landraces and spreading awareness as well as sharing his expertise on traditional agricultural practices and wild food resources amongst the local farmers. He is practicing integration of farm yard manure and chemical fertilizers for cultivation of these landraces. He is also following traditional agricultural practices like manuring, weeding, harvesting, threshing and using Khillar bulls for ploughing and sowing operations. Along with traditional practices he has adopted improved method of rice cultivation i.e. SRI. He also has shown interest and become one of the *in-situ* conservator of 10 rice landraces. Due to his contribution and efforts, a Community Seed Bank and a Seed Saver Committee has been established in Junnar cluster with support of MGB project. He is the President and an active member of the Seed Saver Committee. Mr. Diwate's work has been recognized by Government of Maharashtra at the state and district level. His efforts have been appreciated by various awards like Vasantrao Naik Shetinishth Shetakari Puraskar-2008, Agriculture Department, Maharashtra; Krushinishth Shetakari Puraskar-2008-09, Zilha Parishad, Pune and Shetakari Gaurav Smruti Chinha-2010-11.

Mr. Sunil Bhoye- a seed saver

Mr. Sunil Vishnu Bhoye is a successful farmer from a remote village of Chirechapada, about 18 km away from Jawhar in Palghar district, where traditional agriculture is being practiced.

He has attended various trainings in vegetable cultivation, seed production, sustainable agriculture practices, horticulture plantation and capacity building conducted by BAIF. Afterwards he started various improved practices like micro irrigation, use of shade net, SRI method for rice cultivation, use of solar dryer, organic farming etc. He has not only started implementing these techniques in own land but also became a resource person for BAIF and various government departments to guide fellow farmers in adopting these techniques.

Till now, he participated in 40 training programmes and benefitted 1150 farmers. He has initiated farmers training and practical demo center at his farm. for awareness purpose. He has been conserving more than 55 landraces of different crops like rice, millets, vegetables, pulses, spices etc. A model for kitchen garden with tubers (Potato, Suran), fruit vegetables (Bottle gourd, Bitter gourd, Ash gourd, brinjal, Red Pumpkin), leafy vegetables (Cowpea, Alu), Lablab beans, Tondli, Lemon grass, Fruit Species (Guava, Papaya, Lemon) etc. for their house consumption and they are using it year round. He also conserved and multiplied 5 vegetable crops (Bitter gourd, snake gourd, Ash gourd, Ridge gourd, Snake gourd, Little gourd), adopted line transplantation, ridge and furrow method, is an organic techniques and expert in seed selection of various crops. He had represented BAIF's agrobiodiversity conservation programme at different programmes like seed exhibitions, awareness programmes at Kudal-Sindhudurg, Bangalore, Palghar etc. He is an active member of seed saver group in Jawhar and engaged in agro-biodiversity conservation program under MGB project. Sunil's wife “Shakuntala” is active member of SHG and Sunil is leader of farmer's group.

Mr. Bhoye is recipient of BAIF's 'Best Farmer Award 2017' as appreciation of his work in agro-biodiversity conservation.

Mr. Mavanji Pawar- Young Farmer Scientist in Biodiversity Conservation

Mavanji Ganpat Pawar, 35 years' age, is a youth belonging to Chowk village (Taluka Jawhar, District Palghar). Mavanji is doing exceptional work in the area of conservation of crop diversity. The efforts of Sri Mavanji have been recognized by Protection of Plant varieties and Farmers Rights Authority (PPV & FRA), Ministry of Agriculture, Government of India by conferring 'Plant Genome Savior Farmer Recognition Award' for the year 2011-12, for valuable contribution in conserving crop diversity in rice, finger millet, Little millet, sorghum, pulses, vegetables and tuber crops.

In June 2004, Mavanji took part in the Agri-Horti Forestry Programme (Wadi) launched by BAIF. With his keen observation, he realized the importance of crop genetic diversity in today's scenario of climate change for sustainable agriculture. Mavanji then focused on conservation of seeds of local landraces from April 2008 with the help of BAIF. He donated land for establishing 'Community Seed Bank'. He is a member of 'Biyane Savardhan Samiti' (Seed Savers' Group), in village Chowk. His wife, who is active in social activities, is a member of the 'Self Help Group' (SHG) of the village.

Mavanji adopted SRI (System of Rice Intensification) method of rice cultivation since the last four years and rice nursery through raised bed method. He has expertise in participatory seed and varietal selection and conserved landraces of rice (28), finger millet (2), Little millet (1), sorghum (1), pigeon pea (2), black gram (1) and Niger. An *in-situ* germplasm conservation centre has been established in his field. In the hilly areas, he has conserved indigenous tree species supplying timber and fruits, turning the area into a biodiversity centre. He has expertise in Mango grafting, Mahuva grafting and seed selection in rice and Millet crops. Mavanji has developed three rice landraces namely Sadhana, Kirti and Kamal through selection method and has applied for Registration under PPV & FR act, through BAIF's support.

Manvanji in Nursery

Rice Selection -Kamal Bhat

Manvanji's father in seed bank

Manvanji's mother, selecting foxtall millet diversity

Plant Genome Savior Farmer Recognition-2011-12

Mavanji has initiated seed production of rice landraces (Kolapi, Mahadi, Kamal), finger millet (Kalperi), Little millet (Dudhmogra) and is supplying the seeds to the 'Community Seed Bank'.

His family is cultivating tubers (Karande, Kochi, Suran), fruit vegetables (Bottle gourd, Bitter gourd, Brinjal, Pumpkin), leafy vegetables (Cowpea, Alu), Lablab beans, Tondli, Ambadi etc for their house consumption. Mavanji is working as a 'Resource Person' for production techniques of organic inputs, participatory seed selection for rice and millets and 'SRI' method of rice cultivation. More than 2000 farmers have been trained in the above techniques.

Mavanji has shared his experiences in 'Conservation and Revival of Crop Diversity' at different conferences and workshops organized in the state of Maharashtra, Gujarat and Madhya Pradesh. Scientists, farmers and students from different parts of the country have visited Mavanji's farm, which has become an experimental learning and a live gene centre.

Mr. Sunil Kamadi - Seeds of Hope, Seeds of Future

Mr. Sunil Kamadi, is a young farmer aged 36 years and belonged to Kamadipada village (Taluka-Jawhar, District Palghar). His family of seven members is cultivating 3 acres of rainfed agriculture land. In the year 2008, he realized that fertility and water holding capacity of the soil is degrading rapidly because of excessive use of chemical fertilizers. With technical support of BAIF, he learnt the technique of improving soil fertility and use of organic fertilizers. He also received training in production of organic fertilizers and cultivation of rice with SRI method for higher production than the traditional method.

In the year, 2010, Sunil got involved in BAIF's 'Crop Germplasm Conservation Programme' and conserved about 21 landraces of rice through *in-situ* conservation of the germplasm and became an expert in 'participatory seed selection' in rice, finger millet and proso millet.

Visit of Scientists from PPV & FRA, New Delhi

Cultivation of Finger Millet

Sunil Kamadi with 'Ashiwini' Variety of Rice

Plant Genome Farmer Recognition 2011-12

He also collected local varieties of tubers (*karande, kochi, suran),* fruit vegetables (Bottle gourd, Bitter gourd, Ash gourd, Brinjal, Pumpkin), Leafy vegetables (cow pea, *alu*), lablab beans and little gourd (tondli), which he cultivated for home consumption. While inspecting his rice crop, Sunil observed an unusual panicle of rice in the field. The panicle had more number of grains, smaller grain size and medium plant height. He removed the panicle carefully and then planted seeds from this panicle inthree successive seasons i.e. summer 2010, Kharif 2011, summer 2012, Kharif 2013.After three years of successive purification and upgradation under the guidance of BAIF experts, he was successful in developing new selection variety having specific characters. Sunil has named this rice variety as '*Ashiwini*' in name of his daughter

Farmers in the area have favored this variety because of grain yield, short slender grains, non-lodging nature and resistance to pests and diseases. Sunil produced more than 25 quintals seeds of this rice selection variety and supplied to the Seed Bank for distribution, so that it reaches to as many farmers as possible.

Sunil is active member of Seed savers farmer group, Jawhar. The efforts of Sunil in developing the variety through selection method has been appreciated and conferred 'Plant Genome Savior Farmer Recognition Award' for the year 2011-12, at New Delhi and also received Vasantrao Naik Krishi Purskar 2018.

Festivals of agrobiodiversity

Asthamba Festival: This festival is celebrated at holy place known as Asthamba hill in Nandurbar district. People from Gujarat, Maharashtra and Madhya Pradesh gather together and each one brings seeds of fresh harvest as offering to god and exchange of seeds.

Navai Festival: It is festival celebrated in Dhadgaon area of Nandurbar district. During this festival farmer worship their new harvest, pray to goddess for prosperity and also invite relatives and friends for meal.

Traditional Knowledge Associated with Crop Diversity

Gourd diversity in Satpuda ranges: Satpuda mountain ranges are hub for unique crop landraces, NTFP and other biodiversity. Among these indigenous crops, gourd is one of the unique crop having considerable diversity. In local language gourd is known as 'Kullo'. Information on some local gourd types is highlighted below.

Motho kullo

Ray kullo

Motho tumbado

Chhoto tumbado

Lambdo kullo

Gangaphal kullo

Motho kullo: It is cultivated in month of May-June and mostly allowed climbing on roof. This pumpkin has yellowish orange coloured, larger size fruits. Vine bears 20-25 fruits; each fruit weight ranges 4-6 kg. Fruits have more than six months' shelf life. Fruits are consumed after boiling.

Raykullo: These pumpkins are cultivated on farm bunds or in kitchen garden and allow to climb on roof. It has smaller, reddish scarlet coloured fruits. Vine bears 15-20 fruits, each fruit weighing up to 3 kg. Mostly it is used as vegetable but occasionally cooked with rice. Seeds are also edible and eaten after roasting.

Motho tumbado: It is naturally grown non-edible pumpkin but has various uses as water vessel. It is used in processing of Mahua flower for fermentation. It has great importance in tribal rituals.

Chhoto tumbado: It is same as Motho tumbado but smaller in size. It is also used as spoon or water bag. It has prime importance in 'Holi' festival and it is one of the components of their drapery.

Lambdo kullo: It is bottle gourd locally also known as Dudhi. It is mostly cultivated on farm bunds/ kitchen gardens. Vines bears up to 15 fruits. Fruits are used as vegetable and for desserts/dishes.

Gangaphal kullo: It is largest and sweeter pumpkin grown in Satpuda area. Gangaphal is cultivated in kitchen garden and allowed climbing on roof and each vine bears 5-7 fruits. A fruit weighs up to 7 kg and has 5-7 years of shelf life. It has importance in rituals of Dashera festival. Fruits are used in preparation of various sweet dishes.

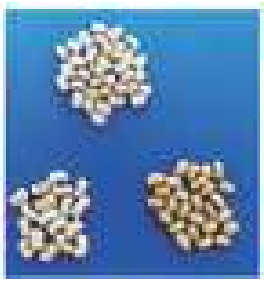
According to elderly people in this area, few years ago, there were more than 15 types of pumpkins. However, today only few types are observed under cultivation. As these gourds have special importance in tribal culture, there is need for conservation of this pumpkin diversity.

Pulses diversity in Akole block of Ahmednagar

Considering the nutritional importance of pulses, survey was conducted for documentation of diversity, traditional knowledge associated and germplasm collection of pulses diversity in Akole (Ahmednagar district) and Jawhar (Palghar district) block. Data was collected through group meetings, field visits and organizing exhibitions and germplasm collected from seed savers.

Pulses diversity in Akole (Ahmednagar district)

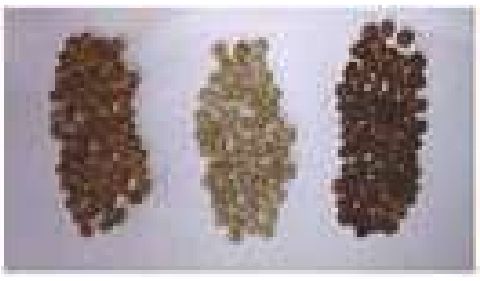
Bengal gram



Cow pea

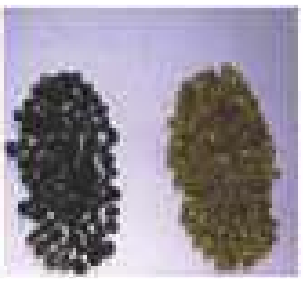
Pea

Lentil



Red pea

Moth beans



Black gram

31 accessions of seven pulse crops were documented and collected during present survey. A list of seed savers was compiled and it has been found that the unique pulses diversity does exists and being conserved because of its specific traits like drought tolerance, grain yield, food security, specific end uses, pest and disease resistance, taste, a major protein source etc.

Future prospective: Collected germplasm will be evaluated for its field performance and the shortlisted accessions will be promoted for large scale cultivation.

Realizations about human nature/ human-nature relationship

- Tribal communities Warli, Kokana, Mahdeo koli, Madiya, Pawara are well associated with the nature and live in harmony.
- They have simple living with minimal dependence on external things for self-use and agriculture inputs.
- Each tribal community had their own risk mitigation plan for food and fodder. *Warli* and *Kokana* cannot sell finger millet as they believe it is a god's crop. It can grow in any adverse climatic conditions and give food for consumption. *Pawara* community store barnyard millet for more than 25-30 years as food for adverse situations.
- Each festival in tribal communities has deep relationship with nature

Observations about ecology- regeneration/ depletion/ conservation

- Agro-biodiversity is a part of culture for tribal communities. Plants and animals are integral part of their life and hence each festival, ceremony, ritual has close association with biodiversity. Warli and Kokana (Akhati- festival of seeds, Kovli Bhaji), Pawara (Asthamba, Navai), Mahadeo Koli (Pola)
- Soil fertility is major issue in these locations due to erosion.
- Admixture of seeds caused major problem.

Species lists/inventory: Inventory of crop germplasm accessions incorporated in RDBMS.

Impact: The likely impact of the project on ecology and community is given below:

On ecology

- Amazing diversity of crops and their genotypes conserved and multiplied in their ecological zone may be helpful for risk mitigation.
- Promotion of organic agricultural practices will reduce adverse effect of chemical pesticides and fertilizers on soil and environment.

On community

- Demand for rice landraces (Ambemohor, Kalbhat, Raibhog, Kolpi, Mahadi, Jai Shriram, Surti Kolam, Kamal, J. gundi, Mahadi), Maize (Pivla makka, Kaheri makka, Kakkud makka), Sorghum (Mani Jawar, Dudhmogra), Little Millet (Dudhmogra), Finger millet (Kalperi), Hycinth bean (Hirva Akhud ghevda) has increased.
- Farmers realized value of diversity based farming and initiated cultivation of crop genotypes as per their topography, soil type and end use.
- Cultivation of finger millet, little millet, barnyard millet was preferred by many farmers e.g. Dudhmogra landrace of little millet is cultivated by 750 farmers on 280 acres because of its grain yield, market value and good tillering ability.
- Enhanced grain yield of indigenous crop landraces due to improved cultivation practices like single seedling method of Rice cultivation (20-25 %) and Line sowing of maize and sorghum (30-35 %).
- Improved access to market has created demand by consumers and thereby economic benefits to the farmers:
- Community led enterprises established and started business activities like Kitchen garden kits and Finger Millet laddus.

On academic circle

- Scientists from PPV & FRA, IIMR-Hyderabad, UAS Dharwad, MPKV Rahuri, NBPGR, KVK Kosbad, KVK Nandurbar, KVK Baramati admired efforts of conservation programme and realized need of community managed agro-biodiversity programme for long term sustainability.

Failure stories

- Initially we had started distributing seeds of elite germplasm to farmers and taken back double quantity in return after crop harvest. It was noticed that while returning the seed, quality was badly affected due to admixture, improper drying etc.
- SRI method of rice cultivation: Some of the principles of SRI could be possible under field conditions like early age seedlings (8-10 days old), wider spacing and use of manure. However, water management of alternate wetting and drying was difficult to adopt due to high rainfall in areas like Jawhar, Akole, Junner and Etapalli. The risk of crop failure during transplantation due to high rainfall was noticed.

What worked instead?

- After failure in sharing and exchange of quality seeds from seed bank, farmers participating in seed production were properly trained for quality seed production, which has resulted in improvement in seed quality. This seed was deposited in the community seed banks after testing seed quality parameters. The importance of removing of admixtures in landraces was well understood by farmers.

Modified SRI system for rice cultivation was adopted which includes seedling transplantation at the age of 18 days at the rate of 2 seedlings /hill and avoid flooding rice field and only keep the soil moist.

Way forward

- *In-situ* conservation centers of collected germplasm of different crops need to becontinued for maintenance of genetic purity in respective agro-climatic zones.
- Identification and germplasm collection of underutilized crops and its genotypes.
- Community level seed production of selected genotypes through community seed saver groups.
- Promotion of preferred and well adapted genotypes of different crops through large scale field demonstrations.
- Nutritional evaluation of purified genotypes which have some specific claims regarding nutritional, and medicinal uses.
- Marketing of grains produced with special focus on landraces which have specific end use, market value and nutritionally rich.
- Promotion of climate resilient crops and varieties for food security and livelihood of farming communities in adverse situations.
- Large scale promotion of selected wild food resources through developing nurseries and plantation on farm bunds, and kitchen gardens for easy availability of nutritionally rich food source.
- Promotion of tubers which has good storage life and possible to cultivate as crop for marketing and food security.
- Promotion of women seed savers organizations for preparation of kitchen garden kits which has good market value in terrace gardens, back yard and nutrition gardens.
- Developing proper packaging and marketing system through PGS/self-certification and developing special brand.
- *Ex-situ* conservation of plant genetic resources for long term storage under cold conditions at organization level.

Support structure

- *In-situ* conservation activities may be continued with external funding and institutional technical support.
- Support for seed production and upscaling of potential genotypes needs to be created through project funding.
- Some of the things may be continued by creating corpus fund through sale of kitchen garden kits, quality seeds of selected genotypes, and nurseries of wild food plants at community level.

How the learning/ achievements from MGBP should be taken forward

- Training and facilitation for community level seed production through seed producer farmers.
- Support for NGO's, and government departments for promotion of selected landraces, organic input production and seed selection.
- Linking seed and grain producer farmers with government schemes like ATMA, organic farming scheme and, tribal sub plans.
- At organizational level, promotion of suitable landraces in respective agro-climatic zones through other ongoing projects.
- Sharing experiences with research institutes, SAU's, KVK's, colleges and plan for further promotion of agro-biodiversity and wild food resources.

How are you planning to make use of work done under MGBP in the work ahead

- Establishing seed savers network at project level and also regional level for long term sustainability of work and learning from experiences.
- The shortlisted elite landraces may be further explored in crop improvement programmes.
- Promotion of experiences of MGB project at field level through field resource persons and seed savers.
- MGB project approach and achievements sharing at state and national level for promotion.
- Sharing of germplasm along with scientific information with NGO's and individuals through Material Transfer Agreement.
- Screening of crop landraces for abiotic stress tolerance in collaboration with scientific institutes.

How this support would help for the betterment at work

- Self-sustainable community led enterprise for conservation, revival and sustainable use of crop diversity and wild food resources.
- Establishment of seed bank that can be properly maintained by community.
- Scientific data on morphological characterization generated for cow pea, hyacinth bean, foxtail millet and barnyard millet landraces.
- Opportunities for livelihood generation through production and sale of grains and food items which can produce from crop landraces.
- Proper system will be established for sharing of germplasm.
- Exposure to gene bank will be useful for handling and maintaining the plant genetic resources in long term. Mechanism will be helpful in making available good quality seed to farming community even after the project period.

List of staff involved in the project

#	Name	Position	Education
1	Dr. Vitthal K. Kauthale	Principle investigator	Ph.D. M.Sc.(Agri)
2	Mr. Sanjay Patil	JRF &Co-PI	B.Sc.(Tech)
3	Mr. Lilesh L Chavan	JRF	B.Sc. Agri ,MBA
4	Mr. Mavanji Pawar	Programme assistant	9th
5	Mr. Rakesh Durge	Programme assistant	MSW
6	Mr. Ramchandra Gavit	Field programme assistant	Agri. Diploma
7	Mr. Yogesh P. Navale	Field assistant	Agri. Diploma

BAIF-MGB -Crop Diversity Data - Summery sheet

#	Data Type	Description	Unit	No. of records
1	Village data	List of villages covered for actual conservation and Revival work	No of villages	60
2	Crop diversity data	Agrocliamtic zone wise crops under cultivation along with Language, Dilect and season of cultivation	No of Entries	229
3	Accession data (Landraces conserved)	crop wise landraces/Farmer varieties with Name of seed savers, Village, Block and District	No of landraces	588
4	Seed centres data	On farm centres with its GPS location ,Crop diversity under conservation	No of seed centres	7
5	Morphology data as per DUS guidelines	Morphological data as per DUS guidelines of PPV & FRA, New Delhi for 14 crops	No of landraces	259
6	Traditional knowledge data			
A	Traditional knowledge (Traditional food recipes data)	Cropwise and landrace wise list of different recipes	No of landraces	293
B	Traditional knowledge (Etymology) data	Cropwise and landrace wise information on denomination of particular landrace	No of landraces	247
C	Traditional knowledge (Reasons for existence and disappearance of crop landraces)	Landrace wise data on existance and disapperance of landraces	No of landraces	238
D	Traditional knowledge (Pest data)	Crop wise pest occurance data and control measures	No of Entries	39
E	Traditional knowledge (Disease data)	Crop wise disease occurance data and control measures	No of Entries	14
G	Traditional knowledge (Festivals and biodiversity))	regionwise Traditional festivals and its relationship with Agribiodiversity	No of Entries	68
H	Traditional knowledge (Traditional crop cultivation practices)	Details of crop wise traditional cultivation practices covering seed sowing, Land Preparation, fertility management, Cropping system, Other crops (Mix crops)	No of Entries	52
I	Traditional knowledge (Medicinal/Nutraceutical uses of crop landraces)	Landrace wise data on medicinal uses of crop landraces	No of landraces	246
J	Traditional knowledge (Traditional Grain & seed storage system)	Different methods of grain and seed storage systems	No of Entries	34
K	Traditional knowledge (crop wise grain & seed Storage)	cropwise methods of grain and seed storage with storage treatments	No of Entries	98

Annexure 1

Village List

Sr No.	Agroclimatic zone	District	Taluka	Study Village	Village Code (census 2011)
1	Transit Zone 2	Nandurbar	Dhadgaon	Kakarda	525251
2				Shelkuvi	525311
3				Borvan	525235
4				Pathali	525248
5				Harankhuri	525232
6				Pathali	525248
7				Pathali	525248
8				Pathali	525248
9				Pathali	525248
10				Chonvade Br.	525238
11				Sirsani	525352
12				Bijari	525354
13				Kakarda	525251
14				Kakarda	525251
15				Kakarda	525251
16			Akkalkuva	Bhagdari	525038
17				Nimbipada	525037
18				Belakund	525053
19	Eastern Vidharbha zone	Gadchiroli	Bhamragad	Hidur	539730
20				Arewada	539741
21				Hemalkasa	539752
22				Dubbagudda	539809
23			Etapalli	Zarewada	539775
24				Petha	539990
25				Tatigudam	539932
26				Wasamundi	539653
27				Todsa	539644
28				Tambada	539637
29				Bande	539646
30				Tumaragunda	539478
31	Western maharashtra Scarcity Zone	Pune	Junner	Jalvandi	555287
32				Khadkumbe	555289
33				Mankeshwar	555315
34				Keli	555317

Sr No.	Agroclimatic zone	District	Taluka	Study Village	Village Code (census 2011)
35		Ahmadnagar	Akole	Chandgirwadi	557198
36				Ekdare	557199
37				Jaynawadi	557201
38				Shenit	557130
39				Ambevangan	557140
40				Pimpaldarawadi	557202
41				Khirvire	557212
42				Babhulwandi	557132
43				Kombhalne	557214
44				Manhere	557141
45	Western Ghat Zone	Palghar	Jawhar	Dengachimet	551911
46				Kalamvihira	551912
47				Shiroshi	551933
48				Hateri	551885
49				Pathardi	551947
50				Walwande	551935
51				Chowk	551948
52				Medhe	551949
53				Nyahale Bk.	551921
54				Vadoli	551881
55	Western Ghat Zone	Sindudurg	Kudal	Digas -chorgewadi	566748
56				Hirlok	566752
57				Humarmala	566726
58				Anav	566724
59				Pawashi	566792
60				Zarap	566808

Annexure 2

Result Based Management: Crop Genetic Diversity

Outputs	Indicators	Targets (January 2014 to March 2020)	Achievements cumulative (January 2014 to 31 March 2020)
Output 1: Scientific and social validation of bio-resources.	No. of bio-resources scientifically validated.	5 Cropsand 50landraces	1) Traditional knowledge –Seed storage methods, Food recipes, Etymology, Festivals of biodiversity, reasons for continued cultivation of landraces. 2) Evaluation of improved Seed storage system and Traditional storage systems at -07 locations 3) Traditional cultivation practices – Rice, Finger, Little, Foxtail and Barnyard Millet. 4) Molecular Studies-Rice(68 landraces) maize (18 landraces) 5) Potential Yield studies- Rice (9 landraces), Finger Millet (02) and Little Millet (02) landraces 6) Morphological characterization-259 landraces of 6 crops 7) Nutritional evaluation – Grains (109) and straw (140) of 5 crops 8) Nutritional evaluation of products-03 (Finger Millet Laddus, Herbal Tea substitute and Herbal coffee substitute.
Output 2: Promotion of validated bio-resources	No. of bio-resources promoted	Crops-5 (15)	Under seed production 1) Total crops- 8 2) Total landraces- 49 3) Seed production- 56.5 MT 4) Families covered under nutritional garden-8738 families 5) Promotion of superior landraces of rice (Javayachi gundi)-200 acres, Little millet (Dudhmogra)- 650 acres, Pivli Mukai 600 acres), Dudhmogra (300 acres) 6) Production of tubers (2 species- 6 Tons) 7) Market linkages & Branding -Rice (15 MT) & Kitchen garden kit (8738)
Output 3: Research papers/ case studies/ articles	No. of research papers/articles/ case studies	Crops-4	1) Published research papers-13 2) Popular articles published -08 3) Papers presented in conference- 12
Output 4: Preparation of bio-resources inventory	No. of documents prepared	25 (5 clusters)	1) Bio-resources inventory of different crops, along with storage systems, festivals, Traditional recipes prepared. Traditional grain storage system (7 methods), Traditional Agriculture implements (25), Traditional food Recipes (48), Festivals of Agro biodiversity (10), Wild edible plants- 175 species and 75 recipes, Crop economics data-3 crops
	No. of schools involved in bio-resource documentation	Jawhar-7, Nandurbar-4, Kudal-5	1) 16 schools in 3 clusters
Output 5: Conservation of bio- resources in gene bank	No. of bio-resource conserved *in-situ*	Crop-9	1) Crops-9 2) Landraces- 587 *3) In-situ* centres-31
	No. of bio-resource conserved *ex-situ*	2 Locations	1) Jawhar - 547 accessions 2) Urulikanchan Gene Bank- 539 accessions 3) Safeguarded germplasm-registration with NBPGR (94) 4) Application filled for Registration with PPV & FRA (53) and received registration for 03 landraces

Outputs	Indicators	Targets (January 2014 to March 2020)	Achievements cumulative (January 2014 to 31 March 2020)
Output 6: Promotion of bio-resources with individual families	No. of Families involved in promotion	1500 families	1) Seed production & Multiplication –3000 families 2) Kitchen Gardens: 8738 families
	No. of events organized and participated	10 events	1) Seed exhibitions and wild food recipe events-203 (11563 participants) 2) Field trainings (SRI, seed selection, post-harvest techniques) and farmer exposure- 139 (2703 participants)
Output 7: Formed and strengthen village level BMC/seed saver groups	No. of groups formed and strengthened	35 groups	Seed saver groups strengthened-89 Biyane Savardhan Samiti-4 Capacity building of CRP's-10 Farmer producer organization-1 Community organization-1
Output 8: Collaboration with scientific institutes	No. of institutes	3 institutes	1) International (2) –Bioversity International, ICRISAT 2) National (5) –PPV & FRA, NBPGR, IIMR, NABI, RRA Network 3) State (3)- MPKV Rahuri 4) Regional level (2) 5) NGO's (7)
Output 9: Dissemination of knowledge	No. of extension material developed (pamphlet, posters, PoP's etc.)	Broachers/ pamphlets/ posters-1 E newsletter-2 Catlogue-1	1) 15 posters of diversity 2) MGB e News Letter - 08 3) Yearly Calendar- 4 4) Crop diversity brochure in Marathi and English 5) Video documents -03 6) Indigenous Crop diversity catalogue 7) Guidelines for agrobiodiversity conservation 8) Operational guidelines for community seed banks 9) Compendium of MGB publication 10) Catalogue of genome saviors
	No. of events in school	2 schools, 14 events	1) No. of schools -16 2) No. of students -2575 3) No. of events-66
	No of activities undertaken	25	1) Awareness programmes and seed exhibitions – 08 events 2) Field trainings & Technical support-09 3) Workshops organized -02 4) Exposure visits -07
	No. of good practices documented	20	Improved agricultural practices-4 Organic farming practices -4 Seed storage syatems -10 Seed slection practice-1

Annexure 3

Details of Crop germplasm received IC No. from NBPGR and registration No. from PPV & FRA

IC No. and PPV& FRA registration number	Crops Name	Accession numbers	Landraces / Farmers varieties name
632824	Maize	BAIF/Dhadgaon/Maize/88	Choti Lal Mukai
632828	Maize	BAIF/Dhadgaon/Maize/86	Oda Duda
632830	Maize	BAIF/Dhadgaon/Maize/91	Kehari Motha Duda
632831	Maize	BAIF/Dhadgaon/Maize/13	Piwali lal Mukai
632834	Maize	BAIF/Dhadgaon/Maize/79	Lal Mukai
632838	Maize	BAIF/Dhadgaon/Maize/87b	Choti tapkiri mukai
632825	Maize	BAIF/Dhadgaon/Maize/92	Lahan Tapkiri Mukai
632836	Maize	BAIF/Dhadgaon/Maize/77	Piwalo motho dudo
632837	Maize	BAIF/Dhadgaon/Maize/3	Kehari mukai
632826	Maize	BAIF/Dhadgaon/Maize/22	Mothi Piwali makka
632827	Maize	BAIF/Dhadgaon/Maize/87	Ovhi Tapkiri Mukai
632829	Maize	BAIF/Dhadgaon/Maize/82	Motha Makka
632832	Maize	BAIF/Dhadgaon/Maize/90	Tapkiri Mukai
632833	Maize	BAIF/Dhadgaon/Maize/83	Pivalo choto dudo
632835	Maize	BAIF/Dhadgaon/Maize/81	Kehari laylyo dudo
632762	Sorghum	BAIF/Dhadgaon/Sorghum/27	Chikani Zanjari Juwar
632765	Sorghum	BAIF/Dhadgaon/Sorghum/40	Mothi Piwali mani juwar
632766	Sorghum	BAIF/Dhadgaon/Sorghum/39	Gavathi Dudh Mogara (Red Stalk)
632767 **(Reg No. 101/2020)**	Sorghum	BAIF/Dhadgaon/Sorghum/05	Mothi Mani Juwar
632770 **(Reg No. 257/2020)**	Sorghum	BAIF/Dhadgaon/Sorghum/19	Chikani Lal Juwar (Loose panicle)
632771 **(Reg No. 107/2020)**	Sorghum	BAIF/Dhadgaon/Sorghum/13	Mothi Safed Juwar
632772	Sorghum	BAIF/Dhadgaon/Sorghum/31	Mothi Safed Juwar
632776	Sorghum	BAIF/Dhadgaon/Sorghum/32	Ovhi Juwar
632763	Sorghum	BAIF/Dhadgaon/Sorghum/33	Gedi Juwar
632764	Sorghum	BAIF/Dhadgaon/Sorghum/28	Chikani Nilayi Juwar
632768 **(Reg No. 239/2020)**	Sorghum	BAIF/Dhadgaon/Sorghum/2	Lahan Mani Juwar
632769	Sorghum	BAIF/Dhadgaon/Sorghum/25	Nilayi Chikani Juwar
632773 **(Reg No. 257/2020)**	Sorghum	BAIF/Dhadgaon/Sorghum/09	Chikani Lal Juwar (Compact panicle)
632774	Sorghum	BAIF/Dhadgaon/Sorghum/35	Mothi Dudh Mogara (Loose panicle)
632775	Sorghum	BAIF/Dhadgaon/Sorghum/38	Tapkiri Juwar
630838	Finger Millet	BAIF/Jawhar/Finger Millet/1	Piter Bendri
630839	Finger Millet	BAIF/Jawhar/Finger Millet/2	Dasar Bendri

IC No. and PPV& FRA registration number	Crops Name	Accession numbers	Landraces / Farmers varieties name
630840	Finger Millet	BAIF/Jawhar/Finger Millet/4	Malgond
630841	Finger Millet	BAIF/Mokhada/Finger Millet/5	Kalperi
630842	Finger Millet	BAIF/Karjat/Finger Millet/6	Nagali Garvi
630843	Finger Millet	BAIF/Karjat/Finger Millet/7	Shitpadi
630844	Finger Millet	BAIF/Mokhada/Finger Millet/9	Dhavalperi
630845	Finger Millet	BAIF/Jawhar/Finger Millet/10	Shitoli
630846	Finger Millet	BAIF/Jawhar/Finger Millet/12	Nagali Lal
630847	Finger Millet	BAIF/Murbad/Finger Millet/13	Nagli Shitoli
630848	Little Millet	BAIF/Murbad/Little Millet/3	Sakali
630849	Little Millet	BAIF/Sahapur/Little Millet/4	Ghopadi Varai
630850	Little Millet	BAIF/Murbad/Little Millet/6	Mor Varai
630851	Little Millet	BAIF/Murbad/Little Millet/8	Dudhmogara
630852	Little Millet	BAIF/Sahapur/Little Millet/9	Ghoshi Varai
630853	Little Millet	BAIF/Sahapur/Little Millet/10	Dhanori
630854	Little Millet	BAIF/Jawhar/Little Millet/12	Kali Varai
630855	Little Millet	BAIF/Sahapur/Little Milley/13	Juni Varai
630856	Little Millet	BAIF/Murbad/Little Millet/14	Garvi Varai
630857	Little Millet	BAIF/Jawhar/Little Millet/15	Varai Jawhar
630794	Rice	BAIF/Jawhar/Rice/2	Sagg Bhat
630795	Rice	BAIF/Jawhar/Rice/3	Masala Baht
630796	Rice	BAIF/Jawhar/Rice/4	Malghudya
630797	Rice	BAIF/Mokhada/Rice/5	Kolpi (E)
630798	Rice	BAIF/Vikramgad/Rice/7	Dhundune
630799	Rice	BAIF/shahapur/Rice/9	Zini (Early)
630800	Rice	BAIF/Mokhada/Rice/10	Dhaval Bhat
630801	Rice	BAIF/Jawhar/Rice/11	Dula-1
630802	Rice	BAIF/Jawhar/Rice/12	Kavla Bhat
630803	Rice	BAIF/Jawhar/Rice/15	Dangi (Red)
630804	Rice	BAIF/Shahapur/Rice/19	Lalya
630805	Rice	BAIF/Jawhar/Rice/20	Kali Khadsi
630806	Rice	BAIF/Rice/22	Vanai
630807	Rice	BAIF/Mokhada/Rice/27	Kolpi (Midlate)
630808	Rice	BAIF/Wada/Rice/29	Wada Zini
630809	Rice	BAIF/Jawhar/Rice/34	Zini (ML)
630810	Rice	BAIF/Trimbekshwar/Rice/40	Chimansal
630811	Rice	BAIF/Wada/Rice/41	Surti Kolam
630812	Rice	BAIF/Jawhar/Rice/47	Juna Kolam
630813	Rice	BAIF/shahapur/Rice/51	Gujrat zini
630814	Rice	BAIF/Mokhada/Rice/53	Kolpi garvi (Small)

IC No. and PPV& FRA registration number	Crops Name	Accession numbers	Landraces / Farmers varieties name
630815	Rice	BAIF/Trimbakeshwar/Rice/56	Sal Bhat
630816	Rice	BAIF/Jawhar/Rice/64	Najar Bhat
630817	Rice	BAIF/Jawhar/Rice/67	Kasbai
630818	Rice	BAIF/karjat/Rice/72	Mahadi (Late)
630819	Rice	BAIF/Mokhada/Rice/77	Vakvel
630820	Rice	BAIF/Jawhar/Rice/80	Masura
630821	Rice	BAIF/Jawhar/Rice/81	Kasvel
630822	Rice	BAIF/Jawhar/Rice/83	Dodgi
630823	Rice	BAIF/Mokhada/Rice/84	Javyachi gundi
630824	Rice	BAIF/Jawhar/Rice/85	Dula-2
630825	Rice	BAIF/shahapur/Rice/117	Suklya
630826	Rice	BAIF/Jawhar/Rice/125	Tulshya
630827	Rice	BAIF/Dahisar/Rice/131	Raat Bhat
630828	Rice	BAIF/Rice/135	Sikander
630829	Rice	BAIF/Jawhar/Rice/147	Kala girvel new
630830	Rice	BAIF/Jawhar/Rice/148	Kala bagad
630831	Rice	BAIF/murbad/Rice/150	Gavti zini
630832	Rice	BAIF/murbad/Rice/152	Masura
630833	Rice	BAIF/murbad/Rice/153	Jira zini
630834	Rice	BAIF/Talasari/Rice/286	Kasbai
630835	Rice	BAIF/Peinth/Rice/319	Kali Khadsi
630836	Rice	BAIF/Jawhar/Rice/366	Ashwini (Farmer's variety)
630837	Rice	BAIF/Jawhar/Rice/369	Kamal (Farmer's variety)

Documents published and printed under the MGB project

1) Indigenous crop diversity – a catalogue of landraces

2) Approaches and guidelines for Agro Biodiversity Conservation, management and revival

3) Establishment and management Community seed banks

4) Wild edible plant recipe booklet

5) Genome savior's compendium and inventory

6) Compendium of publications (soft copy)

7) Compendium on crop landrace characterization (soft copy)

8) Poster-Community led conservation and management of indigenous crop diversity and wild edible plants

9) Photos of major activities

Report

7.2

Conservation Management and Revival of Local Resources II - Livestock Genetic Diversity

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Background

Maharashtra state has rich diversity of livestock breeds. As per 20th Livestock census, 2019, the total livestock population in Maharashtra state was 331 lakhs including 140 lakhs cattle, 56 lakhs buffalo, 27 lakhs sheep and 106 lakhs goats. The dairy farming is becoming main occupation of most of the farmers due to regular and attractive remuneration. The maximum crossbred animal population is observed in Ahmednagar, Pune, Solapur and Nashik districts and these are the major milk producing districts. The indigenous cattle population was dominant in Nashik, Yavatmal, Nanded and Ahmednagar districts in Maharashtra. The small-holder livestock system with a herd size of 2 to 3 animals with combination of cows and buffaloes are common in Maharashtra.

Livestock is an important source of livelihood and survival for the rural and tribal communities. Livestock supports the farming systems by providing milk, meat, egg, draught power, fiber, manure etc. Maharashtra is original place for breeds of cow like Dangi, Deoni, Gaolao, Khilar, Lal Kandhari; Breeds of buffalo like Marathwadi, Nagpuri, Pandhrapuri; for breeds of goats like Osmanabadi, Sangamneri, Berari as well as for local poultry namely Bursa (https://ahd.maharashtra.gov.in). All the indigenous breeds have certain common characteristics: they are hardy, resistant to disease, and can withstand harsh ecological conditions. The problem becomes alarming as the reduction of diverse genetic resources has its own consequences on the rich knowledge base of local communities associated with these resources that has been acquired for past many years. The lack of fodder is also one of the factors affecting livestock rearing in a region.

Increasing demand for milk and a large number of low productive bovine population owned by the weaker sections of the society have been compelling factors for expansion of BAIF's dairy development programme. The programme has been providing doorstep breeding services and other support services to over 5.26 million families spread over 88,272 villages in 13 states namely, Andhra Pradesh, Bihar, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Uttar Pradesh and Uttarakhand states.

Active involvement of women as service providers and mentors in livestock development was initiated with the support from the Bill and Melinda Gates Foundation through 158 cattle development centres in Maharashtra, Bihar and Uttar Pradesh states. The project has been successfully completed by reaching 49% of the poor through gender integration through 7718 women members and 399 women groups. 1125 dairy interest groups are engaged in adoption of new technologies and organising collection and marketing of milk.

The focus is on promotion of small flock with genetic improvement, feed supplementation, minor health services such as deworming and vaccination, castration of the kids, and selling goats on weight basis. While 3000 families in Vidarbha region are using Osmanabadi breeds for upgrading their nondescript goats, 4025 families in Udaipur area in Rajasthan, are using Sirohi breed. The farmers in desert areas of Barmer, have adopted Desi Sindh breed of goat which is hardy. Over 30,000 families in Jharkhand, 2000 families in Tripura and 25,000 families in Orissa, are using Black Bengal breed.

Journey with MGBP

Maharashtra Gene Bank Project (MGBP) focuses on participatory *in-situ* and *ex-situ* conservation, management and revival of local resources i.e. crop landraces, livestock types, forestry species (Non-Timber Forest Produce) and habitat types in select clusters and diverse agro-climatic zones of Maharashtra. Work is in progress in nine clusters covering 100 villages across Maharashtra.

Program Approach

i. Conservation of important indigenous livestock breeds by involving community

ii. Blending traditional and scientific knowledge in sustainable conservation program

iii. Scientific and technical assistance to the livestock breeder's associations.

Priority Livestock breeds

The region specific important indigenous livestock breeds were selected for conservation and improvement. Dangi, Lal Kandhari and Gaolao cattle breeds, Sangamneri and Berari goat breeds and local Satpudi Poultry.

Coverage of Livestock program

Clusters	Kandhar	Gangakhed	Dhadgaon	Aasti	Akole	Pimpal-khuta	Total
District	Nanded	Parbhani	Nandurbar	Gadchiroli	Ahmednagar	Wardha	
No. of Villages	25	11	14	10	22	05	**87**
Priority breeds	Lal Kandhari cattle	Lal Kandhari cattle	Satpudi poultry	Berari goat	Dangi cattle and Sangamneri goat	Gaolao cattle	

Details of villages given in Annexure 1.

Community profile in Livestock program area

#	Communities	Breed types	Living practice	Districts
1	Nanda Gaolis	Cattle- Gaolao	Partial Pastoralists	Wardha, Nagpur
2	Banjaras	Cattle- Lal Kandhari	Settled	Nanded, Parbhani
3	Kanadi, Talwar, Mahadev Koli, Thakar	Cattle- Dangi	Partial Pastoralists	Ahmednagar, Nashik, Palghar
4	Mana, Gond	Goat- Berari	Settled	Nagpur, Chandrapur
5	Thakar, other community	Goat- Sangamneri	Settled	Ahmednagar
6	Pawara	Poultry- Satpudi	Settled	Nandurbar

Key issues addressed

i. Decreasing population of animals due to shrinking land holding and lack of grazing land.

ii. Less income from indigenous breeds as they are draught purpose breeds.

iii. Unavailability of breeding and veterinary services in remote areas.

iv. Acute shortage of green fodder during summer.

v. Decreased water resource availability due to erratic rainfall.

vi. Lack of interest and knowledge about livestock /dairy business in young generation.

vii. Lack of manpower to care the animals as young generation is migrating towards cities for livelihood.

Objectives

i. To design and undertake detailed participatory appraisals for diverse livestock genetic resources that exists in diverse agro climatic zones in the state.

ii. To plan and introduce activities for *in situ* and *ex-situ* conservation, revival and management of regionally important breeds of cattle, local poultry and goat.

iii. To plan and initiate activities for building motivation of local communities to participate and manage the program.

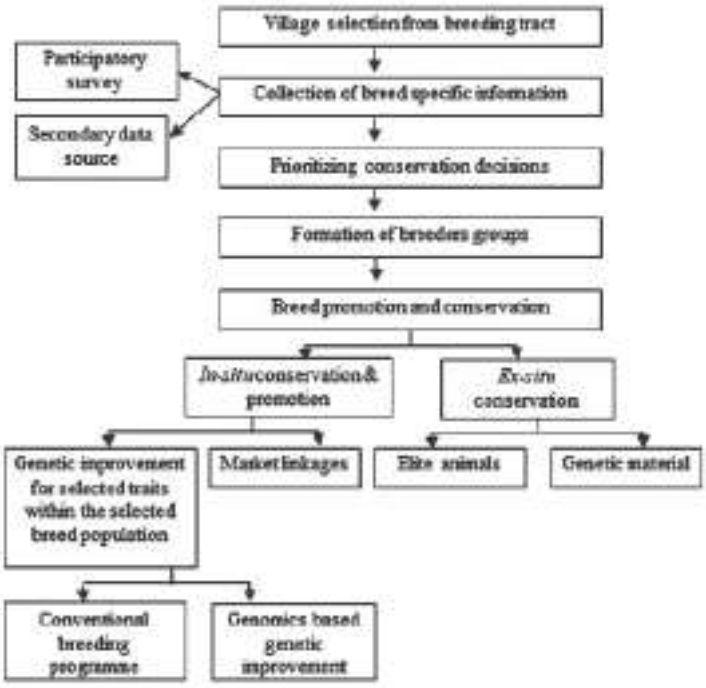
Sampling methods

During the inception of the project, Participatory Rural Appraisal (PRA's) and Focus Group Discussions (FGD's) were organized in different villages to explore the livestock population and its diversity. Breed specific

information was collected through FGD, secondary data source and accordingly 60 villages were selected across the four agro-climatic regions in Maharashtra. The approach and methodology of conservation of priority breeds were decided. Families engaged in rearing the focused breeds were selected as project participants. Breeder's groups were formed to bring together the likeminded / common interest farmers for capacity building and the technical as well as input support. As an *in-situ* conservation approach, genetic improvement of the breeds for selected traits within a selected breed population was initiated through providing quality breeding services. The elite bulls and bucks were selected from their native tract for semen collection and preservation as an *ex-situ* conservation approach. The data on breed utility, production performance, breeder profile, elite animal selection and migration were collected through specially designed questionnaire / formats as well as formats and guideline of National Bureau of Animal Genetic Resources (NBAGR).

The flow chart of community led conservation programme is given below:

Community-led livestock conservation program



Major work done under MGBP

i. Collected information on native livestock breeds and their management practices through baseline survey.

ii. In depth survey of 1886 livestock breeders for selection of families for *in-situ* conservation work.

iii. Under i*n-situ* breed conservation program, 10335 artificial inseminations were performed through 12 cattle breeding centers and 3255 calves were born. Through 3356 buck breeding services, 2973 kids were born in Sangamneri and Berari goat. 631 artificial inseminations in Sangamneri goat were performed and 325 kids were born.

iv. Elite bull calves of Dangi, Lal Kandhari and Gaolao were procured and 2.87 lakhs of semen doses and 18539 semen doses of elite bucks of Sangamneri and Berari goats were produced, utilized and preserved as an *ex-situ* conservation approach for future breeding.

v. Milk recording of three cattle breeds was undertaken to study the milk yield potential and milk recording of 617 cows was completed.

vi. Completed phenotypic measurement of 500 animals of Dangi, Lal Kandhari and Gaolao cattle, physical characterization of 5000 Satpudi poultry birds. Growth measurements of 1032 Sangamneri and Berari kids were completed.

vii. Genomic study of indigenous cattle (150) breeds were undertaken to study the genetic diversity among the breeds using latest genomic tools such as SNPs and microarray.

viii. Produced 182 doses (72 male and 110 female) of Gaolao cattle using sex semen technology.

ix. Organized 786 events like health camp, calf rally, goat rally, deworming and vaccination, awareness meet, exhibition etc. for community awareness.

x. Documented traditional forage resources and nutritional analysis of 107 samples completed.

xi. Documentation: 4 research papers, articles, 13 case studies and 21 extension material.

Database

Data collected on different components compiled, updated and incorporated in Relational Data Base Management System (RDBMS) for further uploading on MGB web portal (Annexure 2).

Qualitative impact of the work

Project activities like quality breeding services to livestock breeders through Artificial Insemination service, availability of elite bucks for goat breeding, mother unit and hatchery for Satpudi poultry chick production, organization of health camps to address infertility, deworming and vaccination, promotion of quality fodder seed of improved fodder varieties, mineral mixture, bag silage at farmer's level, were undertaken across all villages. These efforts were useful in genetic improvement of the cattle and goat breeds, health and better nutrition of the animals. Awareness and exposure visits were undertaken for capacity building of the livestock breeders and it has reflected in adoption of better management practices in project areas.

Quantitative impact of the work: Brief report on quantitative achievements is given in Result Based Management (RBM) framework at the end of this report.

Conservation of indigenous cattle breeds

Three cattle breed namely Dangi, Lal Kandhari and Gaolao were selected for conservation and improvement.

Dangi Cattle: This breed originated from Dang District of Gujarat, and mostly found in Akole block of Ahmednagar district and Sinnar, Igatpuri block of Nasik district. The breed is medium size, sturdy in heavy rain due to its oily skin and hard hoof with excellent working abilities in rice fields as well as on hill rocks. Six strains named as Bhahada, Manhera, kala, khaira, shevra and Para are found based on coat colour. Bhahada is the most acceptable strain by the farmers. White colour with black patches on body and side of face with bulging head, black switch and hoof with shiny skin are the typical characters of Bahada strain.


Dangi Cattle

Lal Kandhari Cattle: This breed was picked by the Royal dynasty of King Somadevraya far back in 4th century AD. Lal Kandhari cattle is reared mainly for draught purpose. Animals are medium in size, strong, compact and good looking. Body color is dull red to almost dark brown. Breed originated from Kandhar block of Nanded District and then spread in Nanded, Parbhani, Latur, Hingoli and Beed districts of Maharashtra.


Lal Kandhari Cattle

Gaolao Cattle: This is a famous dual-purpose breed of Vidarbha Region (mainly Wardha and Nagpur districts) of Maharashtra. The animals are small sized and reared for draught and milk production mainly by the community of Nanda Gaulis (Gaoli) who are responsible for developing it. Community claims that bullocks are capable of travelling up to 20 to 25 km a day.


Gaolao Cattle

Based on initial surveys and interaction with the community, the approach and methodology were developed. Cattle Development Centers (CDC) were established at respective native tract of the cattle breed to provide quality breeding services to the breeders. In all, 12 CDC's (4 for each breed) are in operation across four clusters. The breed improvement efforts led to production of 3255 calves. The elite bull calves of respective breeds were selected based on the community perception and scientific criteria and were procured for semen collection and preservation at Urulikanchan. Nearly 2.87 lakhs semen doses were produced, utilized for breeding work and few doses were preserved for long-term storage for *ex-situ* conservation.

Field level studies were conducted to generate data on various aspects related to focused cattle breeds viz. phenotypic characterization, milk recording, economics of breed rearing, local forage resources etc. Genomic study in Dangi and Lal Kandhari cattle have been initiated to understand within and between breed diversity of indigenous breeds.

Conservation of indigenous goat breeds

Sangamneri and Berari breeds are the focused goat breeds under conservation.

Sangamneri goat: This breed has derived its name from Sangamner block of Ahmednagar district. The breed has white prominent colour or brown and white with black colour. It is a sturdy breed and sustainable in high temperature and drought. Under field conditions, goats are maintained on semi-intensive management. Goats are maintained in open houses and are reared mainly for meat purpose.

Berari goat: This is breed of central region of India, and is mainly used for meat purpose. The breed derived its name from its native region- the Central Provinces and Berar. Central Provinces covered much of present-day Madhya Pradesh, Chhattisgarh and Maharashtra states. The habitat of Berari breed of goat is the Vidarbha region spread in 11 districts of Vidarbha.

Quality breeding services were provided to goat keepers through availability of elite bucks in the selected villages. The buck breeding services resulted in production of 2973 kids. Field level studies in kidding pattern, periodical growth measurements of kids and socio-economic survey were undertaken. Genomic study on diversity and karyotyping study for screening of genetic disorder in bucks provided for breeding purpose were undertaken. 25246 semen doses of elite bucks of Sangamneri and Berari breeds were produced and preserved as *ex-situ* conservation approach for future breeding.

Conservation of local Satpudi poultry

Satpudi poultry: This is local semi wild bird found in Khadki valley of Toranmal hills of Satpuda in Nandurbar district and reared by Pawara tribal community. Birds appeared in different colors. Sustained under extreme conditions, birds are reared for meat purpose. Characterization of this breed and study on production performance and management systems was undertaken.

Community is rearing this breed as backyard poultry and it is one of the good sources of income. Bird characterization was undertaken for studying morphology, and performance of the Satpudi poultry in various selected villages. Efforts were made to recognize this breed as a new breed and will explore its registration at National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana. Based on the community perception, pure birds were selected for mother unit to study the production performance. A hatchery unit is also established at village level for production of good quality chicker to supply to the farmers.

Documentation: Documentation on traditional animal management practices, various strains based on colour pattern, seasonal cattle migration, animal festivals, case study/ success story were undertaken.

Community mobilization and promotional activities

786 community level events like awareness meeting, health camps, deworming, vaccination, exposure visits, training and capacity building were organized. Promotional activities like supply of fodder seed, mineral mixture, silage making were undertaken every year to address feed and fodder availability issues. Breeder's groups were formed across the selected villages to bring likeminded persons on common platform to share and discuss conservation aspects of focused breeds.

Community participation in MGBP process

The Participatory Rural Appraisals were initially undertaken at villages where community was actively involved in listing the biodiversity in the village. Knowledgeable persons / key persons in the respective bio-resources were identified. Focus group discussions with the livestock owners were organized to discuss the current status and challenges in rearing the livestock. The families maintaining indigenous cattle and goat breeds were identified in respective native tracts of the particular breeds. The elite bulls of Dangi, Lal Kandhari and Gaolao as well as bucks were selected from their native tracts based on the community perception and the traditional knowledge of the community in animal selection for breeding purpose.

Traditional conservation practices and Sustainable harvest practices

Traditional conservation practices were observed in different livestock breeds across the selected villages. Cattle exhibition / yatra is being organized at Dangi cattle tract in Akole (Rajur yatra) and Lal Kandhari cattle tract in Kandhar (Malegaon yatra). Many farmers have passion of rearing and maintaining the elite bulls and cows to exhibit in the village yatra and nominate for the championship. The village yatra committee is organizing such events involving the livestock department as well as

NGO's and the criteria for champion bull and cows are also decided by the committee.

Pastoral communities

The Kanadi, Talvar, Mahadev Koli, Thakar are the tribal community rearing Dangi cattle breed in Akole (Ahmadnagar), Ghoti (Nashik) and Nanda Gauli Community rearing Gaolao Cattle in Arvi (Wardha) are the pastoral community. These communities migrate to other areas along with their livestock. The project participants were belonging to these communities and various field level activities were undertaken with their active participation.

Beneficiaries

The farmers (2552) rearing the focused indigenous cattle, goat and Satpudy poultry breeds were the direct beneficiaries of the project across 60 villages in four agro-climatic zones of Maharashtra. The community profile in project area is mentioned elsewhere.

Benefits received by the community

a) Farmers are getting quality breeding services to their livestock through artificial insemination services at doorstep, availability of elite bucks for goat breeding, mother unit and hatchery for Satpudi poultry chick production, which helps in increasing number of pure breed animals in the project villages.

b) Promotion of quality seed and planting material of improved fodder varieties, mineral mixture, silage making helps in better nutritional care of the animals

c) Organization of health camps to address infertility, deworming and vaccination benefited in better health care of the animals.

d) Knowledge gained through exposure and capacity building of local breed keepers.

e) Community mobilization through formation of breeders groups across all selected villages has benefitted in development and conservation of indigenous livestock breeds along with upgradation of the breed.

Measures to reassure that benefits to the community continue even after conclusion of MGBP

a) The Cattle Development Centers engaged in providing quality breeding services to the livestock breeders will be continued after the project period. Efforts are being taken to make these centers self-sustainable.

b) Elite breeding bucks are provided for goat breeding services and these services are being monitored through the goat owner's groups formed under the project. These services will be continued and managed by the groups.

c) There is awareness in the community about the artificial insemination and they are now opting for these services than the natural services.

d) The breeder's groups formed across all the project villages will support in promotion and conservation of indigenous livestock breeds.

Peoples selection criteria

It was observed that communities have their own criteria for selecting a preferred and suitable animal or bird for managing and getting optimum production from these resources. These criteria are based on their experiential knowledge over generations and their preference is based on the optimum production and performance of these animal genetic resources in their agro-ecological area and community needs.

Traditional knowledge of community on some important characters and the claims for good and preferred animal breed are mentioned below.

	Breed types	Breeding tract	Phenotypic characters of preferred animals
1	Gaolao Cattle	Wardha, Amravati and Nagpur districts	Milky white body coat, Thin skin swirls on the skin should be three, black hooves, muzzle and tail switch, turned backward small horns, medium size dewlap , bowl shaped udder in cows with medium sized tits with curved milk veins, long and straight legs equally proportionate,
2	Lal Kandhari Cattle	Nanded, Parbhani and Hingoli	Red color is preferred with oily glaze generally known as Telya, Body Size large with long legs and rounded black hooves, tail should be long and it should be beyond hock. Horns are preferred short and broad. Skin should be thin and attached compactly with body, swirls should be at the middle part of the back bone with clockwise round shapes and number should not be more than two.
3	Dangi Cattle	Ahmednagar, Nashik	Black and white colored spots on the body with equal distribution, skin with oily secretions; swirls should be two through overall body coat. Hooves should be black. Hump in bulls should be large. Backward straight horns. Long tail.
4	Berari Goat	Vidarbha area	Dark red with black boundaries in coat color, muscles of hind limbs should be tight. Compact pouch i.e. belly.
5	Satpudi chicken	Nandurbar district Satpuda hills and valleys	Different color combinations of body and wings, wings should be long, body size must be large and rounded, beak shank and nails should be yellow. Pea shaped comb in cocks.

Threats to certain breeds

a) The natural resource base such as feed and fodder and related production systems are diminishing. This is considered as one of the major threats to Dangi, Lal Kandhari and Gaolao cattle in their native tracts.

b) Utility of the animal for draught purpose is decreasing day by day due to introduction of farm mechanization.

Fodder species and their nutritive values

Local fodder species were documented and samples were collected for their nutritional evaluation. It was observed that the locally grown forage grasses are main fodder source for maintaining the indigenous livestock breeds in all clusters. Findings of the nutritional analysis indicated that local fodder species provided partly required nutrients for indigenous livestock and reduced keeping cost by many folds. All the fodder species have shown variations in nutrients and they are good sources of fodder for grazing animals.

List of Publications and presentations at conferences etc.

Research papers published

- Sayed M.A.I, Sajal Kulkarni, Dilip Kulkarni, Ashok Pande and Vitthal Kauthale (2017). Nutritional Study of Local Fodder Species in Ahmednagar District of Western Maharashtra. Agric. Sci. Digest., 37(2): 154-156
- Vitthal Kauthale, Sajal Kulkarni and Anjali Nalawade (2017). Nutritional Evaluation of Selected Fodder Species from Wardha District of Maharashtra, India. Forage Res., 43 (3): 247-249
- Kauthale V. K., S. R. Chirfare, G. J. Bidgar and J. R. Khadse (2019). Socio-economic Profile of Farmers Rearing Gaolao Cattle in Wardha District of Maharashtra, International Journal of Tropical Agriculture, Vol. 37 (2), 203-208.
- Kauthale V.K., Chirfare S.R. and Khadse J.R. (2019) Socio-economic Status of Red Kandhari Cattle Rearing Farmers in Kandhar Block of Nanded District in Maharashtra. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 11, Issue 13, 8700-8700.
- Kauthale V. K., G. J. Bidgar, M.A.I. Sayed and J. R. Khadse (2019). Socio-economic Status of Dangi Cattle Owners in Ahmednagar Districts of Maharashtra, Communicated to SOCDAB journal.

Research papers presented

- Sajal Kulkarni, Sayed M. A. I., Ashok Pande, and Vitthal Kauthale (2016). Studies on traditional knowledge base of the tribal and pastoralists communities conserving animal genetic resources in Maharashtra. Paper presented in 1st International Agro. Biodiversity Congress (IAC 2016), 6-9 November 2016, New Delhi
- Sajal Kulkarni, Sayed M. A. I., Yogesh Navle, Ashok Pande, and Vitthal Kauthale (2017). Study on Migration Pattern of Dangi Cattle Owners in Akole Block of Ahmednagar District Paper presented in 3rd Indian Biodiversity Congress (IBC-2017), 10-12 March 2017, Puducherry

Popular article published

- *Pashupalak Janukanche Rakshak* -Mr. Sajal Kulkarni, article published in Agrowon daily, 2017
- *Nandurbarchi Satpudi Kombadi* – Dr. Vitthal Kauthale and Lilesh Chavan article published in Agrowon daily, 2019

Networking with other MGBP groups: BAIF's expert team, alongwith the President, BAIF, visited the MGB partners working on Grassland Diversity and Livestock diversity, and discussions with the community were organized. Required technical and input support as well as laboratory facility for analysis of grass and soil samples was provided by BAIF to all these partners. The project team of these partners along with farmers have visited BAIF's Urulikanchan campus for exposure to various activities in agriculture and livestock. Following partners were visited by BAIF team.

#	Name of the NGO	Dates visited	Type of facilitation provided
1	Vasudha, Lamkani, Dhule	21 April 2015	Supply of seed and planting material of Hybrid Napier (BNH-10) and BAIF Bajra, training to 5 AI technician, Proximate Analysis of grasses.
2	Lokpanchayat, Akole	23 April 2015	Nutritional evaluation of grain and grasses samples.
3	Ugam, Hingoli	5 June 2015	Supply of seed and planting material of Hybrid Napier (BNH-10) and BAIF Bajra, training to AI technician.
4	Samvedana, Washim	6 June 2015	Supply of fodder seed of BAIF Bajra-1 for field demonstrations.

i) MoU between BAIF and Sanskrti Samvardhan Mandal (SSM), Sagroli, Nanded was entered for Lal Kandhari cattle breed conservation work in Kandhar block of Nanded district.

ii) BAIF has facilitated all MGB partner organizations through workshop on preparation of Result Based Management framework.

Outreach

Connection with people beyond beneficiaries

i) The people participated in community awareness programme, animal health camps for infertility, deworming and vaccination connected with the conservation programme during the project period.

ii) Cattle fairs and exhibitions organized at village level were attended by the farmers from various locations and were connected with the programme.

National/ international outreach

i) Director, National Bureau of Animal Genetic Resources, New Delhi

ii) MoU signed between BAIF and Mahatma Phule Krishi Vidyapeeth, Rahuri for Sangamneri goat conservation work in Sangamner, Ahmednagar district.

iii) Dr. Ilse Kohler Rollefson, Lokhit Pashupalak Sanstha, Sadri, Rajasthan for Community Bio-cultural protocol.

Knowledge Outcomes

Interesting / unknown/ unrealized facts

Stories emerged: Following case studies/success stories were documented

- Morphological characterization of Satpudi poultry
- Strain patterns in Dangi cattle
- Success story of Dangi breeders - Mr. Dattu Dhonnar and Mr. Ashok Bnedkuli
- Indigenous breed keepers- savers of genes
- Dangi calf rally- an approach for promotion of indigenous breed
- Migration pattern in Dangi cattle owner in Akole block
- Sangamneri goat rally- an approach for promotion of indigenous breed
- Dangi festival
- Bailpola festival
- Bio-cultural community protocol

Realizations about human nature/ human-nature relationship

The community rearing the indigenous livestock breeds at different locations is mostly dependent upon the available natural forage resources for feeding the animals. The balance between the available natural resources and livestock population needs to be maintained by the community to retain ecological harmony.

Observations about ecology- regeneration/ depletion/ conservation

It was observed that livestock is being maintained mainly on grazing in common/forest land and few farmers are providing additional feed and fodder to the animals. Availability of feed and fodder is the major challenge observed in conservation of animal genetic resources. Due to changing climatic scenario, degradation of land due to erosion and overgrazing the available grazing lands / grasslands are depleting fast and in many places they have reached worst conditions. The existing grasslands are not able to feed the available livestock population. The change in the forest policy of not allowing the animal grazing in forest land is also one of the challenge limiting the animal feeding. All these factors have contributed in depleting the animal population of indigenous breeds.

Species lists/inventory

List of local fodder species observed in the project area of Akole, Sangamner and Wardha is given below:

#	Local Name	Botanical Name
1	Pochad	*Apluda mutica* L.
2	Limb	*Azadirachta indica* A. Juss.
3	Dongari	*Chrysopogon fulvus* (Spreng.) Chiov.
4	Sugaran	*Cleistachne stocksii* Hook. f.
5	Tahakal	*Clerodendrum multiflorum* O.Ktze.
6	Tikhadi /Turda	*Cymbopogon martinii* (Roxb.) Wats.
7	Malvel	*Dicanthium annulatum* (Forssk.) Stapf
8	Pawanya	*Eulalia fimbriata* (Hack.) Kuntze
9	Gandhari	*Grewia asiatica* L.
10	Surad	*Heteropogon contortus* P. Beauv
11	Kusal	*Heteropogon ritchiei* (Hook. f.) Blatt. & McCann
12	Godali gawat	*Indigofera cordifolia* Heyne ex Roth.
13	Bakan	*Melia azadarach* L.
14	Dinanath	*Pennisetum pedicellatum* Trin.
15	Wadebabli	*Prosopis julifera* (Sw.) DC.
16	Shedal	*Sehima nervosum* (Rottler ex Roem. & Schult.) Stapf
17	Papaniya	*Sehima sulcatum* (Hack.) A. Camus.
18	Chikta	*Setaria intermedia* (Roth.) R. &.S.
19	Shide	*Spodiopogon rhizophorus* (Steud.) Pilg.
20	Stylo Hamata	*Stylosanthes hamata* (L.) Taub.
21	Suradi	*Tephrosia purpurea* (L.) Pers.
22	Bondare	*Thelepogon elegans* Roth
23	Dhowyad	*Themeda quadrivalvis* (L.) Kuntze
24	Kandal	*Themeda triandra* Forssk.

Database (s) generated

Various field level studies were conducted across selected villages during the project period and sufficient data generated. The data were tabulated, analyzed and results are depicted below.

· Nutritional study of local fodder species in Ahmednagar district

The locally grown forage grasses are main fodder source for maintaining the indigenous livestock breeds like Dangi cattle and Sangamneri goat in Ahmednagar district. Most commonly observed fodder grass and tree species grazed by livestock were collected from the field. The nutritional quality of these grasses and tree species was determined by undertaking proximate analysis. The local fodder species include *Dicanthium annulatum, Setaria intermedia, Themeda triandra, Heteropogon contortus, Indigofera cordifolia, Apluda mutica, Cymbopogon martini, Tephrosia purpurea*. Among the tree species *Melia azedarach, Azadirachta indica, Prosopis julifera, Grewia asiatica, Clerodendrum multiflorum* were the major tree species commonly available as fodder source. The nutritional analysis indicated that crude protein content ranged from 5.61 to 15.46%, crude fiber 18.09 to 34.87%, ether extract 1.00 to 3.24%, Ash 6.44 to 21.56 % and silica was less than 5.31%. The grass and tree species found in hilly regions are showing tremendous variation in nutritional composition. This study highlighted the importance of local fodder species including grasses, legumes, bushes and trees in rearing the livestock with low inputs at field conditions.

Table 1: Chemical composition (% DM basis) for fodder species in Akole and Sangamner

#	Local Name	Scientific Name	Dry Matter %	Crude Protein %	Crude Fiber %	Ether Extract %	Ash %	Silica %
1	Tahakal	*Clerodendrum multiflorum* O. Ktze.	92.42	14.25	18.09	1.1	12.7	4.38
2	Bakan	*Melia azadarach L.*	91.05	15.46	20.63	1.19	9.61	1.62
3	Limb	*Azadirachta indica* A. Juss.	93.41	10.17	20.21	3.24	6.44	0.67
4	Godali gawat	*Indigofera cordifolia* Heyne ex Roth.	92.38	9.76	20.32	1.41	21.56	5.31
5	Gandhari	*Grewia asiatica* L.	89.78	10.62	20.55	1.33	11.45	2.66
6	Wadebabli beans	*Prosopis julifera* (Sw.) DC.	90.69	13.74	29.86	1.64	5.22	0.63
7	Surad	*Heteropogon contortus* P. Beauv	92.31	6.06	31.15	1.03	9.74	4.69
8	Chikta	*Setaria intermedia* (Roth.) R. &.S.	91.45	7.04	28.82	1.17	15.32	5.15
9	Kandal	*Themeda triandra* Forssk.	92.07	6.01	34.42	1.46	12.43	4.99
10	Flvara	*Apluda mutica* L.	84.92	5.84	34.47	1.28	13.24	4.75
11	Turda	*Cymbopogon martinii* Wats.	94.52	6.42	30.22	1	11.19	4.06
12	Suradi	*Tephrosia purpurea* (L.) Pers.	90.49	5.95	34.15	1.68	10.11	5.01
13	Malvel	*Dicanthium annulatum* (Forssk.) Stapf	92.17	5.61	34.87	1.19	13.4	3.16

· Nutritional evaluation of selected fodder species from Wardha district

Fourteen fodder species viz., *Apluda mutica, Sehima sulcatum, Dichanthium sp., Themeda quadrivalvis, Spodiopogon rhizophorus, Chrysopogon fulvus, Cleistachne stocksii, Sehima nervosum, Pennisetum pedicellatum, Eulalia fimbriata, Heteropogon ritchiei, Cymbopogon martini, Thelepogon elegans* and *Stylosanthes hamata* were analyzed for crude protein, crude fiber, oil/ether extract, ash and silica content. The crude protein content of the investigated fodder species ranged from 2.81 to 10.17 per cent, the crude fiber content from 24. 56 to 35.73 per cent, the ether extract from 0.59 to 1.01 per cent, ash content from 8.17 to 11.55 per cent and silica content from 3.87 to 7. 47 per cent. Findings of the present analysis indicated that fodder species showed variations in nutrients status before seed maturity stage and local fodder species provided partly required nutrients for indigenous livestock and reduced keeping cost by many folds.

Table 2: Chemical composition (% DM basis) of fodder species in Wardha district

#	Common Name	Scientific Name	Crude Protein %	Crude Fibre %	Ether Extract %	Ash %	Silica %
1	Dongari	*Chrysopogon fulvus* (Spreng.) Chiov.	4.23	35.73	0.76	8.17	6.38
2	Sugaran	*Cleistachne stocksii* Hook. f.	4.06	34.04	0.71	8.57	6.04
3	Papaniya	*Sehima sulcatum* (Hack.) A. Camus.	4.80	30.13	0.98	8.59	5.26

#	Common Name	Scientific Name	Crude Protein %	Crude Fibre %	Ether Extract %	Ash %	Silica %
4	Marvel	*Dichanthium* sp.	4.97	24.56	0.78	8.67	6.04
5	Pochad	*Apluda mutica* L.	4.15	29.89	1.01	8.96	5.34
6	Shide	*Spodiopogon rhizophorus* (Steud.) Pilg.	4.16	29.57	0.68	9.14	4.68
7	Dhowyad	*Themeda quadrivalvis* (L.) Kuntze	5.12	27.26	0.88	9.27	6.13
8	Pawanya	*Eulalia fimbriata* (Hack.) Kuntze	4.02	26.23	0.63	10.26	3.87
9	Dinanath	*Pennisetum pedicellatum* Trin.	4.17	26.46	0.68	10.34	5.26
10	Stylo Hamata	*Stylosanthes hamata* (L.) Taub.	10.17	27.09	0.76	10.47	4.74
11	Bondare	*Thelepogon elegans* Roth	3.70	33.40	0.76	10.56	6.81
12	Tikhadi	*Cymbopogon martinii* (Roxb.) Wats.	3.71	28.21	0.71	10.67	7.18
13	Kusal	*Heteropogon ritchiei* (Hook. f.) Blatt. & McCann	2.81	32.49	0.73	11.16	5.68
14	Shedal	*Sehima nervosum* (Rottler ex Roem. & Schult.) Stapf	4.31	29.22	0.59	11.55	6.16

· Socio-economic Status of Red Kandhari Cattle Rearing Farmer

This study was conducted to evaluate socio-economic status of Red Kandhari cattle rearing farmers during the year 2015-16 in Kandhar block of Nanded district in Maharashtra. Data on family background, land holding, and animal management practices were collected from the farmers through interview and specially designed questionnaire. The majority of livestock farmers (64.56%) lived in nuclear family; small family size (64.56%) and 79.64% farmers were literate. Majority of Red Kandhari animals (61.61%) were owned by farmers having small family size. Animal husbandry was the main source of livelihood. Majority of farmers (60.13%) had small land holding below 5 acres, 53.14% farmers had medium herd size (6-10 animals). The animal breeding was undertaken by natural service (66.31%). The animal housing was low cost *kaccha* type (85.32%). 79.72% farmers grazed their animals and remaining animals were stallfed, 72.02% farmers followed deworming and 83.21% vaccinated animals. About 48.95% farmers were rearing Red Kandhari animals for milk and draught purpose. All farmers followed clean milk production practices.

· Socio-economic Status of Gaolao Cattle Rearing Farmers

The study was conducted in Wardha district of Maharashtra state during 2015-16 to assess the socio-economic profile of farmers rearing Gaolao cattle. Gaolao cattle are very hardy animals and are mainly used for milking and agricultural works. Information on socio-economic profile of the randomly selected respondents was collected through structured interview. The results revealed that majority of farmers have nuclear family (68.18%) and owning 64.48% cattle. The majority households were having small land holding (51.05%) and owning 52.82% cattle. The main source of income for majority of farmers (52.10%) was dairy farming. The herd size ranged from 1 to 33 cattle. The cattle management practices indicated that majority of the farmers (78.79%) provided kuccha type of roof shed, and 90.12% farmers follow grazing practices. 56.30% farmers follow natural breeding services and most of the farmers (91.17%) adopted deworming and vaccination of their animals.

· Socio-economic status of Dangi cattle breed owners

Present investigation was carried out to study the socio-economic profile of Dangi cattle owners in Akole block of Ahmednagar district of Maharashtra. A sample of 335 Dangi cattle owners was randomly selected from seven villages during 2015-16. Primary data was collected through structured questionnaire on family type, land holding, herd size and animal management practices. The results revealed that majority of Dangi farmers (70.75%) lived in nuclear family having medium family size (51.94%). Majority of Dangi farmers reared animals for agricultural operations (81.79%) with small herd size (57.62%). Natural breeding practice (61.79%) was preferred to artificial insemination. Mostly the animals were free grazing (85.98%). Most of the farmers followed clean milking practices like cleaning udder (96.42%) and milking utensils (97.91%), and vaccination of animals (75.22%). The animal housing was in *kachha* roof (55.82%) and *kachha* floor (87.16%) with closed byre (58.81%) to protect animals from adverse conditions.

· Molecular diversity study of indigenous cattle breeds (Dangi, Gaolao and Lalkandhari) using High Density (700K) SNP assay

The study on the genomic application in elucidating Indian cattle population structure and study indicated that genomic information especially the SNP (Single Nucleotide Polymorphism) marker information

provides ample opportunity in understanding the genetic basis of the specific cattle population structure. Genomic tools could be used to determine effective population size that is indicative of the levels of population endangerment. It could be useful in understanding within breed and between breed diversity levels in terms of allelic diversity, again a useful tool for designing the breeding program for a specific breed. It could be useful in understanding the relatedness among the animals or breeds under study that could be useful to control inbreeding levels in a population. It can elucidate certain levels of breed ancestry, useful to breed back the specific breeds, which are in endangerment. It can provide information on the two most closely related breeds and populations that will provide basis for breed conservation (the breed under endangerment could be revived with a highly related breed, which is abundant in numbers). The genomic information could be useful to design specific mating program within or between breeds in a region simultaneously taking care of genetic diversity and genetic improvement. The genetic merit of individual animal within a population could be elucidated using genomic information that will be highly useful in selection of high genetic merit breeding stock.

A study was conducted to understand the molecular level genetic diversity within the selected Maharashtra indigenous breeds (viz. Dangi, Gaolao, Redkandhari, Khillar) of cattle using Illuminia High Density (77,000) SNP (Single Nucleotide Polymorphism) bead array. Number of samples used for the study: Dangi-68, Gaolao – 28, Khillar – 25, Redkandhari – 35. In addition, other Indian breeds (Gir, Hallikar, Haryana, Krishna valley, Malinar Gidda, Ongle, Rathi, Redsindhi, Tharparkar, Vechur and Non-Descript) genotypes were compared. The analysis was extended by including some reference *Bos indicus* breeds (from various reference open data base as well as *Bos Taurus* breeds) to understand how Maharashtra indigenous breeds cluster within other *Bos indicus* breeds.

Principal Component Analysis

The genotyped data were checked for quality using Genome Studio Software and the resulting data was used for statistical analysis. The diversity analysis was undertaken through Principal Component Analysis in R software.

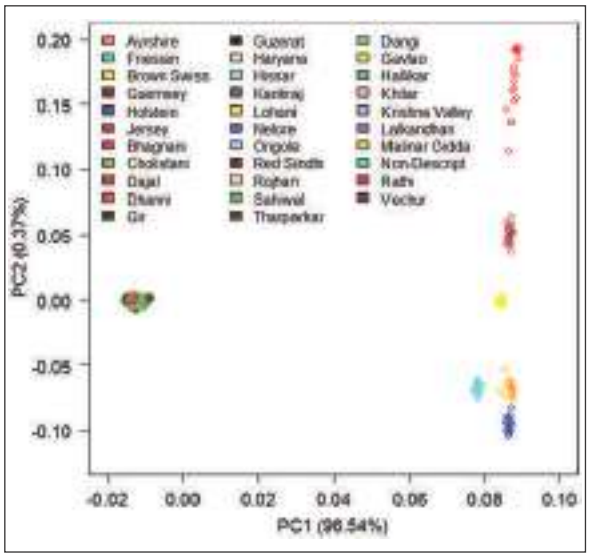


Figure I: PCA of *Bos Taurus* and *Bos indicus*

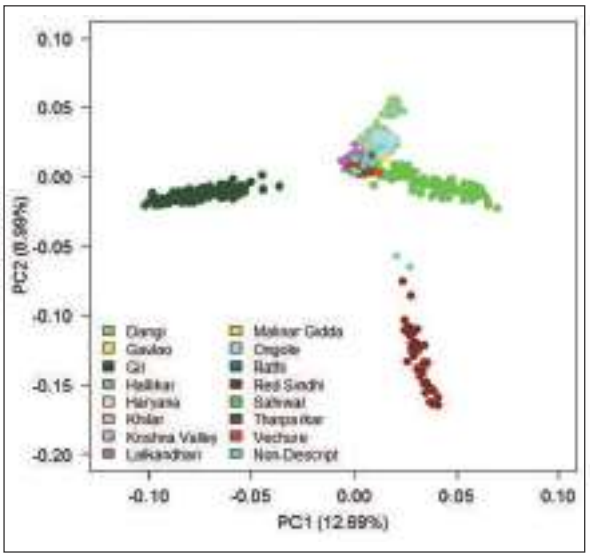


Figure II: PCA of *Bos indicus*

In this PCA analyses, results are often dominated by the most numerous classes of animal, which in this case are the *Bos indicus* (reference plus Indian indigenous) samples. In Figure-I, the fact that all *Bos indicus* breeds cluster so tightly compared to the 6 B*os taurus* breeds in the PCA, indicates that more variation exists between *Bos taurus* than *Bos indicus* breeds. Figure-II shows the PCA of Indian indigenous animals only. Indian indigenous breeds show similar amounts of variation within breeds as between breeds. In other words, at the molecular level *Bos indicus* breeds show lower levels of variation between breeds relative to that within breeds than is seen for *Bos taurus* breeds. The same is true for Maharashtra breeds sampled under this study.

For Maharashtra breeds, analyses were performed using all animals (Figure III) that were sampled and also using just 20 animals per breed (Figure IV). The analyses with a fixed number of animals per breed avoid biases due to some breeds having more animals than others.

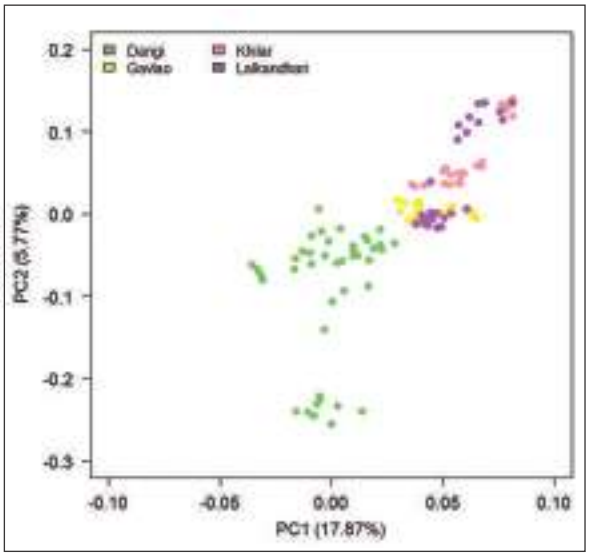


Figure III: PCA of all samples

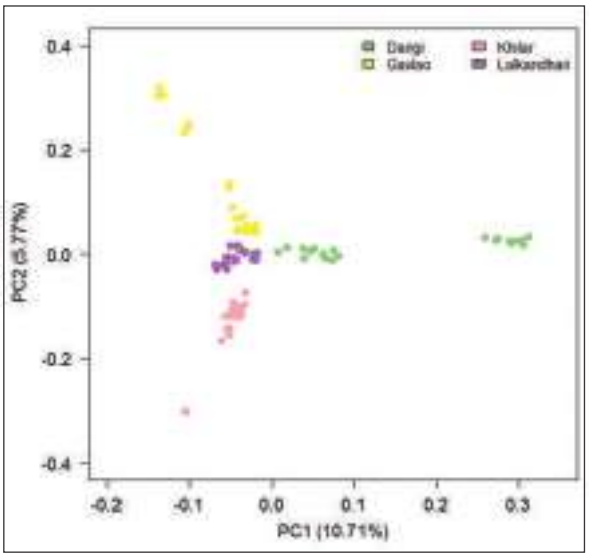


Figure IV: PCA of 20 or less animals

In Figure-III, it is observed that the Dangi and Gaolao is spread long over and having more variation but the Khilllar and Lalkandhari is somewhat intermixed with each other. In Figure-IV it is seen that all breeds are having the variation within the breeds as well as in the breed. In brief, the PCA shows that the Maharashtra breeds show more variation within breeds than between breeds, though there is sufficient variation between breeds that they are generally identifiable from each other as distinct clusters. This is more or less of a characteristic when all the Indian breeds are analysed together. All four breeds show at least two separate clusters in at least one dimension of the principal component analyses. This indicates that all breeds have a distinct population structure within the breeds with at least two separate groups identifiable within each breed. There are also individual animals within breeds that appear to be more similar to other breeds than their own breed.

Phylogenetic tree of Indian *Bos Indicus* breeds sampled under the Study

Phylogenetic tree of Indian indigenous breeds based on allele frequencies for 700k SNPs with 10,000 bootstraps was created using hierarchical clustering method. The breed names in capital letters are Indian animals sampled by BAIF, and in small letters are the reference breeds derived from other projects and open data source.

The four breeds sampled from Maharashtra, Dangi, Gaolao, Khillar and Lal Kandhari, are not more closely related to each other than other breeds that are not from North West India. These trees are instructive as estimates of genetic distance but cannot be automatically interpreted as indicating the evolutionary relationships between breeds because the phylogenetic tree assumes non-reticulate evolution (i.e. no breeds arise by admixture between breeds) whereas the evolution of livestock breeds almost certainly involves some degree of admixture of populations during breed formation.

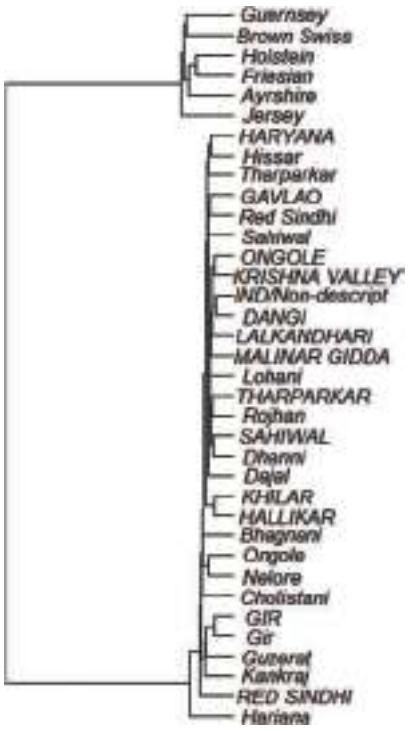


Figure V: Phylogenetic tree of Indian *Bos Indicus* Breeds

Admixture analysis

Admixture analyses was done to estimate the ancestral breed proportions represented in a given animal based on the reference genotype data sets. The results are displayed as a heat map showing the proportion of each ancestral reference breed (columns) for every Indian indigenous breed. The colour scale goes from green (high proportion) to red (low proportion). These analyses are not intended to indicate true ancestral breed composition but are useful to indicate the diversity between and within breeds and the degree of affinity between the various *Bos indicus* reference samples and the indigenous samples from Maharashtra.

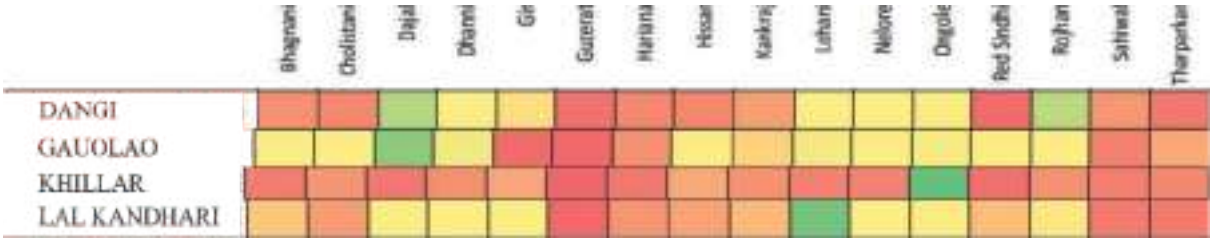


Figure VI: admixture estimates of ancestral breed proportion (columns) displayed as a heat map for each Maharashtra indigenous breed (rows).

The heat map suggests that Dangi and Gaolao appears to have large proportions from the Dajal cattle, a drought type of cattle found in Pakistan. Similarly, Lal Kandhari shares ancestral proportion from Rojhan, again a Pakisan draught breed and Khillar shares its proportion with Ongole.

Breed Diversity Measures

The study measured the diversity in terms of FIS (Fixation Index inbreeding coefficient). FIS is a measure of the relative degree of inbreeding of individuals within a breed, with higher values indicating a higher degree of inbreeding.

Table 3: FIS (±SD) with 35,000 and 700,000 SNPs, plus average diagonal and off-diagonal elements of the GRM (Genomic Relationship Matrix)

Breeds	FIS (±SD) with 35000 SNP	FIS (±SD) with 700,000 SNPs	GRM Diagonal	GRM Off-Diagonal
Dangi	0.013 (±0.119)	-0.015 (±0.124)	1.004 (±0.021)	0.07 (±0.091)
Gaolao	0.022 (±0.22)	0.022 (±0.226)	1.05 (±0.069)	0.082 (±0.115)
Khillar	0.015 (±0.195)	0.015 (±0.2)	1.033 (±0.043)	0.082 (±0.068)
Lalkandhari	0.009 (±0.165)	0.008 (±0.168)	1.016 (±0.05)	0.062 (±0.087)

For the breeds under study, the FIS values showed relatively low inbreeding levels (diagonal elements close to 1) and quite low average values for relationships among animals within a breed, indicating a lower level of genetic differentiation between breeds and more distant relationships among animals within breeds.

Effective population size

The genomic data was analysed for decay in LD (Linkage Disequilibrium) over generations, which provides an estimate of Effective Population Size (Ne). Ne is the number of individuals in an ideal population (in which every individual reproduces) in which the rate of genetic drift and inbreeding would be the same as it is in the actual population. The rate of genetic drift is highly influenced by the lowest population size in a series of generations. In any one generation, Ne is roughly equivalent to the number of breeding individuals in the population. Ne reflects the probability that genetic variation will not be lost by random chance and the heterozygosity is not lost.

Table 4: Effective population size (Ne) for MH breeds at 1000 and 5 generations before present

Breed	Effective population 1000 generations before	Effective population 5 generations before
Dangi	1525	121
Gaolao	1366	72
Khillar	1401	95
Lalkandhari	1477	103

Table 4 shows the estimated Ne of MH breeds at 5 and 1000 generations before present. All breeds have a relatively low Ne 5 generations ago, with the highest Ne being 121 for Dangi. The rate of decline in Ne has decreased in recent times and so Ne may not have declined much further since 5 generations ago. It should be noted that the sampling of animals for the current assessment of indigenous diversity took place over a smaller area than the full area of distribution for breeds in this study. This may well have led to underestimation of Ne for the whole population of a breed across the whole of its range. Therefore, any conclusion on this limited study should be taken with caution. However, the results derived out of limited samples indicates that care needs to be taken as effective genetic improvement programs are being currently developed for a number of

indigenous breeds, which could rapidly drive down Ne and drive up inbreeding rates unless genetic selection and mating processes are put in place that aim to balance the maintenance of Ne with the increase in genetic merit.

Phenotypic characterization of Satpudy birds

Data were collected on 9 qualitative traits recorded for a total of 5006 chicken using structured questionnaires. Quantitative data was collected on body weight (gm), body length (cm), chest diameter (cm), leg length (cm) and feather length (cm). Study revealed that bird populations possessed multiple variants of feather and other physical features. Red (40.75%) feather is one of the prominent features over white, black, blue and grey. Along with normal (89.11%) some birds shows stripes (9.83%) and mixed (0.48%) feather pattern. 92.49% birds showed normal feather appearance while 7.13% and 0.38% showed curly and soft appearance, respectively. Although most of the birds were observed with normal feather style (84.66%), other types like naked neck, feathered legs, mane, feathers on comb, ankles like vultures etc. were also overserved. White (58.85%) skin colour is dominant over yellow (35.84%) and bluish black (5.3%). Red (60.97 %) ear lobe was dominant over white (26.21%), red and white (9.83%) and other (3.0%). Single, double, pea and rose comb types were observed in Satpudy poultry, with single type (75.79%) comb being the dominant comb type. Most of birds had either small (44.05%) or medium (49.06%) sized comb. Leg color varies as white (24.43%), yellow (58.31%), bluish black (15.58%) and black (1.68%). The average body weight of 1972.61 g and average chest diameter of 38.39 cm were recorded. The average body length, leg length and feather length were 40.05 cm, 13.70 cm and 49.83 cm, respectively. Along with morphological characters, production performance was also evaluated. The average age at first laying was recorded as 18 weeks and average of 70.71 eggs production per year was recorded. An average interval of 12.45 week was reported between two hatchings. The average weight of whole egg, average egg-shell weight and average egg yolk weight were measured as 36.72 g, 9.69 g, and 14.03 g, respectively. 18 µ average egg shell thickness was measured. The average weight at slaughter and weight after slaughter were recorded as 1580.96 g, and 1088.31 g, respectively, while dressing percentage was 68.85.

Milk yield studies in indigenous cattle breeds

Milk yield potential study was undertaken in Dangi, Lalkandhari and Gaolao cattle breeds. Milk recordings of 617 cows including 246 Dangi, 156 Lalkandhari and 215 Gaolao breeds were undertaken through the milk recorders during 2017-18. A daily milk record book with all details was kept with cattle owners to record milk yield during morning and evening and was closely monitored by milk recorders at every 15 days' interval to actually measure quantity of milk at the time of milking of cows. Milk yield data along with other observations like AI date, date of calving, milking date, dry date etc. were recorded in a record book and then entered in Mobile Based App, and transferred to server for further analysis. The results indicated that average milk yield of 2.98 liters, 3.57 liters and 3.84 liters per day with a peak milk yield of 4.50 liters, 4.95 liters and 5.52 liters was observed in Dangi, Lalkandhari and Gaolao cattle, respectively. The lactation period was in the range of 238 to 278 days among the three breeds.

Table 5: Milk yield study in Dangi, Lalkandhari, Gaolao Cattle breeds

#	Cattle breed	N	Age at first calving (days)	Average milk yield/day (Lit)	Peak milk yield/day (Lit)	Lactation yield (kg)	Lactation period (days)
1	Dangi	246	1580.38±23.18	2.98±0.03	4.50±0.06	618.1±3.90	238.8±3.54
2	Red Kandhari	156	1460.25±38.98	3.57±0.05	4.95± 0.12	654.6±5.28	278.3±3.22
3	Gaolao	215	1421.08±31.45	3.84±0.02	5.52±0.07	742.1±6.72	245.7±10.96

Growth performance of Goat breeds

A study was undertaken in Sangamneri goat breeds to understand the growth performance of newly born kids under field conditions. The growth observations on body weight was recorded on monthly basis from birth of the kids until it is sold in market. It was observed that average body weight at birth was 2.16 kg and increased to 20.16 kg at the age of 8 months. The average monthly and daily weight gain was 2.26 kg and 75.41 g, respectively. The weight gains in male kids (81.31 g/day) was comparatively faster than the female kids (72.51 g/day).

Table 6: Growth performance of Sangamneri goat kids

Birth Weight	Weight at 1st month	Weight at 2nd month	Weight at 3rd month	Weight at 4th month	Weight at 5th month	Weight at 6th month	Weight at 7th month	Weight at 8th month	Mean
2.16	3.34	6.05	8.84	11.56	14	16.39	18.72	20.26	
Wt. gain in kg	1.18	2.71	2.8	2.72	2.44	2.39	2.33	1.54	2.26
Wt. gain in gm/day	39.32	90.25	93.18	90.62	81.17	79.7	77.75	51.31	75.41

Economics of rearing indigenous cattle breeds

Economics of rearing Dangi cattle was studied by collecting field data through specially designed questionnaire. The data was collected from Dangi cattle owners from Akole taluka of Ahmednagar District and Igatpuri taluka of Nashik district during 2018-19. The objective of the study was to understand the cost towards animal maintenance and returns from Dangi cattle based on herd size. Total of 50 Dangi cattle owners were randomly selected based on herd size and data collected as per the designed questionnaire.

The data indicated that average net annual income of Rs. 55,411, Rs. 82,240 and Rs. 2, 29, 508 was received with herd size of 1 to 5, 6 to 10 and above 11 Dangi cattle, respectively. The sale of milk, dung, cattle and draftability were the source of income and feeding, animal health and manpower were the major cost items involved in the rearing of Dangi cattle. The manpower has contributed over 70% cost as family labour in the total input cost required for rearing the Dangi cattle, as majority of farmers are following the free grazing practice.

Impact

On ecology

It has been reported that there is 59.26% shortage of green fodder in Maharashtra. (Office of the Commissioner of Animal Husbandry and Dairy, Govt. of Maharashtra report 2018). More or less, a similar situation was noticed in the project villages and acute shortage of green fodder was observed during post rainy season. To address this issue, the supply of seed of improved fodder varieties was undertaken during the project period to enhance fodder production. This intervention has supported in making availability of green fodder to the livestock which also helped in reducing the pressure on natural resources. The silage making was also adopted by farmers when there was surplus green fodder production.

On community

The genetic improvement undertaken through providing elite breeding services in cattle and goat along with interventions related to animal nutrition has resulted in better animal performance and thereby good remuneration to the livestock owners. The efforts are paving ways for community based conservation program through utilization.

On policy level interventions / recommendations

- Considering that India and the State of Maharashtra has crop-livestock as integrated farming system, efforts are required to study local diversity in livestock resources to be able to identify worthy breeds and strains to support livelihoods and nutrition to build resilience for farming communities.
- Need to deepen our knowledge and database on intra and inter species diversity of animals along with its useful traits.
- Many communities and shepherds have unique knowledge about various traits of local breeds of livestock apart from milk and meat. Such communities and groups need to be recognized and rewarded. The knowledge that they possess needs to be understood and documented as well.
- Maintaining purity amongst worthy breeds of cattle and goat is a challenge. *Ex-situ* conservation measures like semen freezing and reproduction through artificial insemination seems to be good practice to be adopted and expanded for many more worthy breeds. Under the project, many elite animals have been conserved in respective native tracts.
- Even in goat, there is a need to focus on promotion of artificial insemination practices for assurance of quality breeding and production of elite animals.
- There are many good practices that have emerged and have been followed by communities for participatory breed selection, conservation and upgradation. Lot of local wisdom is used. This needs to be studied, understood and documented as this is a form of people science.
- There are many breeder's associations being formed and strengthened in many regions. These are voluntary groups doing excellent work on breed conservation and promotion. There is a need to take note of their efforts and mainstream such efforts under government funds.
- The participatory breed conservation program as demonstrated under the MGB project could be incorporated into state policies on conservation and genetic improvement of livestock resources.
- There are very good opportunities to leverage and use biotechnology tools for further studies on livestock diversity. The study on the genomic application in elucidating Indian cattle population structure indicated that genomic information especially the SNP (Single Nucleotide Polymorphism) marker information provides ample opportunity in understanding the genetic basis of the specific cattle population structure. Genomic tools could be used to determine effective population size that is indicative of the levels of population endangerment.
- Like crop diversity there is need to plan focused and network efforts to capture fodder diversity and locally used fodder species of importance as well. Thrust is required to conserve and promote local fodder and grass species, preservation through silage, and practices that would enhance fodder availability in the areas.

- Thrust should be given to revive and ecologically restore the earlier pastoral lands.
- Value addition and work across value chain is needed to ensure financial incentives to farmers. This may include efforts like promotion and market linkage of milk and milk products, value added products from cow dung, urine etc.
- There is need to study and understand various livestock breed-wise pressures, threats and factors that can cause damage to region's livestock diversity. More surveys, surveillance and actions on ground are required. One important aspects that needs attention is migration of cattle from one place to other due to fodder scarcity.
- Apart from entire economics, there is need to understand other indirect benefits of indigenous livestock resources as well for drought purpose and resilience to climate change etc.
- Thrust is required on improved breeding and scientific management services in indigenous livestock resource as well including both large and small ruminants.
- Suggested partnership of state animal husbandry and forest department regarding making available the fodder resources from the forest areas will help farmers in reducing the expenses on feeding the animals.
- Strengthening and capacity building of breeders groups is required for participating in dialogue with state Animal Husbandry Department for economic benefits and support in breed conservation.
- Capacity building and promotion of Ethno-veterinary practices among the farmers will be helpful for availability of cost effective and timely health services locally.

Failure stories

- Efforts were taken for formation of the breeders group and association at cluster level, however, formation of breeder association doesn't work due to political influence at village level.
- The collection of milk of indigenous cattle breed, value addition and market linkage was thought of during the project phase. However, it has not happened due to poor response by the farmers and scattered cattle population in cluster.

Way forward

What part of work must continue?

i) The Cattle Development Centers (CDC) established at respective breeding tracts of the focused breeds for providing the quality breeding services needs to be continued.

ii) Availability of seeds and planting material of important fodder crops at village level to undertake the cultivation of green fodder

Support structure

Efforts are being made to make the CDC self-sustainable so that it could be run independently. The BAIF's model of self-employed youth will be explored for this purpose.

i) Seeds of fodder crops could be made available through breeder's groups established at village level under the project. The nurseries of BAIF Napier Hybrid-10 variety are established at farmers' field which could meet out the demand of planting material in the locality.

How the learning/ achievements from MGBP should be taken forward How are you planning to make use of work done under MGBP in the work ahead?

i) Genetic Improvement of Dangi, Lal Kandhari and Gaolao cattle breeds through selection based on milk yield, phenotypic and genomic data. Elite animals could be selected to produce bull mother and bulls for further breeding

ii) Genomic study of cattle breeds for specific characters (stress /heat tolerance)

iii) Promotion of milk and milk products of indigenous cattle breeds

Articles / case studies / success stories documented under Livestock diversity

Morphological characterization of Satpudi poultry birds:

Poultry bird plays important role in lifestyle of tribal community of Dhadgaon and Akkalkua blocks of Nandurbar district. Especially indigenous Satpudi poultry has importance in cultural as well as livelihood point of view. Satpuda ranges are considered as native place of Satpudi poultry. Participatory *in-situ* and *ex-situ* conservation, management and revival of these indigenous poultry are one of the objectives of Maharashtra gene bank program. The study was conducted to characterize the variations in morphological features in different populations of native chickens of Satpuda ranges of Maharashtra. During study it was found that there are lot of variations in morphological characters of Satpudi poultry. For conservation of any species, its correct identity becomes fundamental step. To identify actual Satpudi poultry, survey of five thousand families around Toranmal and Khadki area was conducted, as pure birds of Satpudi poultry can be seen in this area. As per local people view, true to type Satpudi bird has mix brown- gray colour, medium height, short legs and brown eyes. Following are the major strains in Satpudi poultry found in their native range:

a) Birds with frizzled feathers: Locally such frizzled birds are known as *Hayali Kukadi*. These types of bird occur in more number. Tribal community has a belief that these birds are unlucky and not used for any holy rituals.


Hayali Kukadi


Talya Kukadi


Kalyo Kukadi


Bahada


Shevara


Kala


Gavathi Kukadi


Kabharyo Kukadi


Mahnera


Khaira


Para

b) Naked neck (*Talya kukadi*): As name indicate neck portion of these birds are featherless. These birds are little bit taller than other strains and resistant for many diseases, however local people have least preference for these birds.

c) Mix coloured birds (*Kabharyo kukadi*): this strain has mix coloured feathers, shorter legs, brown coloured-medium sized eggs. People give more preference for rearing these birds.

d) Black coloured birds: Black coloured birds locally known as '*Kalyo kukadi'*. It has light yellow coloured legs and brown eyes. This strain is similar to 'Kadaknath' breed.

e) Local birds: This strain is locally known as '*Gavathi kukadi'* and has many desirable characters like larger size, heavy weight and high demand in market. It is similar to Akaleshawar breed in Gujarat state.

Characteristics of different strains in Dangi cattle

India is blessed with more than 30 indigenous cattle breeds. Dangi is one of the indigenous cattle breeds, which is reared in Dang district of Gujarat; Nasik, Thane, Palghar and Ahmednagar district of Maharashtra. The breed is medium size, sturdy with hard hoof and can withstand heavy rainfall due to its oily skin. The characteristic hard hooves provide them with excellent working abilities in paddy fields as well as on hill rocks.

Although it has a restricted distribution, it shows variability in morphology, especially the colour pattern. Based on the color variability, broadly six strains of Dangi cattle viz. *Bhahada, Manhera, Kala, Khaira, Shevra,* and *Para* have been observed. These are as follows:

1. Bahada: White colour with black patches

2. Shevara: Black colour with brown patches

3. Kala: Complete black colour

4. Manhera: Black colour with white patches

5. Khaira: White colour with brown patches

6. Para: Mostly white with small black patches

According to the study, apart from the coat color variation, there are no other differences like variability in resistance power, working capacity, traction power, breeding performance, tick infestation etc. in Dangi. However, it has been observed that the *Bahada* strain of Dangi is more popular among people due to the community perception that it has an attractive color. The experts too select *Bahada* as a champion during festivals/local yatras. All these factors lead to a good market value and community preference for *Bahada*. For conservation of these indigenous breed various activities like artificial insemination (AI) services, deworming- vaccination camp, awareness rally, support in festivals etc. were undertaken under MGB project.

Success story of Mr. Dattu Dhonnar- a Dangi breeder

Mr. Dattu Karbhari Dhonnar is a well-known Dangi breeder in Samsherpur village in Akole block in Ahmednagar district. He is a traditional Dangi keeper and having herd of over 25 elite Dangi animals. He is participating in Dangi festival at Rajur and Khirvire every year and his animals are continuously getting champion award for Dangi breeding bull since last 10 years. He has deep knowledge of selecting animals based on certain criteria. He indicated that Dangi animals are sturdy and acclimatized to the local environment of this area and no other cattle breed will sustain in this area.


Mr. Dattu Karbhari Dhonnar with his Dangi animals

The major criteria for selecting the animals are looks, size, color, temperament, milk yield of the mother and other related females; he also follows the traditional methods of bull exchange or bull change to avoid inbreeding within the herd. The management practices for keeping Dangi herd is semi intensive as his animal graze on grazing land whole day and he feeds them at home with some grains, and dry and green fodder. With low input costs he is getting regular manure, a calf and milk for home consumption from a single cow.

He is one of the Dangi breed conservators under Maharashtra Gene Bank programme and around 10 to 12 calves were born from AI services since last three years. Besides the breeding services, technical guidance in animal health and fodder production are also being provided by BAIF's technical experts. Proper care of cows, newly born calves and young heifers resulted into herd of good and productive animals which are the repositories for future breed conservation. His success story was broadcast on "***Krishidarshan***" a TV program on "***Community led Dangi cattle conservation***" dated 7 December 2016.

Mr. Ashok Sakharam Bendkuli - a passionate Dangi breeder in Akole

Dangi animal rearing is traditional family business of Bendkuli family from Kokanwadi in Akole block of Ahmednagar district. Their whole family is engaged in animal rearing. At present, they have around 150 animals in their herd including cows, calves and bullock. They have passion of rearing bull calves and are participating in bull champion competition every year. He used to participate in Dangi festival at Rajur, Ghoti, and Khirvire as well as various exhibitions at Kalas, Rahuri, Nasik etc. Till date his bulls has been selected for champion award as Dangi breeding bull for nine times. The breeding bull named as 'Nandya' is one of the champion bulls they have. The management practices for keeping Dangi herd are semi intensive and they allow grazing them on grazing land. They migrate to Kokan region during water scarcity period. Special care of animals is being taken as per age and body requirement. He has formulated special feed containing black gram, soybean, rice and jaggery for breeding bull. The dry and green fodder ratio is maintained by feeding maize, Bajara, Lucerne, grasses and rice straw. On an average, annually he is getting a gross income of Rs. 4.5 lakhs from sale of calves, milk, milk products (Khoa and ghee) and manure. He is one of the Dangi breed conservators under Maharashtra Gene Bank program and benefitted from quality breeding and health services as well as technical guidance for green fodder production since the inception of the program. The better animal care has resulted into herd of good and productive animals which are the repositories for future breed conservation.

Indigenous breed keepers- savers of genes

Indigenous breeds have acclimatized in different agro-climatic zones of India. They have evolved over several generations of natural selection, domestication and are well adapted to their specific environment. Region-wise breed are often a livelihood bastion for marginal farmers and tribals. Particular community rearing specific animal breed e.g. Nanda Gaolis- Gaolao cattle, Banjara- Lalkandhari, Kanadi/Talwar – Dangi cattle, Mana tribe- Berari goat, Gond- Kathani, Golkar- Shahi Golkar buffalo, Pawara- Satpudi poultry. These breeds are sources, carriers and stewards of cultural heritage: practices, customs, knowledge, myths-beliefs, and aesthetic preferences.

Banjara with her Lalkandhari Cattle

It was observed that communities have their own criteria for selecting a preferred and suitable animal or bird for managing and getting optimum production from these resources. These criteria are based on their experience and knowledge gained over generations and their preference is based on the optimum production and performance of these animal genetic resources in their agro ecological area. For better selection and sound breeding programme these criteria and claims should be quantified and validated for better management and involvement of keepers in decision making for conservation of animal genetic resources.

Under the MGB project, six local breeds were selected and by community participation efforts they have been made to conserve these indigenous breeds.

Dangi Calf Rally- an approach for promotion of indigenous breed

In some of the villages, initially farmers were not accepting the Artificial Insemination (AI) services and natural breeding services were preferred. For awareness and promotion of AI services, exposure visit to indigenous breeding track of Dangi in Samsherpur; calf rally was organised to show the calves born through the AI. To show the best calves /progeny from the elite bulls we had conducted the 'Dangi Calves Melawa'. The objectives of Calf Melawa are as follows:

a) To make awareness of Dangi breed improvement.

b) To motivate the farmers for good animal management practices.

c) To provide information about health and other management practices

In this calf rally, three groups of male and female were made on the basis of age -- 0-3 months, 4-6 months and 6 months and above. The criteria of selection is management, health and weight gain. The details of calf (date of birth, sire name, village, farmer's name, age) were collected. Government veterinary team was involved in judge panel. Three best male and 3 best female were selected based on above set criteria. A total of 99 calves participated in the calf rally. Out of these, best 18 calves and two champions were selected. Deworming of all animals was done with the help of Government veterinary persons. One plastic feeding pan and one kilogram mineral mixture were distributed to every participant of calf rally. Two milking cans (10 liters capacity) were distributed to champion heifer owner.

This event was very much useful for awareness and learning to the livestock breeders. It also helped in motivation of farmers for adopting good management practices including AI services.

Dangi Calf rally at Akole

Migration Pattern of Dangi Cattle Owners in Akole Block

Cattle rearing is an important enterprise in dry land regions and in most semiarid agricultural systems, for the pastoralists like Dangi Cattle Owners in Akole Block of Ahmednagar District, Maharashtra. Even these days there are certain families rearing herds of 80 to 100 animals in the area of Sahyadri Mountain ranges and having major source of livelihood. For sustaining the herd strength the herd is to graze on substantial grazing land or agriculture land after cropping or forest land. Throughout the year migration is necessary for grazing and living with cattle herds. For the cattle herders the season for cattle migration is from February to October with the typical route for migration, with halting places depending on the availability of water bodies. Two persons per family, depending on the herd size, are involved in the activity. All three communities Kanadis, Mahadeo Kolis and Thakars are involved in migration activity for maintaining their herds.

The economics of migration phase is a package of so many inputs and output gained due to grazing, dung droppings, male calf, and milk products. Systems like Halting in a fallow land and getting grains from the land owners against dung as manure saves the money earned from selling of male calf or milk product like Khoa. These barter systems were evolved by maintaining the cattle herds in migratory system. Also the breed diversity and gene pool which can be sustained and integrate under natural pressure is maintained for generations.

However, migration is a risky job for the herd and the owners, as they have to pass through unknown territories. Harassment and exposure to criminal elements during passage through interior area is common threat for herders. Along with such risks

decline of common grazing lands due to encroachment and restrictions, lack of good quality fodder grasses, lack of livestock health services and quality veterinary medicines, proliferation of non-edible plant species in common lands are other issues faced by cattle owners which is now resulting in decline in this system as well as cattle population.

The migration of Dangi cattle in Akole tahsil of Ahmednagar is an age old practice that allows livestock keepers to maintain their herds. Better fodder and water availability in the migratory route is the major factor influencing the migration. The deterioration of common grazing lands has made it difficult for large herd owners to maintain the animals in their native areas round the year. Livestock keepers have their own management system which determines routes to be followed and areas to be approached for grazing. Lack of health services, quality medicines at reasonable prices are the difficulties faced by Dangi cattle keepers. The interventions of state government by making provision of mobile veterinary services and quality medicines on different migratory routes will help in reducing losses to livestock owners. Control of criminals shall provide a healthy space for livestock owners in different regions and ensure safety of people engaged in this enterprise.

Sangamneri Goat Rally- an approach for promotion of indigenous breed

Sangamneri is one of the recognised indigenous goat breed, and well adapted to agro-climatic conditions of Sangamner and Akole blocks of Ahmednagar district and adjoining areas of Pune and Nashik districts. To understand the characteristics of this goat and good management practices, goat rally was organised in project areas. The objectives of Goat rally are as follows:

a) To make awareness of Sanagmneri goat and bucks
b) To motivate the farmers to rear local Sangamneri Goat
c) To create awareness about project activities
d) To motivate the farmers for good management practices

Sangamner Goat Rally

In this goat rally two groups, one group male and one female was made for selection and judging was based on true to type breed of Sangamneri breed and well management. About 56 farmers with 170 goats have participated in this goat rally. We have provided deworming to all goats. Three male and female Sangamneri goats were selected for giving award. The best Sangamneri goat keeper's awards was given to two farmers from Hivergaon Pavsa village. Plastic feeding pans were provided to each owner who have participated in this rally and also given the information on good goat management practices. This event was very much useful for awareness and learning to the goat breeders and keepers. It also helped in motivation of farmers for adopting good management practices and importance of local Sangamneri breed. An expert committee involving local veterinary livestock development officer, MPKV scientist, BAIF livestock expert and representative from goat keepers was formed to select the best goats for award.

Dangi festival

The Dangi festival is traditionally being organized by Grampanchayat of Rajur and Adivasi Vikas Department since last 55 years and was pioneered by Mr. Madhukarrao Pichad. There are 15-20 members in organizing committee, who are actively involved in the overall event management. Initially it was limited up to Rajur but presently the animals from Akole Taluka, Nasik region and Thane district are participating in this event. It is gaining popularity throughout the Dangi Track as the required facilities are provided by the organising committee. The festival goes for three days. All the participating government departments, NGOs, and private sectors arrange their stall for giving the information of new varieties of seeds, agriculture and livestock instruments, feeds and fodder, new agricultural techniques etc. Approximately forty to fifty thousand animals from different regions are participating and there are minimum 4-5 crore Rupees turnover during this festival towards sale of animals and other inputs.

There is selection committee including Government LDO and other experts for selecting the elite bulls of Dangi of different age and high yielding Dangi cow. The best animals from different categories are awarded with a prize worth two lakh rupees along with trophy.

Bailpola festival

In Akole region, Bailpola festival is being celebrated on new moon in *Shravan* month of Hindu calendar. It is celebrated in honor of animals (bulls) as the bulls are backbone of traditional agriculture system. On this occasion farmer does not perform any agriculture work and give complete rest to bulls.

Customs of *Bailpola* festival

Farmers worship the cattle by using CHAURA (prepared by UMBER TREES), the thread of *chaura* tied to bulls behind the ear. The Bail Pola starts at 4:00 PM. Before that farmers wash and decorate the bull with different colours, tie the *bashing/Gonda*, ring of *Ghungru* in neck and horn. They use *murki, Kasra, Gopchara* (behind the ear), *rang birangi begde*, small and large shining *Gajra* and cover the animal with *jhul* (a big cloth with different colours and design). After all decoration the bulls are brought to temple with music to give respect by bowing the bulls head and offer coconut in the temple in the name of bulls. After temple *Pooja,* the bulls are brought to their homes. Farmers worship the bulls with *Pooja Thali, and Puran poli* (sweet pancake) and sweets are offered to bulls. In this way farmers celebrate the traditional *bailpola* in their respective villages. This tradition is being continued even today as a reverence to the animals which support the farmers' livelihood.

Accessories and Material for decoration of Bulls (As per local language)

Morkhi, Matwat and Gatwat (forehead), *Kasra, Goup, Chauwar* (both ears), *Shing bashing* (wool bond to decor the horn), *Begde* (prepared by paper to decor the horn), *jhul* (big cloth to cover the whole animal), *Ghungroo chain, garland of coloured flowers.*

Bio-cultural Community Protocol

Communities are keeping livestock breeds from generation to generation by learning through experience. It has been observed that communities and different tribes are responsible for maintaining as well as conserving indigenous breeds of livestock. Biocultural Community Protocols is the tool for understanding the role of these livestock breeds in the culture of local communities. It is the method to document and understand how communities are rearing livestock breeds, their way of keeping animals, managing to survive in harsh conditions, breeding goals, community's traditional knowledge etc. For exploring the knowledge of Banjaras and their Lal Kandhari cattle in Marathwada region in Maharashtra, a preliminary dialogue-cum- meeting was arranged at Banjara Tanda near Kandhar block of Nanded District. The day was for special Malegaon Yatra the second biggest of such events in India after Rajasthan's Pushkar Mela and the largest market for donkeys, cattle and horses. The dialogue with the Banjaras was a great learning experience and some of the findings are as follows:

How Lal Kandhari breed developed

Banjaras were the traditional salt, grain and cattle traders throughout India during Mughal sultanate. According to the elderly people, the Banjaras have brought the original stock which is a precursor of Lal Kandhari breed and through selective breeding they have developed it.

Breeding objectives: According to traditional breeders in the villages, this breed is useful for working in the hardy and rocky fields. Their hoofs are round in shape and very strong legs adapted to work in harsh and rocky fields. This breed is suitable and adapted in small hilly region of Marathwada. The main objective of breeding and keeping these animals is for draught purpose. Milk is the second objective only for house consumption. The cost of a pair of male calves is Rs. 60000 to 70000.

Management: This breed is under total zero input based rearing, i.e., no outside help or dependency on market for rearing them. Women in the house are the key persons who manage the herds. Natural grasses along with crop residues are used for feeding the herds. Cows are kept for reproduction and and dung manure.

Shrinking herds: It was told to us that in olden days every family was rearing 3 to 4 Khandis (One khandi= 20 animals) of animals but due to shrinking lands, and changing cropping pattern the herd size is also shrinking. In one of the the tandas visited, out of 67 families only 5 families were having a good number of herds. People are facing the problem of drought to water their animals; they have to buy water from different sources. Need to further document detailed cultural as well as livelihood aspects of Lal Kandhari breed for developing Biocultural Community Protocols of Banjaras, to help in securing their experience and traditional knowledge of rearing Lal Kandhari cattle breed for future generations.

List of staff involved in the project with their posts and one-line introduction

Sr. No.	Name	Position	Education
1	Dr. Vitthal K. Kauthale	Principle investigator	Ph. D, M.Sc.(Agri)
2	Dr. Ganesh Bidgar	JRF	M. V. Sc. (Veterinary public health and epidemiology
3	Dr. Sayed M. A. I.	JRF	M. V. Sc. (Pharmacology)

Sr. No.	Name	Position	Education
4	Dr. Shivaji Chirphare	Program Assistant	M. V. Sc. (Animal Reproduction, Gynecology and Obstetrics)
5	Mr. Sajal Kulkarni	Program Assistant	B.Sc.(Bio Tech), M.Sc. (Biodiversity)
6	Mr. Bajirao Mandlik	Program Assistant	Dairy Diploma
7	Mr. Pravin R Rajwade	Field program assistant	B. Sc. (Agri)

Field assistants for livestock development program at various locations

Sr. No.	Name of the assistant	Position / location	Education
1	Mr. Kashinath Gaddalwar	Goat technician, Aasti	LSS
2	Mr. Sunil Sadgir	AI technician, Akole	LSS
3	Mr. Shivaji Waje	AI technician, Akole	LSS
4	Mr. R. J. Kendre	AI technician, Gangakhed	LSS
5	Mr. Bhaskare Arun Ashok	AI technician, Basmat	LSS
6	Mr. Ganesh Chavan	AI technician, Kandhar	LSS
7	Mr. S. M. Paratwad	AI technician, Kandhar	LSS
8	Mr. Rajkumar Chandankhede	AI technician, Wardha	LSS
9	Mr. Sham Kamthe	AI technician, Wardha	LSS
10	Mr. Sanjay Kolhe	AI technician, Wardha	LSS
11	Mr. Gajanan Kukade	AI technician, Wardha	LSS

Result Based Management: Livestock Genetic Diversity

Outputs	Indicators	Targets (2 January 2014 to 31 March 2020)	Achievements cumulative (2 January 2014 to 31 March 2020)
Output 1: Scientific and social validation of bio-resources.	No. of bio-resources scientifically validated.	1) Milk Recording-500 cows 2) Phenotypic characterization-500 cows 3) Growth Measurement of 400 kids 4) Genomic study of Cattle and Goat 5) Socio-economic survey of breed keepers-300	1) Milk recording-617 cows 2) Phenotypic characterization-500 3) Kids growth measurement-1032 4) Blood samples- 474, Genomic study-150 5) Socio-economic surveys-1886
Output 2: Promotion of validated bio-resources	No. of bio-resources promoted	Cattle-3 breeds Goat-2 breeds Poultry-1 breed	1) Cattle Breeding Centers-12 2) Breeding bucks -29 3) Mother units-10 4) Hatchery-1
Output 3: Research papers/case studies/articles	No. of research papers/articles/ case studies	1) Research paper-2 2) Popular articles-4 3) Case studies-5	1) Research papers-5 2) Papers presented in conference-4 3) Articles/success stories-13
Output 4: Preparation of bio-resources inventory	No. of documents prepared	2 nos.	1) Bio-resource inventory-1 2) Documents on animal diversity-4
Output 5: Conservation of bio-resources in gene bank	No. of bio-resource conserved *in-situ*	Cattle-3 breeds Goat-2 breeds Poultry-1	1) *In-situ* cattle breeding center-12 2) Total artificial insemination (AI) - 10335 3) Calvings- 3255 (Male- 1729, Female-1526 4) Breeding bucks-29 5) Buck breeding services-3356 6) Goat AI-631 7) Kidding-2973 8) Poultry mother units-10

Outputs	Indicators	Targets (2 January 2014 to 31 March 2020)	Achievements cumulative (2 January 2014 to 31 March 2020)
	No. of bio-resource conserved *ex-situ*	3 cattle breeds 2 goat breed	1) Breeding bulls in collection-8 2) Semen doses produced-312638 · Dangi-152026 · Lal Kandhari-71034 · Gaolao-64332 · Sangamneri Goat-14181 · Berari goat-11065 3) Gaolao sorted semen doses-182
Output 6: Promotion of bio-resources with individual families	No. of Families involved in promotion	1000 families	1) Cattle breeding services through 12 CDC's-2439 2) Goat breeding services-480 3) Poultry mother units-10
	No. of events organized and participated	700 events	Total events-786
Output 7: Formed and strengthen village level BMC/seed saver groups	No. of groups formed and strengthened	Breed keepers group-25 nos.	Total breeders groups-61
Output 8: Collaboration with scientific institutes	No. of institutes	2 Institute	Total institutes-10
Output 9: Dissemination of knowledge	No. of extension material developed (pamphlet, posters, good practices etc.)	2 nos.	Extension material-21
	No. of good practices	2 practices	Total practices documented-4

Annexure 1

BAIF Institute for Sustainable Livelohood and Development, Pune

List of project villages under Livestock conservation in Maharashtra Gene Bank Project

Sr. NO.	District	Taluka	Villages	Village Code No.	Livestock diversity					
					Dangi cattle	Sangamneri Goat	Satpudi poultry	Berari goat	Lal Kandhari cattle	Gaolao cattle
1	Ahmednagar	Akole	Babhulwandi	557132	*					
2	Ahmednagar	Akole	Bitaka	557200	*					
3	Ahmednagar	Akole	Chandgirwadi	557198	*					
4	Ahmednagar	Akole	Devgaon	557138	*					
5	Ahmednagar	Akole	Ekdare	557199	*					
6	Ahmednagar	Akole	Jaynawadi	557201	*					
7	Ahmednagar	Akole	Khirvire	557212	*					
8	Ahmednagar	Akole	Kokanwadi	557197	*					
9	Ahmednagar	Akole	Kombhalne	557214	*					
10	Ahmednagar	Akole	Manhere	557141	*					
11	Ahmednagar	Akole	Padoshi	557203	*					
12	Ahmednagar	Akole	Pimpalgaon nakvinda	557135	*					
13	Ahmednagar	Akole	Sangavi	557204	*					
14	Ahmednagar	Akole	Shelvire	557156	*					
15	Ahmednagar	Akole	Shenit	557130	*					
16	Ahmednagar	Akole	Titavi	557155	*					
17	Ahmednagar	Sangmaner	Chincholi Gurav	557322		*				
18	Ahmednagar	Sangmaner	Deogaon	557423		*				
19	Ahmednagar	Sangmaner	Hiwargaon Pawasa	557426		*				
20	Ahmednagar	Sangmaner	Sawargaon Tal	557414		*				
21	Ahmednagar	Sangmaner	Talegaon	557324		*				
22	Ahmednagar	Sangmaner	Zole	557425		*				
23	Gadchiroli	Chamorshi	Ankhoda	539533				*		
24	Gadchiroli	Chamorshi	Ashti	539421				*		
25	Gadchiroli	Chamorshi	Chandankhedi	539331				*		
26	Gadchiroli	Chamorshi	Chaprala	539545				*		
27	Gadchiroli	Chamorshi	Illur	539340				*		
28	Gadchiroli	Chamorshi	Kadholi	539328				*		
29	Gadchiroli	Chamorshi	Kunghada	538783				*		
30	Gadchiroli	Chamorshi	Markanda	539338				*		

Sr. NO.	District	Taluka	Villages	Village Code No.	Livestock diversity					
					Dangi cattle	Sangamneri Goat	Satpudi poultry	Berari goat	Lal Kandhari cattle	Gaolao cattle
31	Gadchiroli	Chamorshi	Rampur	539267				*		
32	Gadchiroli	Chamorshi	Thakari	539341				*		
33	Nanded	Kandhar	Anandwadi	545341					*	
34	Nanded	Kandhar	Bachoti	545335					*	
35	Nanded	Kandhar	Bahadrapur	545320					*	
36	Nanded	Kandhar	Bori kh	545328					*	
37	Nanded	Kandhar	Chikhali	545370					*	
38	Nanded	Kandhar	Devichiwadi	545407					*	
39	Nanded	Kandhar	Ghanatanda	545329					*	
40	Nanded	Kandhar	Ghodaj	545325					*	
41	Nanded	Kandhar	Kalali	545406					*	
42	Nanded	Kandhar	Kalaka	545394					*	
43	Nanded	Kandhar	Khadgaon	545403					*	
44	Nanded	Kandhar	Magnali	545395					*	
45	Nanded	Kandhar	Navadewadi	545393					*	
46	Nanded	Kandhar	Panshewadi	545342					*	
47	Nanded	Kandhar	Patalganga	545340					*	
48	Nanded	Kandhar	Rahati	545383					*	
49	Nanded	Kandhar	Rui	545410					*	
50	Nanded	Kandhar	Sawargaon Nipani	545409					*	
51	Nanded	Kandhar	Sangamwadi	545330					*	
52	Nanded	Kandhar	Shekapur	545332					*	
53	Nanded	Kandhar	Shelali	545392					*	
54	Nanded	Kandhar	Shirshi bk	545397					*	
55	Nanded	Kandhar	Talyachiwadi	545331					*	
56	Nanded	Kandhar	Umbraj	545329					*	
57	Nanded	Kandhar	Varvand	545376					*	
58	Nandurbar	Akkalkuva	Belakund	525053			*			
59	Nandurbar	Akkalkuva	Bhagdari	525038			*			
60	Nandurbar	Akkalkuva	Nimbipada	525037			*			
61	Nandurbar	Dhadgaon	Bijari	525354			*			
62	Nandurbar	Dhadgaon	Borvan	525235			*			
63	Nandurbar	Dhadgaon	Chonvade Br.	525238			*			
64	Nandurbar	Dhadgaon	Harankhuri	525232			*			

Sr. NO.	District	Taluka	Villages	Village Code No.	Livestock diversity					
					Dangi cattle	Sangamneri Goat	Satpudi poultry	Berari goat	Lal Kandhari cattle	Gaolao cattle
65	Nandurbar	Dhadgaon	Kakarda	525251			*			
66	Nandurbar	Dhadgaon	Khadki	525340			*			
67	Nandurbar	Dhadgaon	Old Toranmal	525345			*			
68	Nandurbar	Dhadgaon	Pathali	525248			*			
69	Nandurbar	Dhadgaon	Shelkuvi	525311			*			
70	Nandurbar	Dhadgaon	Sirsani	525352			*			
71	Nandurbar	Dhadgaon	Zapi	525335			*			
72	Parbhani	Gangakhed	Bhendewadi	547025					*	
73	Parbhani	Gangakhed	Dhawalkewadi	547049					*	
74	Parbhani	Gangakhed	Godavari Tanda	547023					*	
75	Parbhani	Gangakhed	Ilegaon	547053					*	
76	Parbhani	Gangakhed	Kasarwadi	547022					*	
77	Parbhani	Gangakhed	Malewadi	547008					*	
78	Parbhani	Gangakhed	Maragalwadi	547047					*	
79	Parbhani	Gangakhed	Muli	546992					*	
80	Parbhani	Gangakhed	Sangalewadi	547046					*	
81	Parbhani	Gangakhed	Suralwadi	547015					*	
82	Parbhani	Gangakhed	Tokwadi	547024					*	
83	Wardha	Aarvi	Botali heti	533789						*
84	Wardha	Aarvi	Chandani	533686						*
85	Wardha	Aarvi	Chopan	533640						*
86	Wardha	Aarvi	Danapur	533643						*
87	Wardha	Aarvi	Gumgaon	533774						*
					16	6	14	10	36	5

Annexure 2

Livestock diversity conservation summary sheet.

#	Data Type	Description	Unit	No. of records
1	Livestock utility	Livestock breed utility	No. of villages	37
2	Breeder profile	Details of animal breeder	No. of breeder	36
3	Elite animals	Details of identified elite animals	No. of animals	52
4	Migration pattern	Details of migration activity	No. of herd	33
5	Milk production	Dangi, Lalkandhari and Gaolao cattle	No. of animals	150
6	Village list	Project village details	No. of villages	87

Documents published and printed under the MGB project

1) Genome savior's compendium and inventory

2) Compendium of publications(soft copy)

3) Poster-Community led conservation of indigenous livestock breeds

4) Photos of major activities

Report

7.3

Conservation Management: Non Timber Forest Produce and Habitat eco- restoration

BAIF Institute for Sustainable Livelihood and Development (BISLD)
Dr. Manibai Desai Nagar, Warje, Pune, Maharashtra
BISLD is an associate organization of BAIF development Research Foundation, Pune.

Background

Tribal communities in India face characteristic travails of poverty - lack of choice and absence of hope. Although tribals represent over 9% of the total population in the country, there are certain hilly regions where they constitute over 40-50% of the population, living on the edge of the forests collecting minor forest produce for their food security. Most of them have been compelled to migrate for their survival. A majority of the tribals having small and marginal holdings are practicing rainfed agriculture with paddy, millets and pulses, barely enough to meet the needs of the family. Severe shortage of drinking water in summer, poor access to health care, education and other basic services make the tribal communities vulnerable to disease and acute poverty.

Wadi programme for rehabilitation of the scheduled tribes has proved to be a holistic programme across the country. 'Wadi' is a Gujarati word meaning orchard, which is actually a tree-based farming system that consists of fruit trees suitable to the area or a combination of trees with forestry species. Wadi programme which ensures food security through agri-horti- forestry and better quality of life through women empowerment, community health, literacy and development of grass root level people's organizations is being expanded throughout the country with the support from the Ministry of Tribal Affairs and NABARD. BAIF is functioning as a Centre of Excellence of the Tribal Affairs Ministry of the Government of India and as the Resource Agency of NABARD to build the capabilities of the project implementation agency.

During recent times, importance is given to plantation of NTFP trees like Mahua and [um yielding plants, which are having food security and market value. Large number of Mahua trees with diverse phenotypic characters were identified in the MGB project area. Large number of Mahua grafts were produced and planted in the agriculture fields by adopting the Wadi concept. Efforts were taken to domesticate the NTFP trees like Mahua by planting over 5000 grafts of desired trees as food and livelihood security of the tribal community.

Journey with MGBP

Work was undertaken in nine clusters covering 44 villages across Maharashtra.

NTFP Program Approach

- Participatory *in-situ* and *ex-situ* conservation of important NTFP species
- Promoting sustainable harvesting of NTFP species by adopting non-destructive harvesting methods
- Identification of candidate trees and standardizing nursery techniques for mass multiplication
- Plantation of important NTFP species on community and private lands
- Post-harvest management of NTFP

Focused NTFP Species

Prioritization of NTFPs plants was based on initial surveys through Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD) and people's preference. Food, household use, fodder, medicinal use, fruits, availability, yield and market were the criteria used for prioritization of NTFP species.

Following region-wise important NTFP species were shortlisted based on people's preference:

1. Mahua (*Madhuca longifolia*)
2. Charuli (*Buchanania lanzan)*
3. Karaya (*Sterculia urens*)
4. Hirda (*Terminalia chebula*)
5. Behada (*Terminalia bellirica*)
6. Bamboo (*Dendrocalamus strictus*)
7. *Bauhinia* spp.

NTFP program coverage

Clusters	Districts	No of Villages	Focused species for conservation
Jawhar & Vikramgad	Palghar	12	Mahua, Hirda, Behada, Karaya, Bamboo, Bauhinia spp
Dhadagaon & Akkalkua	Nadurbar	14	Mahua, Hirda, Behada, Karaya, Charuli, Bamboo, Bauhinia spp
Etapalli & Bhamragad	Gadchiroli	18	Mahua, Hirda, Behada, Charuli, Karaya, Bamboo, Bauhinia spp
Total		**44**	

Detailed list is given at Annexure 1.

Agro-climatic zones of Maharashtra

Community profile in NTFP program area

The main tribal community in the project area is *Pawra* at Dhadagaon. They are mainly depending on natural resource like forest and traditional agriculture practice. The livelihood of the community mainly depends on collection of NTFP produce such as Mahua flowers and seeds, Charuli seeds, natural gum harvesting and bamboo cultivation etc.

Madia and Gond are the tribal community in Gadchiroli district, where their livelihood is mainly depending on forest resources like *Tendu patta*, Mahua, Charuli, other forest produce and agriculture. Harvesting of *Tendu patta* is their main occupation and it is abundantly available in the forest. The local venders are main players for buying the leaves.

Warli is a tribal community in Jawhar mainly involved in collection of NTFP's like Mahua and gum.

Key issues addressed

i. Depletion in number of NTFP plants due to over-exploitation and deforestation

ii. Availability of limited resource, uneven quality produce, uncertainty of collection of required quantity of NTFP's

iii. High collection cost due to inefficient NTFP harvesting methods which results in gathering of minimum produce

iv. Absence of established market system which will give satisfactory/ maximum returns to NTFP collectors

v. Degradation of forest habitats, natural ecosystem, erosion of soil top layer, lowering of ground water table

vi. Issues of natural regeneration of worthy and economically important forest species

vii. Lack of awareness for plantation of elite NTFP trees species

Objectives

i. Participatory *in-situ* and *ex-situ* conservation of important NTFP species

ii. Promoting sustainable harvesting of NTFP species by adopting non-destructive harvesting methods

iii. Identification of candidate trees and standardizing the nursery techniques for mass multiplication of NTFP species.

iv. Plantation and domestication of important NTFP species on community and private lands.

v. Post-harvesting processing of NTFP

Details of information collection and sampling methods used

During the beginning of the project, Participatory Rural Appraisal (PRA's) and Focus Group Discussions (FGD's) were organized in different villages to explore NTFP diversity. Based on the PRA and FGD reports, villages were selected across the three agro-climatic regions in Maharashtra. Meetings of the NTFP collectors in selected villages were conducted to understand the existing situation, available NTFP species and future scope in promotion and sustainable utilization of NTFP's. Food, household use, fodder, medicinal use, fruits, availability, yield and market were the criteria used for prioritization of NTFP species.

Sampling method for identification of candidate trees was based on people's perception. Experienced farmers were involved in selection of candidate trees. Information on specific traits like phenology, yield, nutritional aspects, religious values about the candidate trees were documented and efforts were taken to validate the same through laboratory studies. Village-wise NTFP groups were formed for creating awareness, training and capacity building in nursery raising, harvesting, value addition, grading and marketing of NTFP's. The NTFP nurseries were grown at farmer's fields across three clusters for further plantation. Plantation program of NTFP species was undertaken on private and common land, as well as selected habitat sites, with active participation of community.

The methodology adopted for implementation of NTFP activity is as per below.

Habitat eco-restoration is another activity undertaken at four sites in two clusters. Among the selected sites, three are community lands that received title under CFR, while one site is private land. Efforts were made to create awareness among villagers about role and importance of healthy forest. After few interactions, villagers agreed to undertake activities like soil water conservations (CCT, CPT, live fencing, stone bund), protection, nursery raising, plantation of local tree species and social fencing for grazing and tree cutting. '*Samuhik Van Hakk Vyavasthapan Samitee*' was formed for monitoring, protection and coordination of restoration activities. This committee set their rules and regulations and even penalize people who are not abiding by these rules. Ecological impact of restoration activities was periodically monitored through survey of flora, birds and insects.

Major work done under MGBP

Major achievements of the NTFP activities at Jawhar, Dhadagaon and Etapalli clusters are as follows:

i. Seven NTFP species were prioritized based on the community preference, conservation perspective and market value.

ii. Individual households survey of 1470 families involved in NTFP collection processing and marketing

iii. Documented availability of produce, local harvesting methods, processing and marketing of NTFP's

iv. 158 candidate trees of Mahua, Charuli, Karaya, Hirda and Behada were identified based on people's perception

v. Laboratory studies of 212 seed and flower samples of Mahua candidate trees for sugar, nutrient and oil content; molecular studies of 48 candidate trees was completed.

vi. 4.70 lakhs seedlings of NTFP species were raised in nurseries at Dadgaon, Jawhar and Etapalli clusters by involving seven entrepreneurs.

vii. Plantation of 4.13 lakhs NTFP plants was undertaken as an effort towards *in-situ* conservation

viii. Standardized and promoted grafting in Mahua.

ix. 12 NTFP groups were formed and market linkage was developed between groups and vendors for Mahua flower at Dhadagaon cluster.

x. Promotion of Bauhinia species as a vegetable on farm bunds and in kitchen gardens; Plantation of 1329 seedlings was undertaken.

xi. Plantation of 114 plants of 38 candidate trees was carried out at BAIF, Wagholi campus. NTFP arboretum of Mahua, Karaya, Hirda and Behada (150 no) was established on 0.40 ha at BAIF Urulikanchan campus as e*x-situ* conservation of NTFP species.

xii. Organized 34 trainings to 1441 participants on value addition, nursery raising, collection and storage of NTFP produce.

xiii. Seeds of 84 selected candidate trees of Mahua, Behada, Hirda, Karaya and Charuli were conserved in gene bank.

xiv. Efforts were taken for collection and collective group marketing of Mahua flowers at Dhadgaon and Etapalli clusters; 15.5 MT of Mahua flowers and 1.5 MT Charuli seed were marketed.

xv. 46.5 ha area selected for habitat conservation work in Konkanpada (6.5 ha) in Jawhar and Harankhuri (15 ha), Belakund (15 ha) and Chinchora (10 ha) in Dhadgaon

xvi. Soil and water conservation measures like cattle protection trench (359.39 m^3), continuous contour trenches (2694 m running length) and stone bunds (58.5 m) were undertaken

xvii. Plantation of various forestry and NTFP species at all 4 sites (seedlings- 1,02,740; seeds-194 kg; and stumps -1.11 lakhs) in habitat site.

xviii. Biological diversity was documented for plants (396 species), insects (92 species) and birds (42 species) in habitat sites.

xix. Documentation: Research papers (4), articles/case studies (10) and extension material (11).

Database

The updated data incorporated in Relational Data Base Management System (RDBMS) for further uploading on MGB web portal.

Quantitative impact of the work

Brief report on quantitative achievements are given in Result Based Management (RBM) framework.

Qualitative impact of the work

The project activities like nursery raising, grafting, and harvesting methods in Mahua flowers have helped in bringing qualitative impact on availability of good quality planting material and grafts of NTFP's and clean Mahua flower collection. The awareness and trainings of community in value addition in Mahua, gum harvesting, nursery raising and selection of candidate trees has created knowledge gain and it has reflected in development of quality products.

Conservation of selected NTFP species

In-depth survey of NTFP collectors: At the time of village meetings, families involved in collection of NTFP's were identified. In-depth survey of these families with a specially designed questionnaire was carried out to understand socio- economic status and contribution of NTFP in their total income.

Selection of candidate trees: During the discussions with the community, it was informed that within the selected NTFP species, there are trees having specific traits, and community has shown interest for conservation and promotion of those trees. The special characters like size of the flower, colour, taste, time of flower dropping, seed oil content, moisture in flower, protein content in Mahua were observed. Similarly, in other species also certain characters were preferred by the community. Based on these traits, candidate trees were identified with the help of local community. The community claims were scientifically validated through

NTFP collectors' meeting

laboratory studies. Molecular studies in Mahua candidate trees were carried out to estimate genetic diversity. Multiplication program of selected candidate trees was carried out in field level nurseries through seedlings, stem cuttings and grafts, for further plantation programme.

Community mobilization and promotional activities

Community level events like awareness meeting, training and capacity building, exhibitions were organized. Promotional activities like Mahua mela, Mahua recipe, value addition, collective marketing, plantation of NTFP species were undertaken. NTFP collectors' groups were formed across the selected villages to bring like of minded persons on common platform to share and discuss conservation aspects of focused NTFP's and habitat restoration.

Documentation

Documentation on traditional storage systems, method of local classification of Mahua trees, and case study/ success story was undertaken.

Community participation in MGBP process

The village level programmes have enabled active involvement of local community in conservation of natural resources.

Role of tradition and culture in conservation

i) Traditional cultures boost the conservation: Cultural diversity in Satpuda regions is closely related to biodiversity. There is a symbiotic relationship between trees and cultures, ecosystems and cultural identity. Religious rules and rituals often strengthen this relationship and are characterized by conservation ethics. *Madia Gond* tribal community at Etapalli in Gadchiroli district has a special traditional event; forest is considered as a deity of the village, in which the Mahua trees are considered as God of individual family. In initial dropping of Mahua flower, the tribal community will not collect the flower abruptly until the ceremony of *Bhiman Marmi* Pooja in village. As part of nature's contribution, the initial flowers are allowed to fall on the ground and they serve as food to birds and wild animals. For such important trees, simply no one will take decision to cut the tree unless there is strong inevitable reason.

Community level event

ii) Mahua trees for prediction of rain fall: In Satpuda range, the natural resources are still intact and maintained by the tribal communities. Their living style is quite natural and the science behind their living is quite dependent on change in the nature. There is one tree at Mandvi village of Dadagaon taluka of Nadurbar district, which exhibits a special phenotypic character in the months of May and June. The prediction of rainfall


Rain prediction Mahua tree

is depending on the change of leaf color from green to pale yellow. Leaf yellowness indicates low rainfall during the year. The farmers depend on this particular tree for their agricultural operations like selection of crops, sowing period and management practices etc. Farmers from 30-40 villages nearby this tree eagerly observe during end of summer.

iii) Mahua is symbol of pride and dignity: In tribal community of Satpuda region, the dignity or richness of the family depend on number of trees grown in his farm. The increased number of trees indicates the symbol of pride and status of family in villages. Even for establishing the marital relations, the number trees is considered as wealth.


Mahua trees

iv) Traditional knowledge on Mahua flowers

Mahua *(Madhuca latifolia*) belongs to Sapotaceae family. It is indigenous to India and found throughout the subtropical region. It holds a special position for tribal people in India. It serves as a prime NTFP and not only as a means of livelihood to them but a tradition in vogue since centuries. Tribal people have great importance to Mahua from both the economic and religious point of view. Mahua fruit is eaten as a vegetable while oil from the seeds is used for cooking and lighting lamps. Mahua flowers are also edible and used in various preparations. Mahua flower drink is part of tribal cultural heritage and an essential drink for them during celebrations. Briefly, we can say that each and every part is useful and that's why it is referred as '*Kalpvriksha*'. By considering the importance of Mahua, trees are being locally classified depending on their flower shedding time, flower size, flower moisture and six types have been identified.

1. *Gulli movali*: This type of plant has flowers that are sweeter and have high moisture. Flower drops down during early morning. Wild animals like monkeys, bear and birds visits more frequently for flowers. It bears maximum fruits.

2. *Ratgol moval*: These plants sheds flower during night hours and they are more fragrant. These flowers are mostly preferred by bears.

3. *Dundal movala:* These trees shed flowers during early morning (5-9 am). These trees possess large size flowers even after drying. These plants give higher flower yield.

4. *Sikatyal muvali:* This type of trees shed flowers during day hours. The process of flower dropping is very slow; even some flowers do not drop from the inflorescence. These types of trees have more latex as compared to others.

5. *Sidani muvali*: It has comparatively smaller flowers. This type of trees shed flowers from late evening hours to late morning. Due to smaller size of flower, collection becomes tedious job as well as yield potential is quite less than other types.

6. *Fatal muvali*: Flowers of this type have more nectar and moisture content. Fruit setting is also more than other types.

Community role in designing or reshaping the work

i) Identifying best candidate trees: Community has played a major role in prioritization of NTFP trees based on their need such as food, fodder, household use, medicinal use, fruits, yield and market. The important five NTFP species namely Mahua, Charuli, Karaya, Behada, Hirda were prioritized based on perception of each individual. The village level focus group discussions of experienced farmers were held to identify the best candidate trees. The special phenotypic characters in Mahua like size of the flower, colour, taste, time of flower dropping, seed oil content, fresh moisture in flower, protein content etc. were observed in Mahua tree. Similarly, in Charuli, Hirda and Behada the thickness of seed rind, yield and time of flowering are major characters, which are required by the community. The trees of Karaya were identified based on desired characteristics like high gum yield, transparent colour and pleasant smell of gum.

ii) Mass multiplication of selected candidate trees: Seeds of selected Mahua, Charuli, Karaya, Behada and Hirda were collected and grown in nursery in large number for plantation in the field. The main purpose of growing these seedlings from selected candidate trees is

Meeting villagers

Community participation in preparation of Cattle protection trench (CPT)

Live fencing

to supply the required plants to farmers in the project area which are having desired characters like high flower and oil yield, sweeter flower, early morning flower dropping, two time flowering, protein rich fruit and flower etc. To achieve this objective, few village entrepreneurs were selected to undertake nursery raising activity and they were initially supported with infrastructural facilities required for nursery preparation. Lakhs of seedlings were made available for plantation on private and common land.

Mr. Ramu Mahadu Gavate- a NTFP entrepreneur

Mr. Ramu Mahadu Gavate, popularly known as Ramudada, is from the village Ruichapada in Jawhar block of District Palghar. Few years ago, he used to practice traditional agriculture. Due to remote place and very poor resources, he faced the financial crisis. In year 2015, he got associated with MGB project and participated in growing nursery of NTFP species and still continues the nursery raising.

He learned technique of low budget nursery and grafting techniques in Mahua. Now he is an expert in grafting and is training other farmers. During current year, over 24,000 seedlings of NTFP species (Mahua, hirda, behda, bamboo etc.) and around 550 Mahua grafts were propagated at his nursery site. These plants were distributed to villagers and were also used for plantation under habitat conservation programme. He has earned good amount of money through nursery activity. Scientists, farmers and students who come to see on-going work of MGB project make sure to visit his NTFP nursery too. He has become important resource person for NTFP related activities. Besides financial gain, Ramudada feels proud as contributor in biodiversity conservation. He also participates in habitat conservation programme of MGBP and enthusiastically participates in any event conducted for biodiversity conservation in neighboring village Kokanpada.

iii) Production of True to Type planting materials: Efforts were taken to develop techniques of soft wood grafting in Mahua and Charuli, to reduce the gestation

Grafting in Mahua

period. Over 6000 grafts of Mahua candidate trees and 300 of Charuli were prepared and are ready for planting in the field. The grafting techniques could help in early bearing of flowers and fruits, which will be useful to generate income from 6-7 years after plantation in the field.

iv) Community participation in plantation and conservation: Plantation of over 1.02 lakh seedlings of NTFP and other local forest species were undertaken in community land at Dadagaon and Jawhar regions. The soil and water conservation measures like cattle protection trench, continuous contour trenches, stone bunds and plantation of various forestry and NTFP species was undertaken at four habitat sites with active participation of the community.

For habitat eco-restoration, four sites in two clusters namely Jawhar and Dhadgaon, were selected. These sites were degraded grassland characterized by low vegetation cover, drained out top soil and excess grazing, and were owned by community.

Initial meetings along with villagers and like-minded organization were organized. Efforts have been taken to create awareness and interest among villagers about role and importance of healthy ecosystem. After few interactions, villagers agreed to undertake activities like soil water conservation, protection, plantation and social fencing to avoid grazing and tree cutting. Next activity plan was drawn based on initial survey and community interactions. That plan included activities like Continuous Contour Trench (CCT), Cattle

Protection Trench (CPT), stone bunds, live fencing, plantation of indigenous trees and ecological surveys. Along with these activities, from time to time, awareness campaigns like *Vanparikrama*, exposure visits and events for school student were organized. During last five years 80,973 seedlings, 180 Kg seeds and 1.11 lakh stumps were planted and 60 % survival was observed in the field. The soil water conservation measures like CCT's of 24.50 m running length, CPT of 359.39 m^3 and stone bund of 58.5 m length were undertaken. Biological survey resulted in documentation of 396, 42 and 92 species of plants, birds and insects, respectively. Simultaneously, efforts were made to prepare a biodiversity inventory of village. A striking feature of undertaken program is the active involvement of villagers of all age groups.

v) Capacity building of women in project areas: The capacity building of women in the villages is every important in collection of forest produce, value addition, product development and nondestructive harvesting. The village level activities like excursions, training and exhibitions were organized as an effort to strengthen the knowledge of the women.

Training on Mahua recipe

The villagers are having long traditions of preparing different local made food items of Mahua flowers for their own consumption. Mostly these are made with locally available ingredients. To strengthen this activity, twelve Mahua value addition trainings were organized at project villages to bring diversity in products as well as nutritionally rich quality food. More than 94 women were trained about Mahua flower value addition at Dadagaon, Jawhar and Etappali clusters. Following nutritionally rich good quality products were prepared.

Mohua Ladu Mahua Koshimbir Mahua Halwa Mahua Khir

Mahua-Bhakari Mahua Bhaji Mahua Saar

vi) Sustainable harvesting practices

a. Scientific method of gum harvesting: Sustainable harvesting of Non-Timber Forest Produce was one of major activity in the project. Destructive harvesting of gum is the general practice of community at local level. Traditionally, many cuts are given to the bark by axe, and the gum oozing out is collected. Quality of gum collected is not clean and does not fetch good market rates. In fact, many gum yielding tree species are in endangered stage in natural habitat due to destructive harvesting. Mainly *Sterculia urens* (Karaya), *and Acacia* sp. are destructively harvested by removing the bark of the tree. There by, the hindered growth and wilting of tree is quite commonly seen in natural habitat.

Traditional destructive gum harvesting

In view of this, scientific method of gum harvesting was adopted such as injecting *Ethaphon solution,* without damaging the tree. Training on scientific gum harvesting was given to 753 gum collectors in the project area. The per tree collection of gum from Karaya tree by traditional method is very minimum (100-200g) and through adopting the scientific method it was increased up to 400-600g per tree. All the 753 participants were actively involved in production of gum at field level.

Scientific gum harvesting method

b. Traditional Mahua harvesting and drying methods.

Normally, the Mahua flowers are collected from open surface under the trees. Because of this, the fresh flowers get contaminated with the mud and other unwanted materials and it loses its market value. The freshly collected clean flowers are sold in the market for higher price. In view of this, tarpaulin sheets were given to project participants to collect flowers and maintain hygiene. Total of 270 storage bags and 300 tarpaulin sheets were given to participants for collection of Mahua flowers and drying of NTFP produce. This has helped a lot to save the manpower and to collect the clean flowers. Consequently, the awareness about collection and storage of forest produce was created among the selected farmers.

vii) Formation of NTFP groups for entrepreneur model: NTFP groups have been formed and were promoted in the project area to bring them on common platform and provide technical and financial support for sustainable utilization of NTFP's. Training and awareness programs were regularly organized. NTFP groups at Dhadgaon in Nadurbar District have been motivated for sustainable harvesting of forest produce. Market linkage was established between collectors and buyers. During the year 2017-20, about 11.5 MT of Mahua flowers were collected and sold at the rate of Rs. 30-35 per kg., with a profit margin of Rs. 25 per kg. This entrepreneurship activity has boosted the livelihood of tribal community and has set a model / example of collective marketing for more profit.

viii) Restoration of forest species in communities managed common resources:

a. Plantation programme: Common resources like forest and community land are well managed by local communities in the area where project activities are undertaken. Through project interventions, effort was made to retrieve the natural habitat by giving protection and plantation of local plants species. During project period, 4.13 lakhs plants were planted at Jawhar and Dhadagaon clusters of Palghar, and Nandurbar District. Plantation was done through people's participation, by organizing various plantation programmes such as *Vanamothsva Karyakrama*, Local festival, youth's movement and village campaign.

b. *Beeja mohim* for seed collection: The Beeja mohim is a locally motivated mass people's programme, where peoples travel from one village forest to another in search of seeds of forest species during the month of March-April. During Beeja Mohim, quintals of seeds of various species are being collected and made ready for direct seed sowing in forest land during pre-monsoon season.

Benefits to the community

i) Benefits during project period

- Increased plant population due to plantation programme undertaken during project period. (4.13 lakh seedlings were planted with a survival rate of 60-70 %)
- Enhanced livelihood through entrepreneur development through nursery raising and marketing of NTFP produce.
- Increased awareness about value addition of Mahua. Trainings on Mahua value addition were organized for women. Exhibitions of traditional as well as newly introduced food items were organized at village level to develop awareness.
- Mass multiplication of selected candidate trees and plantation in their own field- Plantations were undertaken on community and private land, including plantation on 19 individual farmers' fields covering 15-acre area as a NTFP wadi.
- Increased the production of gum through adoption of scientific method of harvesting.
- Increased species diversity, access to green biomass in selected habitat sites

ii) Benefits to the community continue even after the project:

- Collective marketing will help in access to market and fetching better price to the NTFP's. Members of NTFP group are engaged in collection of Mahua flowers. They are collected at one place and stored till it gets better market price.
- Entrepreneurs developed through project support will continue growing nursery of selected candidate trees as an income source. At least two nursery entrepreneurs are active at each of the three clusters.
- Increased scope for marketing of value added Mahua products. Different value added products are promoted through NTFP groups and market access have been created.
- Plantation of NTFP's on private and common land has potential for additional income.
- Improved ecosystem due to eco-restoration measures at selected habitat sites. Soil and water conservation

measures and plantation undertaken during the project period has resulted in increased plant density, which has created microclimate to accommodate all types of fauna in the ecosystem.

iii) People's preference for livelihood species

Due to over-exploitation, species diversity is reducing day by day and thereby the availability of minor forest produce is also decreasing in forests. The species which are having food and economic values are only maintained by people and survived in farm bunds, such as Mahua *(Madhuca indica),* Charuli *(Buchnania lanzan),* Karaya*, (Sterculia urens),* Hirda *(Terminalia chebula),* Behada *(Terminalia bellarica)* and Bamboo etc. The effort has been made to conserve these species which are having livelihood and food security importance.

List of Publications and presentations at conferences

Research papers published: (4)

- Sadashiv D. Nimbalkar, Deepak S. Patil, Vitthal K. Kauthale. Effect of Seed Treatment Methods on Germination and Seed Vigor of *Buchnania lanzan* Spreng, Charoli, *Trends in Biosciences (*2017) Vol. 10 (27): 5729-5732.
- S.D. Nimbalkar, S.S. Jade, V.K. Kauthale, S. Agale and R.A. Bahulika. Genetic diversity in the candidate trees of *Madhuca indica J.F. Gmel.* (Mahua) revealed by inter-simple sequence repeats (ISSRs), *3 Biotech* (2018) 8:143.
- Nimbalkar S.D., S.J. Agale, V.K. Kauthale, K. Kumbre. *Madhuca indica* (Mahua) Tree Serve as a Food and Livelihood Security of Tribal Communities in Palghar, Nadurbar and Gadchiroli District of Maharashtra, *Trends in Biosciences* 12(6), 2019.
- S.D. Nimbalkar, L.N. Chavan S.J. Agale and V.K. Kauthale. *Madhuca indica* J.F Gmel. (Mahua). Candidate Tree Selection Based on the Perception of Tribal Community and Scientific Validation, accepted for publication in Environment Conservation Journal.

Research papers presented in conferences

- Sadashiv Nimbalkar, Lilesh Chavan, Santosh Agale and Vitthal Kauthale. 2016. *Madhuca indica* J.F Gmel. (Mahua) Candidate Tree Selection Based on the Perception of Tribal Community and Scientific Validation, paper presented in 1st International Agrobiodiversity Congress, Nov. 6-9, 2016, New Delhi.
- S.D. Nimbalkar, S.S. Jade, S. Agale, R.A. Bhahulikar and V.K. Kauthale.Mapping the genetic diversity in *Madhuca indica* J.F. gmel. (Mahua) through community perception and scientific approach, Paper presented at National Conference on Tree improvement, Bangalore (2017)

Networking with other MGBP groups

- A training was organized to other groups of MGB in methodology for selection of candidate trees and training on nursery raising, grafting and marketing at Dhadgaon in Nandurbar district during February 2018.
- Technical facilitation in identification of plant species- the other MGB partners (Lokparyay, Aurangabad, Vasudha, Dhule, Samvedana, Karanjelad, Lokpanchayat, Akole) were facilitated by BAIF expert.
- Developing the RBM framework.

Outreach Connection with people beyond beneficiaries

- The people participating in community awareness programme, Mahua mela, recipe competitions and exhibitions were connected with the conservation programme during the project period.
- People participating in plantation programmes undertaken on community land get connected with the habitat eco-restoration program.

Policy level interventions / recommendations

Research Dimensions

- NTFPs are very important considering community's dependence on this resource for meeting various social- ecological, cultural and eco system service related needs. Hence, even in forestry research, there is need to have special thrust on this along with timber species.
- While selecting NTFP species for conservation and multiplication, equal weightage to be given to local people's preferences as, local communities value trees not only for economic purpose but also for ecological, social, and cultural uses.
- The project has evolved and introduced a methodology of identification of candidate plus tree which is an important and preliminary step in tree improvement programme of a particular species. Selection of NTFPs candidate trees should be based on locals needs, social, spiritual and economic importance for the local peoples of respective regions. This will augment the community to participate in large numbers for conservation though sustainable harvesting and with its economic benefits at local level.
- There is tremendous scope to mainstream efforts of community led forestry programs. For generations,

communities have conserved trees and habitats in the name of God or as a part of community practice / tradition.

- There is need to introduce science and technology tools for scientific harvesting of NTFP resource. This will help balancing economic well-being with eco-system wellbeing.
- Need of direct role of local bodies in marketing system: The market of NTFP is extremely imperfect and unstructured. At present, forest dwellers at project area collect NTFPs and sell it to local traders, who in turn sell it to the urban center and finally reach to consumers. The distribution channel from forest collector to urban wholesaler consists of 3-5 middle men. It was found that bulk of the work, right from gathering the NTFPs from the forests to the first level of processing them at homes, is done by women. Presently, they collect NTFPs (Gums, Mahua, Charuli, Hirda, Behada etc.) for sale or barter simply because of lack of alternative employment opportunities. Hence, it is important to develop a strong value chain from collector to directly processor or end user to get direct benefit through developing institutional level of support like Community based organizations / body of Grampanchayat etc. The state and national policy should support such local bodies to play direct role in marketing of NTFPs with due approval of Forest department.
- NTFP nursery entrepreneurs: Good quality of seedlings and grafts of NTFP species were produced by local entrepreneurs, after being given initial support and training. Similarly, many such entrepreneurs could be encouraged with support from forest department to cater to the requirement of huge quantity of seedlings in plantation programs at village level.
- Value addition in NTFP's: Local community has traditional knowledge in value addition of some of the NTFP's like Mahua flowers. Various products are being prepared and utilized for their own consumptions. However, there is tremendous scope to develop many such value added products for further market linkage and commercialization so that community could get attractive remuneration. This activity needs to be strengthened through linkage with various govt. schemes. Local self-help groups (SHG) may be encouraged for NTFP value added product entrepreneurship and incorporation of local value added NTFP products in school mid-day meal scheme.
- Implementation of livelihood based forestry plantation on lands claimed under FRA /CFR land could help in sustainable use and conservation of forest resources. Convergence of govt. schemes like MGNREGA may be linked for eco-restoration of private and CFR land.

National/ international outreach

- Govt. Forest department at Nandurbar, Palghar and Gadchiroli-Provided seedlings for plantation
- CSV, Wardha – Training in scientific gum tapping to project staff
- KVK, Allapalli – Resource person for training to participants
- QUEST Foundation, Wada, Palghar – training to foundation members in preparation of NTFP food items (recipes)

Knowledge Outcomes

The relation with traditional knowledge and nature is precisely defined by the community. Some of the stories/ case studies involving traditional knowledge of the community were collected from the project area They are.

i. Prediction of rainfall based on the change of Mahua leaf color. This tree indicates the occurrence of rainfall during monsoon. The prediction of rainfall is depending on the change in color of the leaves from green to pale yellow. Leaf yellowness indicates low rainfall in that particular direction during the year. The agricultural operation are mainly based on this tree appearance.

ii. Traditional method of Mahua flower collection and storage.

iii. Mahua tree is backbone for livelihood of the tribal community.

iv. Importance of Mahua flower as nutritional diet for poor families.

v. Karaya as alternate income for livelihood development.

vi. Traditional recipes (e.g. *Dink ladu*) prepared from Karaya gum

Database generated

Various field level studies were conducted across selected villages during the project period and sufficient data generated. The data were tabulated, analyzed and outcomes are depicted below.

Mahua candidate tree selection based on the perception of tribal community and its scientific validation

Madhuca indica commonly known as Mahua belongs to family Sapotaceae. Mahua is believed to be backbone for livelihood and cultural prospective of tribal community. The variation within the species with respect to various parameters related to flowering and seeding recognized by tribal communities were included in the study for identification of candidate trees. A study was undertaken

in three agro-climatic zones of Maharashtra. Through people's participation, 58 Mahua candidate trees were selected and scientifically validated. The study revealed that highly significant differences were observed in flower dropping days (29.71±0.10), fresh flower yield (342.43± 24.30), flower dry matter (94.93±0.20), seed oil (39.69±2.14) and dry matter in seeds (94.80±0.21) at Dhadgaon over Etapalli and Jawhar clusters. The maximum mean value with respect to flower sugar (22.94±0.7), Zn (4.42± 0.2) was significant at Etapalli cluster over Jawhar and Dhadgaon. The maximum mean value of crude protein (5.33±0.2%) at Jawhar cluster and 'Fe' content in flower (81.48± 13.0) at Etapalli was recorded. From one of selected candidate trees, the maximum potential of seed oil (50.47%) at Dhadgaon and sugar content (32%) at Etapalli cluster was recorded *(Environment Conservation Journal* 19 (1&2) 161-165, 2018).

Table 1: Tree growth and flower parameter in *Madhuca indica*

Place	Particular	Plant height (m)	Canopy (m)	Girth (cm)	Flower dropping days	Flower yield (Kg)	Flower dry matter (%)	Flower crude protein (%)	Sugar (%)
Dhadagoan	Mean	23.14± 1.6	31.93 ± 1.0	357.14± 16.4	29.71 ± 0.1	342.43± 24.3	94.93± 0.2	4.34 ± 0.1	19.29 ± 1.0
	Min	16.0	23.0	226.0	29.0	197.0	93.0	3.50	13.0
	Max	35.0	36.0	430.0	30.0	504.0	96.0	5.37	27.0
	N	14	14	14	14	14	14	14	14
Ettapalli	Mean	23.97± 0.6	30.03± 0.8	323.16 ±10.3	22.16 ± 0.3	191.55± 4.9	92.00± 0.2	5.14 ±0.2	22.94±0.7
	Min	17.0	21.0	213.0	19.0	134.0	88.0	3.73	17.0
	Max	32.0	38.0	427.0	25.0	265.0	95.0	7.0	32.0
	N	31	31	31	31	31	31	31	31
Jawhar	Mean	22.15±1.2	29.92±1.4	320.23±17.2	21.62±0.6	252.54±10.4	93.23±0.3	5.33±0.2	17.77±0.7
	Min	16.0	22.0	244.0	19.0	180.0	91.0	4.01	14.0
	Max	30.0	38.0	442.0	24.0	293.0	95.0	6.10	23.0
	N	13	13	13	13	13	13	13	13
Over all	Mean	23.36±0.6	30.47±0.6	330.71±7.9	23.86±0.5	241.64±10.6	92.98±0.2	4.99±0.1	20.90±0.5
	Min	16.0	21.0	213.0	19.0	134.0	88.0	3.50	13.0
	Max	35.0	38.0	442.0	30.0	504.0	96.0	7.0	32.0
	N	58	58	58	58	58	58	58	58
R^2		**0.0291**	**0.0332**	**0.0625**	**0.8006**	**0.6008**	**0.4479**	**0.1829**	**0.2949**
"p" value		**NS**	**NS**	**NS**	**0.0001****	**0.0001****	**0.0001****	**0.0039***	**0.0001****

Significant at level of p< 0.05=*, Highly significant at level of p<0.01=**, # Brix reading. S=Non significant

Table 2: Mineral Composition in flower (mg/100g) and Seed oil (%), Seed dry mater (%) of *Madhuca indica*

Place	Particular	Cu	Fe	Zn	Mn	Seed oil (EE)	Seed dry matter
Dhadagoan	Mean	27.77±15.0	81.48±13.0	3.10±0.1	5.66±0.4	39.67±2.1	94.80±0.2
	Min	5.65	41.26	2.90	4.20	24.04	92.86
	Max	86.96	114.40	3.50	6.60	50.47	96.41
Ettapalli	Mean	36.33±7.2	42.74±8.0	4.42±0.2	6.09±0.6	31.87±1.1	81.34±3.0
	Min	4.77	23.76	3.20	1.30	19.54	45.34
	Max	98.47	116.60	5.40	10.0	45.95	95.23
Jawhar	Mean	31.30±12.2	55.40±9.4	3.27±0.1	6.08±0.2	34.13±1.3	93.88±0.4
	Min	6.31	32.90	3.10	5.40	26.88	90.86
	Max	63.69	77.17	3.50	6.50	42.47	96.16
Over all	Mean	33.47±5.6	53.84±6.6	3.91±0.2	5.99±0.3	34.26±0.9	87.40±1.9
	Min	4.77	23.76	2.90	1.30	19.54	45.34
	Max	98.47	116.60	5.40	10.0	50.47	96.41
	N	22	22	22	22	58	58
R2		0.0196	0.2712	0.6345	0.0130	0.2000	0.2969
"p" value		NS	0.049*	0.0001**	NS	0.0022**	0.0012**

Significant at level of p< 0.05 = *, Highly significant at level of p<0.01= **

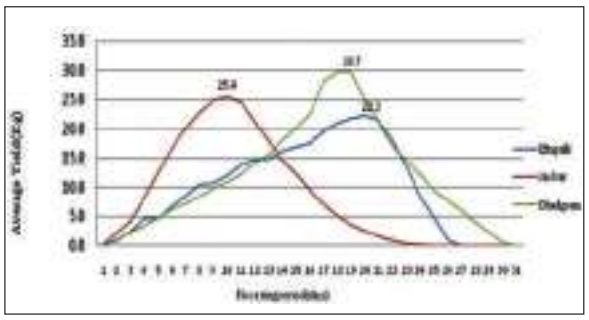


Fig 1: The day wise flower dropping period at three agro climatic zones

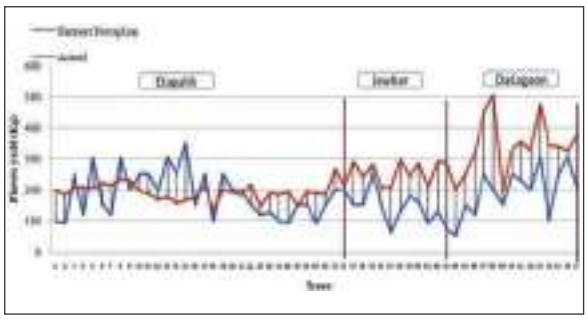


Fig 2: *Madhuca indica* flower yield (Farmers perception Vs Actual measurement)

Seed Treatment Methods for Enhancement of Germination and Seed Vigor in Charoli

Charoli (*Buchnania lanzan* Spreng) is one of the most important Non Timber Forest Produce (NTFP) and the most edible part of this tree is seed kernel from ancient times. Germination is the major problem unless the seed is given right pretreatment. The study revealed that, soaking the seeds in 0.05% GA_3 for 24 hours gave 68% germination with seed vigor of 1754.4 followed by 5% Sulphuric acid (H_2SO_4) solution treatment resulting in 51% germination and seed vigor of 1259.7. The germination under absolute control was hardly 18% with lowest seed vigor of 356.4. The plant height of Charoli varied under different seed treatments. The seeds treated with Gibberellic acid (GA_3) resulted in maximum mean height (25.5cm), followed by the seeds treated with hot water (24.9cm), and 5% H_2SO_4 (24.7cm). The minimum plant height was observed in control treatment. The study indicates that, the use of 0.05% GA_3 for seed treatment is an effective method for increasing germination percentage of Charoli seeds.

Table 3: Effect of different treatments on germination, plant height and seed vigor

Treatments	Germination (%)	Plant height (cm)	Seed vigor
T_1: Mechanical disruption of seed coat	32	17.10 ± 1.176	556.8
T_2: Seed treatment with 5% H_2SO_4	51	24.70 ± 1.375	1259.7
T_3: Pretreatment by Soaking in water	20	24.60 ± 1.108	492.0
T_4: Hot water treatment	40	24.90 ± 0.936	996.0
T_5: Soaking in Gibberellic acid (GA_3)	68	25.80 ± 1.289	1754.4
T_6: Cow dung slurry, alternate wetting and drying	47	24.10 ± 1.233	1132.7
T_7: Cow urine treatment	27	21.20 ± 1.123	572.4
T_8: Oven drying	22	23.10 ± 0.875	508.2
T_9: Wet packing	24	21.90 ± 1.110	525.6
T_{10}: Control	18	19.80 ± 0.554	356.4

Genetic diversity in Mahua candidate trees:

Genetic diversity of 48 candidate Mahua trees from Etapalli, Dadagaon and Jawhar clusters were assessed using ISSR markers. Fourteen ISSR primers revealed a total of 132 polymorphic bands giving overall 92% polymorphism. Genetic diversity in terms of expected number of alleles (Ne), the observed number of alleles (Na), Nei's genetic diversity (H) and Shannon's information index (*I*) were 1.921, 1.333, 0.211, and 0.337, respectively, suggesting lower genetic diversity. Region-wise analysis revealed higher genetic diversity for site Etapalli (H = 0.206) and lowest at Dhadgaon (H = 0.140). Etapalli area possesses higher forest cover than Dhadgaon and Jawhar. Additionally, in Dhadgaon and Jawhar *M. indica* trees are restricted to field bunds; both reasons might contribute to lower genetic diversity in these regions. The dendrogram and the principal coordinate analyses showed no region-specific clustering. The clustering patterns were supported by AMOVA, where higher genetic variance was observed within trees and lower variance among regions. Long distance dispersal and / or higher human interference might be responsible for low diversity and higher genetic variance within the candidate trees (*3 Biotech*, 2018 (8): 143)

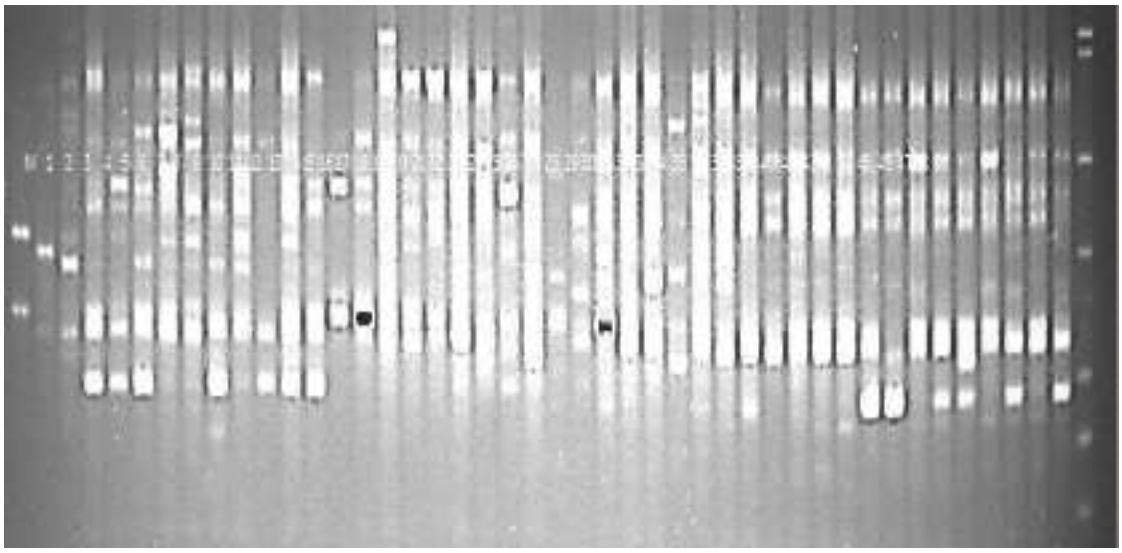
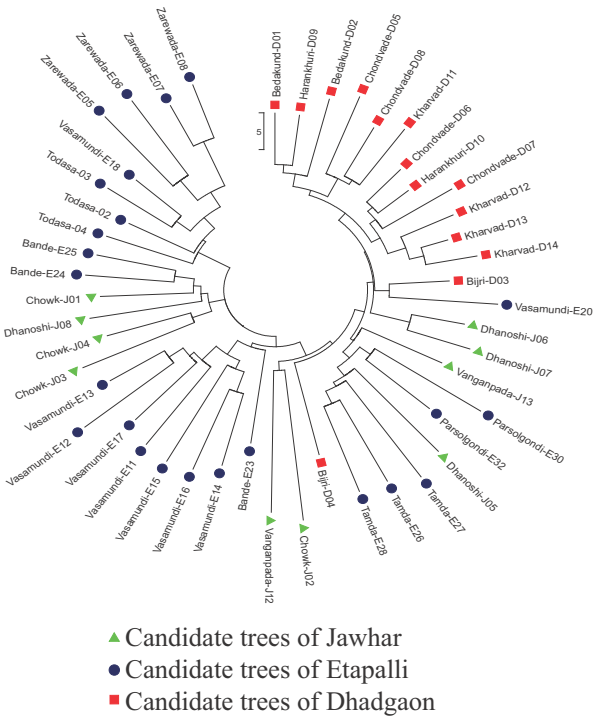


Fig 1: Amplification profile of 48 accessions of Mahua (*Maduca indica)* generated by ISSR primer ISSR 03 showing polymorphism across all accessions. M: 1 kb ladder (Promega, India)

Table 4: Comparison of primers, number of fragments scored, number of polymorphic bands, percentage polymorphism and number of unique markers for amplification profiles of 48 individuals plants generated using 4 ISSR markers

Sr. No.	Primer sequence	Total Bands	Polymorphic bands	% Polymorphism
1	$(AG)_8T$	9	8	88.89
2	$(AC)_8YG$	11	11	100.00
3	$(AC)_8YT$	9	9	100.00
4	$(AG)_8YT$	11	10	90.91
5	$(TC)_8G$	8	7	87.50
6	$(AC)_8G$	12	12	100.00
7	$(GA)_8T$	13	11	84.62
8	$(CA)_8RC$	12	12	100.00
9	$(CT)_8RC$	7	6	85.71
10	$(CA)_8G$	8	7	87.50
11	$(CT)_8G$	12	12	100.00
12	$(AG)_8YC$	8	6	75.00
13	$(CA)_8A$	12	11	91.67
14	$(CA)_8G$	8	7	87.50
	Total	**140**	**129**	**92.14**

Nei's genetic distance matrix was used to construct Neighbor- Joining method for 48 individual trees from three regions using MEGA (ver. 6'0)



Mahua - a Source for Food and Livelihood Security of Tribal Communities

Non-Timber Forest Produces (NTFPs) play a vital role in development and livelihood of tribal people across the world. Income generated by NTFPs have strengthened the household economy of people in and around the forests. 24 plants species were listed as NTFP species in study area considering the food and livelihood security. Mahua (*Madhuca indica*), Charuli (*Buchanania lanzan*), Karaya (*Sterculia urens*), Hirda (*Terminalia chebula*), Behda (*Terminalia bellerica*) were the prioritized species by local community. Study was conducted at 5 tribal clusters namely Jawhar, Dhadgaon, Akkalkuva, Bhamragarh and Etapalli covering 1430 households during the year 2015-16. The Mahua stands first as a top prioritized NTFP tree species by the local tribes in study area. The study revealed that the mean value of Mahua flower collection (767.90±13.63) and income from flower (17063±316) at household level are significantly high at Etapalli followed by Dhadgaon clusters. It has also indicated that the tribal communities are living in remote area and this was the only main source of income after agricultural crops. The mean value of Mahua seed collection (86.22 ± 1.87) and its income from seeds (3018±65) at household level was significantly high at Jawhar cluster followed by Dhadgaon cluster. The accessibility for ready market for seed and availability of actively operating oil extraction units in nearby towns may be the reason (*Trends in Biosciences* 12(6), 447-450, 2019)

Table 5: Collection and marketing of Mahua flower at house hold level

Clusters	Particulars	Flower collection (Kg/year)	Seed collection (Kg/year)	Income from flowers sale (Rs/year)	Income from seed sale (Rs/year)	Total income (Rs/year)
Etapalli	Mean	767.90± 13.63	52.32 ± 1.97	17063±316	1571±59	18633±327
	Std. dev.	366.19	52.89	8479	1587	8795
	Min	50.00	10.0	1200	300	2090
	Max	1800	300.0	51000	9000	52800
	N	721	721	721	721	721
Dhadgaon	Mean	193.04 ± 5.26	72.51 ± 1.93	5791±158	2900±77	8692±214
	Std. dev.	122.30	44.91	3669	1797	4963
	Min	10.0	3.0	300	120	420
	Max	1000	210.0	30000	8400	38400
	N	539	539	539	539	539
Jawhar	Mean	68.41 ± 1.71	86.22 ± 1.87	1984±49	3018±65	5002±103
	Std. dev.	22.76	24.80	650	868	1368
	Min	25.0	35	750	1225	2150
	Max	200.0	150	5000	5250	8850
	N	176	176	176	176	176
Over all	Mean	466.39± 10.75	64.08 ± 1.29	10984±236	2249±45	13231±235
	Std. dev.	407.58	48.89	8933	1740	8887
	Min	10.0	3.0	300	120	420
	Max	1800.0	300.0	51000	9000	52800
	N	1436	1436	1436	1436	1436
"p" Value		0.0001	0.0001	0.0001	0.0001	0.0001

Impact at community level

Earlier, the use of minor forest produce was not fully exploited by the community. After the intervention of project, activities like selection of candidate trees, nursery raising, grafting of Mahua and Charuli, importance of value added products, helped the farmers to understand the importance of NTFP. Now, the participants are well aware about market linkage and importance of conservation of plants. People in the villages have been motivated and have started collective marketing of Mahua, Charuli and gum and they are getting better remuneration.

Way forward

i. Some of the activities are livelihood based activities such as collection and marketing of Mahua flowers through groups. These groups need to be strengthened and consistent follow-up and monitoring is required from the organizational side. The supportive fund may be generated within the groups and that may be utilized to scale up the marketing of NTFP's.

ii. Establishment of large scale NTFP nurseries through entrepreneurs which will cater the need of seedlings and grafts of the NTFP's. Nursery growing is one of the

livelihood activities at village level. Many institutes are approaching for supply of grafted Mahua and even farmers are ready to buy the planting materials.

iii. The method for selection of candidate tree may be followed for other species. Good quality planting material may be supplied and conserved in natural habitat.

iv. The eco-restoration process initiated at four habitat sites needs to be continued for longer period with active involvement of the community.

List of staff involved in the project with their posts and one liner introduction

#	Name	Position	Education
1	Dr. Vitthal K. Kauthale	Principle investigator	Ph. D, M.Sc.(Agri)
2	Mr. S. D. Nimbalkar	Junior Research Fellow	B.Sc.(Forestry), M.Sc. (Env. Sc.)
3	Mr. Santosh Agale	Program Assistant	B.Sc.(Agri)
4	Mr. Nana I. Pawara	Program Assistant	B.Sc.(Agri)
5	Mr. Kailash Kumre	Field project assistant	MSW
6	Dr. Anjali Nalawade	Research Fellow	Ph. D, M. Sc. (Botany)

Result Based Management: Non Timber Forest Produce and Habitat Eco-restoration

Outputs	Indicators	Targets (2 January 2014 to 31 March 2020)	Achievements cumulative (2 January 2014 to 31 March 2020)
Output 1: Scientific and social validation of bio-resources.	No. of bio-resources scientifically validated.	One/ two Important NTFP species (Biosensors-Mahua and Charuli) which have local importance	Totally 5 importance bio resources are selected as candidate trees. Total candidate tree identified -158
		Samples of 48 Candidate tree flowers & seeds	Total 212 flower and seed samples analyzed
		48 Candidate tree	Molecular study of 48 trees completed. (66 Non Candidate tree samples were collected for comparative study)
		Two Species (Mahua & Charuli)	Vegetative propagation studies of Mahua undertaken. Standardized the nursery techniques for Charuli plant
		House hold survey of 1470 in three cluster	Total of 1470 house hold surveys completed
Output 2: Promotion of validated bio-resources	No. of bio-resources promoted	5 NTFP species at Jawhar, Dhadgaon & Etapalli Cluster	4.70 lakhs seedlings raised of 7 NTFP species
		Jawhar & Dhadgaon Cluster	Total 6000 Mahua Grafts raised
Output 3: Research papers/case studies/articles	No. of research papers/articles/ case studies	Research Papers- 4 Case studies- 10	Research Papers- 4 Mahua book let-1 Case studies- 10
Output 4: Preparation of bio-resources inventory	No. of documents prepared	2 villages	Documents of 3 villages prepared.
		Documentation of Bio resources at Jawhar & Dhadgaon Cluster	1) Flowering plants -396 species 2) Insects- 92 species 3) Birds- 42 species documented

Outputs	Indicators	Targets (2 January 2014 to 31 March 2020)	Achievements cumulative (2 January 2014 to 31 March 2020)
	No. of schools involved in bio-resource documentation	2 Schools	2 schools in Dhadgaon cluster
Output 5: Conservation of bio-resources in gene bank	No. of bio-resource conserved *in-situ*	Jawhar, Dhadgaon & Etapalli Cluster	Total of 4.13 lakhs seedlings of 7 species planted
		Jawhar & Dhadgaon Cluster under In situ conservation	Seedlings- 102740 Seed- 194 Kg Stumps- 1,11,200
	No. of bio-resource conserved *ex-situ*	Preservation of Candidate tree seeds and 3 NTFP species	Total seed samples-84 Wagholi ,114- Mahua candidate trees. CRS, Urulikanchan -150 Mahua, Behada and Karaya were planted
Output 6: Promotion of bio-resources with individual families	No. of Families involved in promotion		Total participants-1590
	No. of events organized and participated	1) Mahua mela –10 2) Trainings-20 3) Vendors meet – 3 4) NTFP exhibitions-2 5) Habitat site events -5 6) School events – 10 7) Nursery grafting- 2 8) Beej Mohim- 2	1) Mahua mela –13 2) Trainings-28 3) Vendors meet – 4 4) NTFP exhibitions-3 5) Habitat site events -7 6) School events – 12 7) Nursery grafting- 3 8) Beej Mohim- 3
Output 7: Formed and strengthen village level BMC/NTFP groups	No. of groups formed and strengthened	10 groups	12 groups formed and strengthened
		6 eco-clubs	7 eco-clubs involved
Output 8: Collaboration with scientific institutes	No. of institutes	Insitute-5	Total Insitute-11
Output 9: Dissemination of knowledge	No. of extension material developed (pamphlet, posters, PoP's etc.)	Extension material - 10	Extension material - 11
	No. of events in school	2 school	2 schools
	No. of good practices documented	2- Good practices	Good practices- 2

Annexure 1 List of villages under NTFP and Habitat ecorestoration

Districts	Taluka	Villages	Village code
Gadchiroli	Etapalli	Alenga-Todsa	539644
Gadchiroli	Bhamragad	Arewada	539741
Gadchiroli	Etapalli	Bande	539646
Gadchiroli	Bhamragad	Dubbagudda	539809
Gadchiroli	Bhamragad	Hemalkasa	539752
Gadchiroli	Bhamragad	Hidur	539730
Gadchiroli	Bhamragad	Irakdummi	539748
Gadchiroli	Etapalli	Jivangatta	539643
Gadchiroli	Etapalli	Karampalli	539645
Gadchiroli	Etapalli	Karrem-Gurupalli	539655
Gadchiroli	Bhamragad	Krushnar	539729
Gadchiroli	Etapalli	Lanji	539634
Gadchiroli	Etapalli	Nagulwadi	539582
Gadchiroli	Bhamragad	Palli	539774
Gadchiroli	Etapalli	Todsa	539644
Gadchiroli	Etapalli	Tumaragunda	539478
Gadchiroli	Etapalli	Wasamundi	539653
Gadchiroli	Etapalli	Zarewada	539775
Nandurbar	Akkalkuva	Belakund	525053
Nandurbar	Akkalkuva	Bhagdari	525038
Nandurbar	Dhadgaon	Bijari	525354
Nandurbar	Shahada	Chinchora	525457
Nandurbar	Dhadgaon	Chonvade Br.	525238
Nandurbar	Shahada	Dara	525457
Nandurbar	Dhadgaon	Harankhuri	525232
Nandurbar	Dhadgaon	Kakarda	525251
Nandurbar	Dhadgaon	Mankhedi Kh.	525316
Nandurbar	Akkalkuva	Nimbipada	525037
Nandurbar	Dhadgaon	Pathali	525248
Nandurbar	Dhadgaon	Shelkuvi	525311
Nandurbar	Dhadgaon	Sirsani	525352
Nandurbar	Akkalkuva	Walamba- Dab	525093
Palghar	Jawhar	Chowk	551948
Palghar	Jawhar	Dengachimet	551911
Palghar	Vikramgad	Doyapada- Kunj	551759
Palghar	Jawhar	Hateri-Kokanpada, Ruicha pada)	551885
Palghar	Jawhar	Kalamvihira	551912
Palghar	Jawhar	Medhe	551949
Palghar	Jawhar	Nyahale Bk.	551921
Palghar	Jawhar	Pathardi (Dongarpada)	551947
Palghar	Jawhar	Shiroshi	551933
Palghar	Jawhar	Vanganpada	551947
Palghar	Jawhar	Vanvashi- Raitale	551920
Palghar	Jawhar	Walwande	551935

BAIF-MGB -NTFP and Habitat data - Summary sheet

Sr. No.	Data Type	Description	Unit	No. of records
1	Village data	List of villages covered	No of villages	44
2	List of plant diversity	Year wise plant list	No. of sites	4
3	NTFP household survey	Family survey data of NTFP collectors	No. of families	1470
4	NTFP utility	Household utilisation of NTFP	No. of families	166

Documents published and printed under the MGB project

1) *Mahuca indica* (Mahua)- a Candidate tree manual

2) "*Mohache Prakriyaukta Padartha*" (Mahua recipes) -2019.

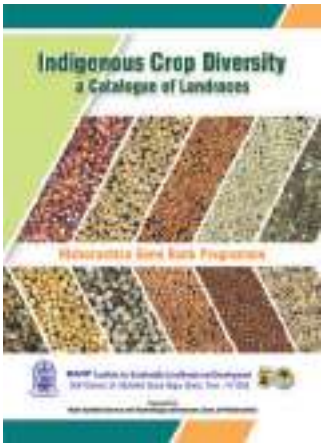
3) Genome savior's compendium and inventory

4) Compendium of publications (soft copy)

5) Poster- Conservation of Non-Timber Forest Produce and habitat eco-restoration

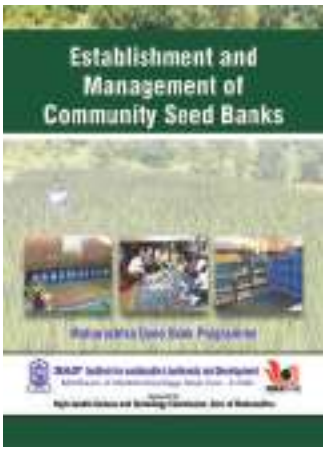
6) Photos of major activities

Books published under MGB Project



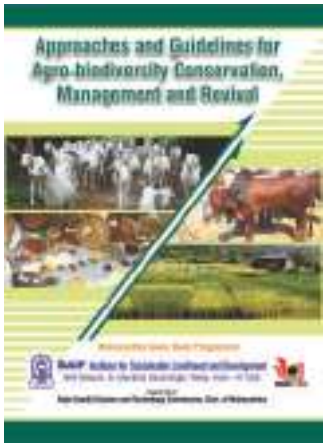
1) Indigenous Crop Diversity: A Catalogue of Landraces

This booklet highlights crop diversity catalogue, documentation of crop landraces and farmer's variety with special features based on research outputs under this project. Details provided of 105 local cultivars of different crops will create awareness about crop diversity in Maharashtra.



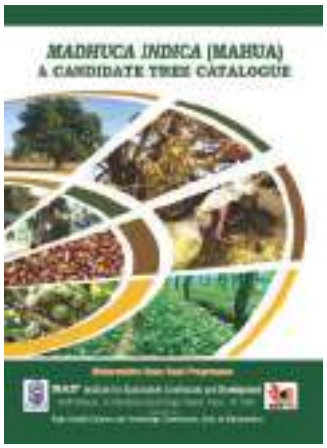
2) Establishment and Management of Community Seed Banks

This document includes guidelines in establishment and maintenance of community seed banks based on our experience under the MGB project. This document can be useful for researchers and development workers in establishing community seed banks in their region for conservation and revival of local crop diversity.



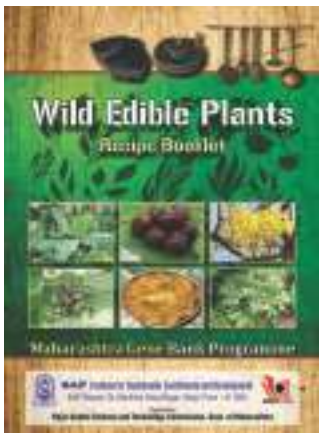
3. Approaches and Guidelines for Agro-biodiversity Conservation and Revival

This document consists of approaches and guidelines for conservation, management and revival of agro biodiversity especially crop, livestock, non-timber forest produce and habitat eco-restoration adopted during implementation of MGB project. This booklet may be useful for researchers and development workers in other parts of the country in initiating agro-biodiversity conservation programme.



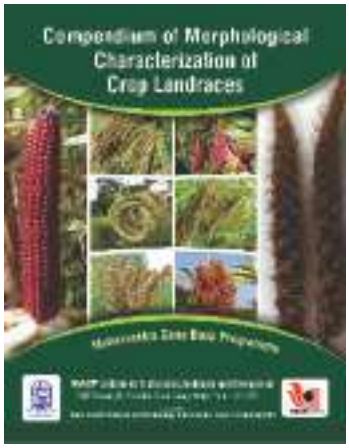
4) Madhuca indica (Mahua): A Candidate Tree Catalogue

80 Mahua candidate tree have been identified from the tribal cluster villages of Jawhar, Dhadagaon, Etapalli in Maharashtra for food security and livelihood development. Detailed information provided for each candidate tree can be of useful reference for further study.



5) Wild Edible plants –Recipe Booklet

This booklet covers wild edible plants recipes from Jawhar (Palghar), Akole (Ahmednagar), Dhadgaon (Nandurbar), Kudal (Sindhudurg) and Etapalli (Gadchiroli) Districts of Maharashtra, along with recipe; information of 134 species covering Scientific and local names, occurrence, Habit, edible parts, method of availability and method of consumption included as annexure. This booklet will be helpful to create awareness among rural and urban population about the availability, methods of preparation and health benefits from consuming wild edible plants.



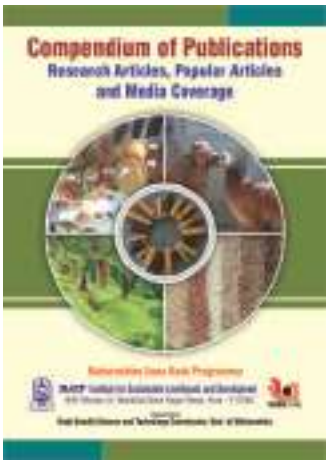
6) Compendium of Morphological Characterization of Crop Landraces

This compendium highlights morphological characters of different crop landraces from Jawhar (Palghar), Akole (Ahmednagar), Dhadgaon (Nandurbar), Kudal (Sindhudurg) and Etapalli (Gadchiroli) Districts of Maharashtra as per DUS guidelines of Protection of Plant Varieties and Farmers Rights Authority (PPV & FRA) along with associated traditional knowledge. It consists of morphology data of 264 local cultivars of 8 crops viz; Rice (160), Maize (18), Sorghum (17), Finger Millet (21), Little Millet (10), Foxtail Millet (3), Barnyard Millet (3), Hyacinth Bean (32). This catalogue will helpful for students, researchers to know more about specific characters of indigenous Crop diversity in Maharashtra and as field guide for area specific landraces.

7) Genome Savior's Digest

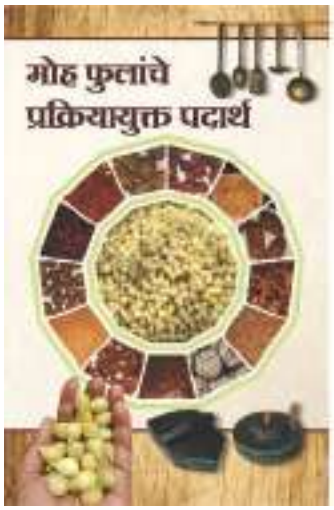
"Genome saviors Digest" covers stories of Genome saviors (Seed savers, NTFP growers and collectors, Livestock breeders) along with its community organizations and groups with their approach, activities undertaken and diverse bioresources conserved and Multiplied.

This document will be helpful to students, Researchers and extension workers, Government departments to understand community level approaches and traditional wisdom of communities for agrobiodiversity conservation and management.



8) Compendium of Publications

"Compendium of Publications" covers research papers, popular articles and media coverage on crop diversity, Livestock diversity and NTFP. This document will be helpful to students, Researchers and extension workers, Government departments to understand community level approaches and traditional wisdom of communities for agrobiodiversity conservation and management.



9) Mahua Recipe booklet

"Mahua Recipe booklet" consists of documentation of traditional preparation methods of different products from Mahua flowers in Jawhar, Dhadgaon and Etapalli clusters in Maharashtra.

Information Management, Education and Communication for Maharashtra Gene Bank Project

Report

8

Information Management, Education and Communication for Maharashtra Gene Bank Project

Centre for Environment Education (CEE), Pune

Background

Maharashtra state has adopted a combination of infusion and separate subject strategies while implementing environmental education at large in the formal education system, which includes topics related to biodiversity education. Projects as a method of continuous, comprehensive assessment at primary level and as a method of learner centric, active learning at secondary and higher secondary levels have been mainstreamed through policy and guidelines. However, inadequate training of teachers/educators in effectively using this method in an interdisciplinary way and lack of quality educational resources remains a significant gap to fill. Looking at 'School Projects' as an hybrid space for engagement between curricular concepts and real life situations, formal and non-formal learning, there is a need for accessible ideas bank and methodology related capacity building of educators.

There are number of activities related to biodiversity in non-formal spaces and methods such as birds, butterflies and other wildlife enthusiasts' activities, plantations, organic food movements and such. There are few organized network activities such as of Maharashtra Pakshi Mitra Sanghatana which are largely species focused, and need not necessarily looking at complex realities of bio-cultural diversity and sustainability challenges.

There is a great potential for linking formal and non-formal spaces and players. Regarding information and educational resources, while various guidebooks in Marathi are slowly but increasingly being available on plants and animals, there is a need for quality control and target group based curation, and materials those deal with cultural and political aspects of biodiversity conservation besides scientific/ecological. Also very few educational resources are available which bring in pedagogic consideration with clear learning group/s which the resources are meant for. Online platforms on state specific biodiversity information sharing, enabling interactive exchanges, is a pressing need.

Education being low on priority and not appreciated for its role as a driver for change remains a challenge. A developmental project or an organization is likely to see it more as one of the component activity and not realize it as an instrument for achieving long term sustainability, objectives or goals. IEC for MGB component project has consciously chosen to work in partnership with organizations implementing various thematic projects to strengthen organizational capacities in facilitating educational activities in their work areas. Following list of statements is intended to provide quick overview of the current status of biodiversity education in the state.

1. Lack of state-wide bench marking in status vis-a-vis National Biodiversity Target 1

2. Low level of subject competencies among the teachers and students to build biodiversity learnings upon them

3. Lack of state contextualized pedagogical strategies and programmes for biodiversity learning

4. Neglect and systemic destruction of linguistic diversity, which is rapidly contributing to the loss of knowledge and practices related to biodiversity

5. Lack of adequate financial resources for environmental education at large and biodiversity education in particular

6. Lack of adequate and effective consumer awareness on biodiversity, quality of life, food & nutrition etc.

7. Sub-optimal resource allocation for existing initiatives e.g. National Green Corps, resulting in lack of adequate inputs in terms of regular capacity building and resource material and other incentives

8. Scheme like Environment Service Scheme (ESS), supported by Environment Department, Govt. Of Maharashtra are able to provide adequate and need based inputs but are currently restricted to small number of schools (50)

9. 'Western Ghats special Eco-club Scheme' - a School based, action projects oriented environment education scheme on northern Western Ghats region, a biodiversity hot spot of global significance and part of UNESCO World natural Heritage Site, was forced to closure due to closure of Scheme by Planning Commission of GoI, in spite of its effectiveness. State Government is yet to find alternate resources for this scheme focused on this extremely important region from biodiversity point of view.

10. Lot of localized groups and activities related to biodiversity appreciation are emerging, which are in need for nurturing and gradually taken to the level of effective conservation learning and actions.

Journey with MGBP

Key issues addressed

1. Lack of baseline about biodiversity information and learning levels among school students. A baseline study of biodiversity related information and values among students was carried out with over 300 students from 16 clusters spread in all the bio-cultural divisions of the state. This included different species of trees, wild edibles, fish, and butterflies from their neighborhood which they could recall. Also, number of plant seeds they could recognize and exercises to assess their mathematical competencies needed for doing environment education projects.

2. Developing understanding about the processes and resources required towards designing bio-cultural diversity learning curriculum contextualized to Maharashtra's bio-cultural realities and sustainability challenges.

3. Need of tested School/College based Biodiversity Registration (SBR) methodology handbook and educational resource kit appropriate for Maharashtra.

4. Lack of statewide studies on status of school projects, topics, materials, costs and learning outcomes

5. What could be appropriate pedagogy to develop understanding about 'food and diversity' among students and teachers in the state's contexts.

6. Lack of appreciation at large and in developmental sector of significance of education both as subject and as a driver for sustainable change.

7. Need of participatory platforms for management of the relevant information towards strengthening public awareness about biodiversity

Objectives

Project was initiated with an objective to develop / strengthen networks of schools, communities, NGOs, knowledgeable persons, ICT hubs at local (multiple villages/ sub-taluka), district and state levels to implement participatory monitoring and assessment of biodiversity and associated practices of use and conservation by students mainly from Secondary and Higher Secondary Levels.

Achievements

Project has developed a network of grassroots biodiversity educators associated with 15 partner organizations. These have been capacity built in areas of environmental education, biodiversity mapping and studies, techniques and documentation and use of multimedia. Cluster level learning resources *'Pitaras'* have been created as a common resources with reference or field guides, binoculars, cameras, weighing machines, water and soil testing kits, magnifying glasses, seed collection boxes etc.

Gotul newsletter and web portal have been developed as tools for information exchange and networking.

Pitara - Common Learning Resource Pool

The project has been able to link school-based learnings to local environment and conservation initiatives by partner organizations and try test hands on activities towards strengthening constructivist approaches.

Education about political dimension of conservation and sustainability though remains a far more challenging objective to achieve to its effective level.

Besides above fulfillments, this project forms a significant response by India towards fulfilling objectives of CBD in general and Aichi Biodiversity Targets-2020 and corresponding National Biodiversity targets -1 in specific.

Major work done under MGBP

A. Curriculum Framework for Bio-cultural diversity and Sustainability Education in Maharashtra developed through participatory approach. This framework has 4 broad themes, viz. Agriculture - Crops genetic diversity and domesticated animals, grassland biodiversity, fresh water biodiversity and forest eco-restoration. Each theme has learning topics linking it with Food & Nutrition, History,

Curriculum Framework of Fresh Water Biodiversity

Language & other Cultural Aspects, Ecology, Gender, Economics & Markets, Climate Change, Conservation Issues & Actions, and Policies related to the theme. Each topics has 'Learning Outcomes' decided through a participatory deliberation, a process involving teachers, pedagogy experts, MGB partner organization teams, text book developers and practitioners from biodiversity and educations fields. Further curriculum has activities & project ideas designed towards achieving those 'learning outcomes'. This process has been sensitive towards Formal Subjects' Curriculum & Textbook linkages for activities and project ideas.

B. Field visits were made to all the 14 partner organizations' project sites towards understanding local bio-cultural context guiding this project component's activity designing, networking and also as a co-benefit, text, photographic and A/v documentation of biodiversity and local communities. Over 1000 photographs during these field visits taken and work on uploading select 500 of them on Wikimedia is on, completed 116 images by March 2019. In year 2018 CEE team visited 28 schools to gain first hand understanding about students' projects post Anandshala Shibir. Partner organizations in which these visits were made and number of schools viz. Janarth-4, Lokpanchyat-7, Sanvedana-2, Vasudha-5, GYPM-2, BNVSAM-4, Khoj-3, Lokparyay-1

C. Audio-Visual and text documentation of stories of Himmatrao Pawar, Lesser Florican Conservation, Bugabai Rathod on paradhi life and conservation issues, Crop Genetic diversity conservation by GYPM and story of Manda Gavadkar from Gondia, Vidarbha; Jowar Varieties in Marathwada, Story of Virpur's Forest conservation, and RET plants research and conservation stories at Botany Department, Shivaji University. Publication of 2 issues of Gotul magazine as a tool of networking among MGB partners, schools, GOs & NGOs and other interested persons with 1000 copies in print and over 2000 e-copies to mailing lists.

D. A state-wide network of 24 Paryavaran Shikshan Mitras - grassroots education facilitators with 14 NGO partners, who were capacity built to facilitate biodiversity education activities and documentation in their local contexts. Hands on learning workshops on environment education approaches and perspectives, biodiversity study, documentation using multimedia tools for Paryavaran Shikshan Mitras, were conducted till September 2018. Salient features of these workshops are listed below:

i. MGB Orientation workshop for PSMs at VAMNICOM, 16-18 October 2014

1. This first workshop saw participation of 18 representatives from 13 partner organizations under MGB project.

PSM Training Session on Biodiversity Education

2. Sessions on MGB project, Mind Mapping on development-conservation binary, role of education and schools in conservation and their experiences till now

3. An exhibition of materials, posters and orientation about MGB partner organizations and their respective projects

4. Environment education approaches – Web of Life game

5. Visit to PWD Nursery in Savitribai Phule Pune University campus for hands on nursery technique learning session and seed identification game

6. Session on Language, biodiversity and cultural capital by Kishore Darak

7. Visit to two schools, Zilla Parishad Primary School, Kenjal, Tal. Bhor and Sumati Balvan School, Katraj to understand activity based learning methods, challenges and effectiveness.

8. Visit to Indradhanushya Citizen Centre of Pune corporation and a session on toys and science education by Shivaji Mane from Muktangan Centre, IUCAA, Pune, and a session on hand made paper making from waste paper

9. Field work on banks of Mula river to understand focused group discussion, survey methods, and subsequent session on formulating research questions and data analysis, graph making.

10. Visit to entomology department of Agriculture College, Pune and understating pests and biological pest control methods.

11. Session on PBR and school based activities by Prof. Madhav Gadgil.

12. Session on evolution of environmental education to education (EE) for sustainable development (ESD) '

13. Station Round' session on designing theme based activities for schools under MGB project

14. Action Plan development and 'letter to yourself' on individual plan

ii. Biodiversity Education Curriculum and activities Workshop, at SM Joshi Foundation, 16- 17 August 2015

1. Participation of 18 persons representing 12 MGB partner organizations.

2. Understanding curriculum, thematic activities modules and learning resources

3. Methodologies for teacher-students training workshops

4. Documentation – basics of photography and field work and individual feedbacks

5. Biodiversity and nutrition link – understanding 'what's all in my plate' activity and feedbacks from PSMs local contexts

6. Hands on learning use of water testing kit and planning of local water testing plan with students

7. Understanding map making, Google Earth Maps

8. Trial of 'Local Festival Calendar' making activity

9. Session on local art forms and biodiversity education and documentation

10. Open discussion session on 'whole school approach' vs 'ecoclub' approach and local situations, and to clarify any doubts of PSMs

iii. Multimedia Workshop, at IISER Pune, 8-9 March 2016

1. Participation by 20 PSMs and NGO representatives from 13 MGB partner organizations

2. Session by Nikhil Seth on open source media tool, w.r.t Windows Movie Maker and Mobile Media Converter

3. Hands on sessions on different file formats, slide show making using movie maker software, audio and audio visual file recording, file transfers and editing

4. Audio-video projects –sharing over internet and uploading on Wikimedia and Google drive

5. Action Plan for making short films on aspects related to MGB project

iv. Bio-cultural mapping workshop at Hivare Bajar, 31 Jan-3 Feb 2017

1. Participation of 21 PSMs and other representatives from 14 MGB partner organizations

2. Introductory sessions on drawing partners picture, briefing on activities in respective school clusters

3. Shivar Feri (village and neighborhood exploration in thematic groups) in Hivare Bajar

4. Map making exercise in thematic groups, presentation and discussion

5. Food Diversity mapping of the village

6. Second round of Shivar Feri and collective map making with bio-cultural elements

7. Open session and evening cultural activities

8. Sessions on ideas inputs for Biodiversity resource corner – *Jaivvividhata Pitara* as a cluster resource kit and on school based projects, education department policy and experiences, ways to address challenges at school level in facilitating biodiversity learning activities

v. Anandshala Shibir preparation workshop at J.P. Naik Institute, 3-6 September 2017

1. Participation by 22 persons including PSMs and additional representatives from 14 MGB partner organizations and one volunteer with CEE.

2. Exploring plant diversity in the workshop venue campus, listing and making suggestions for hypothetical plan of greening the institutional campus

3. Review of status of school based activities and documentation – photos, videos, Gotul magazine articles by PSMs

4. Orientation and distribution of *Jaivividhata Pitara* materials

5. Understanding IEC component of MGB

6. Refresher sessions on use of multimedia tools and bio-cultural diversity map making and 'whats all in my plate' activity with 3 generations of a family

7. Case story of Pachgao – watching a documentary and interactions with Vijay Dethe from the village on community based biodiversity conservation and livelihood strengthening work and role of education in that process

8. Session on 'Local histories and biodiversity', watching documentary 'Young Historians' and local food diversity

vi. Workshop on 'school projects' at Hivare Bajar, 7-9 May 2018

1. Participation of 16 persons including PSMs and additional representatives from 12 MGB partner organizations

2. Presentations on positive case story by each PSM from her/his cluster

3. Inputs for MGB website development

4. Status of school based projects as planned by the teachers and students during *Anandshala Shibirs*

5. Presentation by CEE team on MGB website structure, seeking feedback and planning inputs needed from PSMs and respective partner organizations

6. Session on outcomes of baseline studies conducted with school students on their awareness of local biodiversity elements and further study ideas/potential for local partner organizations

7. Hands on session on 'Seed Germination Test' activity

8. Planning for photography workshop for select students from photography tests conducted during Anandshala Shibirs and PSMs

vii. Photography Workshop at Patanadevi WLS, Dist. Jalgao 25-27 September 2018.

1. 39 persons participated in this workshop including 16 students, 20 PSMs and representative of 12 partner organizations and 3 teachers. The selected participants represented 18 different communities; including indigenous, scheduled tribe communities, viz. Phase-Pardhi, Korku, Pawra, Kokana, Bhill, Gond, Mahadev Koli, Dhivar, Andh, Navbauddh, Kalal, Kunabi, Sonar, Teli, Mali Muslim Kasar, Muslim Khatik and Maratha.

2. Ice Breakers (Who are we? – a visual game) and sharing Experiences about Photography from the group

3. What is a good image? What kinds of photographs do they like?

4.Take a photo from your cell phone- Or the best photo on your cell phone and review of the Photo – discussion

5. Familiarization with all the controls on your mobile camera and Understanding digital cameras and how can it help you further when compared to a mobile phone

6. Camera modes and making the best out of your camera

7. Take an Image from a digital camera and review of the Photo – discussion

8. Technical aspects of making a photograph - Focus and Focal Length, Understanding exposure and metering, Aperture, Depth of Field, Shutter-speed, ISO and White Balance and use these aspects to take a photograph

9. Review of the Photo – discussion

10. Talking about Composition -Watching some photographs and discussing composition

11. About Light and using light to get a good photograph

12. Task for day two- draw an image from what you may have seen – a composition that has stayed with you

13. Discussion on the Images that the participants bring (or talk about)

14. Photo Presentation- How have others in the past referenced their contexts to create something new in Photography? (Not just in terms of newness of subject but also a new way of looking) and Feedback

15. Take 5 photos (an excursion) and Feedback on the photos

Photography and Media Literacy Workshop

16. Selection of personal best and sharing of the images in the classroom. Clarification on further technicalities

17. How to tell a story through photos? What kinds of stories can they think of?

18. Photo presentation and think of a story you may want to share

19. Different kinds of Photographic stories. Elements to keep in mind for a good story

20. Think of a photographic story for next day (either as a group of two or solo) and Work on the photographic story of 10 images

21. Sharing of the stories with the group and review of the stories and discussion

22. Telling the difference between a real and a fake photo? Can you always tell the difference? The danger of fake photos

23. Where to reference images from when it comes to plant species and animals?

24. Is every new image new knowledge? What makes an image important?

25. Planning your own photo stories

Students presenting their project to peers

E. Secondary and higher secondary school level project ideas bank with 60 projects designed and tested in about 150 schools. These project ideas are focused on themes of agro-biodiversity, forest, grassland and freshwater biodiversity, and also bringing cross cutting themes of gender, culture, economics and related policies as learning areas. Schools have submitted 73 school projects done by students back to CEE. Based upon these submissions and experiences shared during teacher-student workshop in 2018, these project ideas are being revised as detailed handbook and planned to be finalized in 2020 and will be integrated in to www.gotul.org.in as a age/standard, subject and thematic searchable database.

F. Designing and testing of *Shivar Feri* – school-based biodiversity registration and studies handbook, and a resource kit for this process comprising 8 different resources, viz.

i. Insect Folder- Photographic field guide for crop-wise

87 agricultural pests & 19 useful insects for 15 crops which area also crops selected for genetic diversity conservation under the large project.

ii. Wild vegetables & tubers - a folder of 30 wild vegetables & 6 tubers, commonly used in Maharashtra with photographs, local name, botanical name, edible part, period of occurrence, habitat, type, growth habit & use. It also provides guidelines for studying wild vegetables in ones region.

iii. Birds - This pocket size bird field guide designed for beginners' use during neighborhood walks and contains 95 birds arranged ecosystem wise wetland, grassland – scrub, agricultural fields, forests, home/kitchen garden and also select endangered & rare ones.

iv. Pocket booklet on snake focuses on similar looking venomous and non-venomous species.

v. Butterfly & Moth - A pocket booklet contains 50 butterfly species from 5 families, with photograph, common name, scientific name, habitat, associated plant species & also 12 moth species.

vi. Gecko & Lizards folder on 12 different species of gecko & lizards with photograph, common names in Marathi and English, scientific name & body length

vii. Mushroom folder with 33 different species of mushrooms with photographs.

viii. Frogs and Toads folder as identification guide.

ix. Cloth bag with MGB logo and graphics of Jowar (One of the millets) varieties viz. Dagadi, Kavali, Gidgyap, Maldandi, Dukari, Manthi and Pivali from Maharashtra.

This kit also includes a register for record keeping at school levels.

G.*Anandshala Shibirs'*- workshop module for teachers and students - 3 days residential workshop modules were designed for teachers and students from participating schools. First module in 2016 focused upon Shivar Feri as a methodology for neighborhood biodiversity survey and studies and trial testing of resource kit, besides sessions on:

Shivar Feri Learning Resources kit

i. Baseline development exercise towards understanding existing levels of information of trees, wild edibles, birds, butterflies and moths, insects, grasses, amphibians, reptiles, fungi, fish including their life experiences among students, basic subject competencies like mathematical competencies needed to effectively undertake environment projects and situational questions to understand their choices and normative values to contextualize biodiversity education under this project.

ii. 'Whats all in my plate' –assessment of food diversity and intergenerational changes, and their links with changes in local environment, markets and food habits

iii. 'Young Historians' – children-teachers exploring local histories including of natural resources, agriculture, forest, grasslands, and water bodies.

iv.Calendar of local festivals

v.Bio-cultural mapping of village and neighborhoods

vi.Seed collection-identification to nursery development

vii. 'Survey, collection and display of agro-biodiversity in our village'

viii. Creating Children Tree Parks on and as village commons – e.g. Amrai

ix. Eco-product development – Natural color from Palash flowers, eco-ganesh idol making

x. Water quality monitoring by schools

xi. Organic fertilizers-pesticide making – CPP technique

xii. Water bird monitoring around village ponds.

xiii. Biodiversity and languages – understanding diversity in languages and regional variations

xiv. Biodiversity in stories and folklore

xv. Biodiversity measurement techniques


Quadrate Study of Grasses on Kayadhu river flood plain

Using this module, 182 teachers (male -164, female-18) teachers from 179 schools were trained in total 16, three days, residential workshops organized at 12 places across the state between Sept – Dec 2016. Total 562 participants participated, including partner organizations' representatives and one teacher and two students each from 179 schools located in 17 districts (Table 1).

Second module of Anandshala Shibirs in 2017 focused upon schools projects with biodiversity as a core theme and linked to school subjects of language, science, maths, history, geography and civics. From 2016 Anandshala Shibir participants, select schools were invited who had conducted Shivar Feri and other activities agreed upon by teacher-students group. Series of 11 Anandshala Shibir workshops were organized during November–December 2017, at six places spread across the state. 122 teachers, 276 students and 36 partner organization representatives and educators participated in these (Table 2). Below is an overview of sessions of these Anandshala Shibirs -2017

i. Teacher's feedbacks of trainings they have received in last 5 years

ii. Last year experience sharing of teacher and students

iii. 2016 Baseline Study outcome discussion

iv. Project selections from projects idea bank and projects based Shivarferi (field work)

v. Photo project: documenting biodiversity by photography

vi. Watching 'Young Historian Film' and understanding project data analysis, discussion of findings and presentation methods

vii. Presenting the Projects

viii. Cultural Program

Students with herbarium project

ix. Selection of project ideas for school and timeline of planning

x. Cultural Program

xi. Feedback

In 2018-19, third round of Anandshala Shibir were organized with focus of sharing of experiences related to biodiversity projects done by students post last Anandshala Shibir. Select schools which reported minimum three project topics by students were invited. Special efforts were taken to get students who have been part of Shivar Feri in their neighborhood, to participate so as to conduct a comparative study against baseline information documented in year one (Table 3). Sessions of these Anandshala Shibir were as below, besides many refresher activities –

i. Ice breaker session with collective story construction

ii. Session on comparative study against baseline study conducted in year one towards capturing any difference possibly attributed to students participating in biodiversity education activities under this project.

iii. Session on documenting school project information on topics, resources used, costs and learning outcomes

iv. Presentation cum learning discussion session by school students and teachers.

v. Session on local bio-cultural histories documentation by students

vi. Discussion session teachers' past experiences of training programmes other than under MGB

vii. Group work on understanding textbook linkages with biodiversity education projects

viii. Session on language and cultural diversity through group exercise on different names of farm fields based upon soil types, location and other associations with plants, animals and human stories and local deities.

ix. Session on peer feedback on first set of photo story images by students, PSMs and teachers.

x. Feedback session

Photostories made by Studends-Teachers-Paryavaran Shikshan Mitras in Anandshala

In 2018, a special Anandshala Shibir was organized between 10th to 12th August 2018 on request from Lokpanchayat organization, for six schools which could not participate in series of shibir in 2017. Session plan of Anandshala Shibir, 2017 was followed for this shibir. 4 teachers (M) and 13 students (9M, 4F) participated in this shibir.

Gender balance among participants

Low representation of the female teachers reflects a variety of factors such as school head's prerogative to depute teachers for these residential workshops, domestic restrictions and social difficulties for female teachers to participate in 3-day long outstation residential workshops. Comparatively, clusters from indigenous ST community areas e.g. Mendha Lekha, Jawhar, Melghat saw less skewed ratio or even more participation of girl students compared to boys. It was also observed that distance of workshop venue also had an impact on participation of girl students. Where workshop venue was close e.g. at Navegao Bandh and Ugam Campus, Umra, girl participation was relatively high.

H. Design and development of website as a public platform to share information on biodiversity and conservation, and educational resource sharing. The website www.gotul.org.in was launched on 22 May 2018, along with an exhibition and panel discussion by MGB principal investigators, which was attended by over 300 people.

Indigenous food and seed exhibition and sale during Gotul Website Inauguration Program

I. In 2019-20 CEE conducted a study of food diversity among school students and across 3 generations. This study captures food diversity and intergenerational changes covering 39 different community groups with 152 families in total sample size. This study builds upon experience of earlier year study only with participating school students and gives insights in to changing food, vanishing food sources such as wild/non cultivated food resources across the regions and generations. It also helps understand social and possibly economic contexts for this change in food habits. A poster presentation proposal on this study was selected for International conference on Designing for children with focus on Play and Learn at IDC School of Design, IIT Bombay.

J. Over last two years CEE conducted a participatory study with Paryavaran Shikshan Mitras on status of projects-based learning in schools of Maharashtra with 1192 school students participating in study, providing insights into the topics, methods, resource materials used financial costs and learning outcome effectiveness. As a related topic this study went on collection of school project materials available in project districts market from 90 different publications and analysed them in terms of publications, prices and material and content quality.

K. A revision of Shivar Feri learning resource kit along with a set of stickers-posters on biodiversity elements has been underway and is scheduled to be completed by September 2020. The revised version will be uploaded on www.gotul.org.in.

L. CEE MGB project team collaborated with Lokparyay in the second phase process of unique 10 year-long Peoples' Biodiversity Register (PBR) development, at Parala village where Lokparyay is anchoring a forest eco-restoration project under MGB.

M. Through an organic process of coming together to discuss the 5 year's learning under the MGB project and way forward, a Parisar Collective was formed by 7 organizations with common areas of interest in working with community centric and ecosystem/landscape approaches towards conservation and sustainable development. CEE Central represented by Mr. Satish Awate, Programme Director and Principal Investigator, IEC for MGB project is currently anchoring this collective.

N. Mr. Satish Awate submitted a full paper on the experiences of Bio-cultural Diversity and Sustainability Learning in Maharashtra in September 2019 to International conference on Designing for children with focus on Play and Learn at IDC School of Design, IIT Bombay.

O. The MGB project at large has constituted a Working group of five experts to develop executive summary and a range of public communication products in forms of brochures, Wiki articles, photo-stories and short films on various thematic components and individual projects under MGB. Mr. Satish Awate is one of the members of this Working Group.

P. 'A Very Curious Wedding: A photo-art Exhibition on Bio-cultural Diversity of Maharashtra'

As part of IEC for the MGB project, CEE Central organized this bi-lingual exhibition at IISER, Pune campus from 10-13 October 2019. The exhibition was inaugurated in presence of Prof. Jayant Udgaonkar, Director, IISER, Pune; Dr. Ravindra Shisve, IPS, Jt CP, Pune, Dr. V.S. Rao, Coordinator, MGB, and Ms. Sanskriti Menon, Sr. Programme Director, CEE Central.

The phrase 'Lagnala Yayla Lagtay' in Marathi literally translates into an endearing way of inviting someone to a wedding; “You have to be there at the wedding," an

invitation extended with warmth, affection and a certain degree of familiarity, which takes the conversation beyond dry or sugary formalities. Different than fantastic wildlife photography exhibitions by resourceful photographers and travellers from urban areas, this exhibition was curated out of works of

Exhibition Inaugeration by Prof. Jayant Udgaokar, Director, IISER, Pune and Dr. Ravindra Shisve, Jt. Commissioner of Police, Pune

photographers from indigenous communities, nomads, fisherfolks, farmers, teachers, students, presenting their perspectives about life and culture around them.

The photography and installation aspects of this visual arts exhibition were a result of state-wide engagement conceptualized and directed by Mr. Satish Awate assisted by Mr. Yuvraj Shingate, Baswant Dhumane,

Photographers-and-Artists

Abhijeet Kamble and Ashok Thorve and group of volunteers and traditional artists groups. This process was kicked-off by a photography and media literacy workshop for these participating photographers,

Table 1. Participation Details of series of Anandshala Shibir, 2016

Sr. No.	Partner Organization	No. of School	Teacher		Students		Org. Representative	Total
			M	F	M	F		
1	Lokparyay	9	9		11	6	4	30
2	Khoj and Lokparyaya	13	13		20	13	4	50
3	Janarth and BAIF Dhadgaon	15	15		22	4	6	47
4	BAIF, Javhar	10	10		15	11	2	38
5	IIRD, Jalana	10	10		14	6	1	31
6	IIRD- Aurangabad	8	7		16		3	26
7	Ugam, Hingoli	34	34	2	21	18	4	79
8	SSM, Sagroli	12	9	1	22	15	2	49
9	Vasudha, Dhule	16	11	5	12	2	2	32
10	Lokpanchayat and SPK	12	15	1	16	2	2	36
11	Vrukshmitra, Gadchiroli	11	9	3	9	15	5	41
12	BNSAM, Bhandara	8	7	1	7	7	6	28
13	GYPM, Bhandara	12	9	3	17	6	3	38
14	Samvedana, Akola	9	6	2	10	12	7	37
		179	164	18	212	117	51	562
	Total		182		329		51	562

conducted in 2018 at Patanadevi Wildlife Sanctuary, facilitated by media professional Mr. Saransh Sugandh, New Delhi.

Using photography as a medium of arts and expression meant that many of the learners found a way to overcome the struggle they often confront while expressing themselves through text- the text of 'high art and literature' that often necessitates a translation. The exhibition was curated with photographs and art installations celebrating bio-cultural diversity in sections on wildlife as guests, different landscapes and waterscapes, connections of biodiversity with rituals and gender, customary gifts and Gotul as an idea, traditional learning institution founded on respect for nature and gender equality. Exhibition as a format gave an opportunity to the visitors to interact with photographers and listen to stories behind each of these photographs.

This exhibition was envisioned by CEE as the start of popular conversation on many ways in which biodiversity supports our lives and cultures, challenges for its conservation and ways in which we can do it, all in a celebratory way, especially connecting with the younger generation. This was also a very local and bottom-up way of making sense of international conventions such as the United Nations Convention on Biological Diversity (CBD). 2020 is marking the end to the UN Decade on Biological Diversity and the deadline for achieving Aichi Targets and National Biodiversity Targets developed by the Government of India.

Over 2000 people including school and college students visited this exhibition.

Table 2. Participation Details of series of Anandshala Shibir, 2017

Sr. No.	Partner Organization	No. of School	Teacher		Students		Org. Representative		Total
			M	F	M	F	M	F	
1	Lokpanchayat and SPK	9	11	0	16	1	2	1	31
2	Lokparyay and Khoj	10	11	0	18	10	5	0	44
3	Ugam and Vasudha	20	17	3	31	14	3	2	70
4	Janarth and BAIF, Dhadgao	11	10	1	24	3	4	1	43
5	BAIF, Javhar	9	9	0	14	9	1	0	33
6	Samvedana, Akola	9	5	2	13	10	5	0	35
7	GYPM, Bhandara	9	7	2	9	9	1	0	28
8	BNVSAM, Bhandara	11	11	1	14	15	4	0	45
9	Vrukshmitra, Gadchiroli	8	6	3	7	11	2	0	29
10	IIRD, Jalna	9	8	1	16	3	2	0	30
11	IIRD, Aurangabad and SSM, Nanded	14	13	1	28	1	2	1	46
		119	108	14	190	86	31	5	434
	Total		122		276		36		434

Table 3. Participation Details of series of Anandshala Shibir, 2018

2018-19										
Sr. No.	Location	Partner Organization	No. of School	Teacher		Students		Org.		Total
				M	F	M	F	M	F	
1	JP Naik Education Center, Kothrud, Pune	BAIF (Jawhar cluster), Ugam, Lokpanchayat and SPK	6	5	1	9	4	4	1	24
2	JP Naik Education Center, Kothrud, Pune	IIRD Jalana and Aurangabad Cluster, Lokparyay	9	6	0	13	4	3	0	26
3	Forest Rest House, Toranmal, Nandurbar	Vasudha, Janarth, Baif (Dhadgav cluster)	6	4	1	10	0	4	1	20
4	Koka Forest Rest House, Koka, Bhandara	GYPM, BNVSAM, Samvedana	6	4	2	3	12	3	0	24
			27	19	4	35	20	14	2	94
		Total		23		55		16		94

Unintended outcome(s)

Below are outcomes which were not planned in the project proposal.

a. Photo documentation and sharing by the MGB project partner organizations has been weak. To address this, capacity building of Paryavaran Shikshan Mitras of partner NGOs in multimedia documentation, audio-visual data editing was undertaken. This emerged as an empowering outcome for these grassroots facilitators, and in the last year of project we expect it contributing to project documentation significantly esp. with photo stories contributed by PSMs along with teachers and students.

b. Uploading biodiversity elements and project activities by PSMs on Wikimedia has been affected adversely by lack of fast speed internet in their localities and also limited access to office computers in their respective organizations, and perhaps low priority in project activities. With these realizations CEE team went on making special efforts towards Photography of bio-cultural diversity elements which contributed to Gotul newsletter website as well as being uploaded on Wikimedia. Over 1000 photos have been collected and a selection is being uploaded on Wikimedia with category tagging in Marathi as well as English.

c. Network of friends and well wishers from across the state. For the entire team this has been an extremely enriching experience beyond professional outcomes.

d. Special studies related to food diversity among the students and school project status which emerged

Qualitative impact of the work

a. Mid Term Review of the project held in May 2017, by Dr. John Mathews from IISER, Pune, gave positive remarks about the quality and impact of the project.

b. Besides this, feedback from school teachers and students are overwhelmingly positive during both the series of *Anandshala Shibir* reflecting the quality of training programe and other resources developed under the project. One representative feedback is as below:"Like its name this workshop was joyful, and enriching with varied experiences. I have not experienced such an excellent workshop in my 20 years of service as a teacher." – Manoj Kulkarni, Dnyanprakash Vidyalay, Pinjar, Tal. Barshi-Takli, Dist. Akola. On last days of Anandshala Shibirs students came with request to extend it, many students became emotional on last day.

c. Quality of resource material kit developed has been appreciated as innovative, useful and of high quality and has already attracted publishers intended to publish it on large scale.

d. Paryavaran Shikshan Mitra (PSMs) have been appreciative of trainings and orientation programmes, and would express how they wait for CEE's programmes as they find it valuable from their learning and professional growth. Often, organizations would send additional persons to the workshops.

e. This project has come up with first statewide baseline study which is useful as reference for any future biodiversity education programmes. Also the statewide study of project topics, methods, materials, costs and learning outcomes when completed along with project ideas and resource materials is expected to have both qualitative and quantitative impacts on the way school projects are done in future. Sharing of these study findings with teachers have impacted them towards more sincere and effective participation in workshop sessions and their taking interest in project based learning activities, reflected also in school project exhibitions at school levels where many students for the first time made presentations on their project works, which was appreciated by partner NGOs and local community as well.

Quantitative impact of the work: Indicative impacts which could be considered are: participation of c.200 schools in the programme; 1004 teacher-student trained and conducted school based projects and other learning activities; 24 grassroots facilitators' capacity built over last 4 years in biodiversity education approaches and multi-media based documentation. Further quantitative impacts are as below:

1. 99 schools conducted total 158 Shivar Feri – neighborhood biodiversity exploration by students groups

2. Students from 59 schools reported 216 projects till November 2018 related to biodiversity theme linked with different subjects, incuding individual and group projects.

3. 379 students undertook organic manure and pesticide making activity and reported quantities of – 236 liters of Dashparni Ark, 5 liters Nimboli Ark, 1 liter Handi Aushadhi, 2 drums of Jeevamrut; 90 kg of CPP manure, 500 kg of vermicompost, and 4 kg of Shivansh manure.

4. Over 300 students participating in exploring and writing stories on local histories including those of local biodiversity elements. Some are complete, some are anecdotal and overall requiring revision along with field work and depending upon resource availability in extended project period.

5. As per reports received from 7 partner organization 4636 students collected over 3.29 lakh seeds of 63 plant species. Total 21130 saplings of 16 species were raised through nursery development activity by 1246 students.

6. 1046 students were trained in nursery technique.

7. 24 schools reported herbarium making including herbarium of 36 grass species.

8. Various activities such as focused group discussions with SHGs, seed exhibitions, wild food festivals, school projects exhibitions, participation in local events were reported to reach out to over 86000 people.

9. 25 short films made by PSMs

Community participation in MGBP process

Community participated indirectly towards curriculum development through informal discussion about social life, ecosystem resources, aspiration and such. Community members played facilitators role during field visits, documentation, Shivar Feri and interactive sessions during Anandshala Shibir.

After first series of Anandshala Shibir focused on Shivar Feri – as neighborhood biodiversity mapping activity, it was teachers and students, their systemic reality and mandate of doing 'projects' has shaped designing of second year series of Anandshala Shibir which focused on school projects. Teachers actively participated in feedback process on the way biodiversity leaning kit and project ideas were designed and written, which forms basis for revision of these resources.

Beneficiaries

331 teachers, 24 Paryavaran Shikshan Mitras (PSMs) and others and 673 school students

Benefits received

Training in projects based learning approach, school based biodiversity studies and registration, using multimedia tools for bio-cultural diversity documentation and sharing, continuous and need based experiential learning opportunities, resource material kits, exposures to different landscapes, biodiversity elements of the state.

List of Publications and presentations at conferences etc (published/ accepted/ in process)

a. Gotul magazine issue I and II

b. Shivar feri handbook

c. Folder with identification charts for crop insects

d. Folder on wild, non-cultivated food items

e. Brochure on frogs and toads of Maharashtra

f. Pocketbook on butterflies and moths of Maharashtra

g. Pocket book on identification of poisonous and similar looking non-poisonous snakes

h. Brochure on mushrooms

i. Brochure on lizards and geckos in Maharashtra

j. Website – www.gotul.org.in (Presently only in Marathi language and planned to have English version of it. Due process of prior sharing, seeking feedback on its structure, content requirement, and other features with all the partner organizations and MGB coordinator was ensured.)

k. Presented a paper in Marathi titled '*Bhasha, paryavaran ani tisare avakash'* at XVII International Conference on Maharashtra organized at Chicago University Centre, New Delhi during 5-8 January 2017.

l. Presented paper titled ' Bio-cultural diversity and sustainability learning curriculum for Maharashtra' at International Conference on 'Designing for Children 2020' organized by IIT-Bombay, 28-30 January 2021

m. Presented poster titled ' What's All in My Plate' - Food Diversity among school students in Maharashtra at International Conference on 'Designing for Children 2020' organized by IIT-Bombay, 28-30 January 2021

n. A case study on 'Information Management Education and Communication (IEC) for Maharashtra gene Bank Project' was published by Asia-Pacific Cultural Centre for UNESCO (ACCU), Japan in publication titled 'Collective Learning and Action for Sustainable Community Development - Case Studies of four countries in Asia', 2021

Networking with other MGBP groups

This project component by design was collaborative in nature with 15 partner organizations, and was possible with active networking as a necessity.

Which collaborations were meaningful for overall impact?

All

Which collaborations you would prefer to continue after MGBP? How you plan to continue these collaborations?

Many elements such as information management, conservation education, indigenous communities and conservation, food, nutrition and biodiversity, statewide biodiversity projects by schools and colleges are worth continuing beyond MGBP in both formal and non-formal way, including new proposal developments seeking financial support etc. In smaller groups we have initiated a process of meetings to discuss learnings, way ahead considering individual organizations realities, priorities and thematic interests. Collective proposal development has been identified as an area to work upon to continue our collaborations beyond MGBP.

Outreach- Connection with people beyond beneficiaries

Gotul newsletter in hard copies and as e-version reached out to over 3000 persons, organizations, institutions in the state. Event to launch website with an exhibition and experience sharing by PIs on the occasion IDB -2018 was participated by c.300 people. Newspaper articles of project component activities are

able to reach out to large number of people. Newly launched website is expected to continue a buildup of outreach significantly.

An exhibition curated out of photo-stories on local bio-cultural diversity by students, PSMs, teachers and CEE team members as a creative public outreach tool and activity ahead.

Educational aspect – to and fro

Project component was inherently and overtly educational.

Policy level interventions

Through a process of synthesizing meta learnings from this project, a policy advocacy dossier is planned to be developed ahead comprising article/s, tested curriculum framework, training modules, and educational resources. A process of meetings with Education Department Officials, including Board of Study members and textbook writers' groups to influence areas of textbook and other educational resource development and teacher capacity building is planned.

National/ international outreach

a. Through exhibition at National Biodiversity Congress -2015 at Chennai

b. IEC for MGB project presentation in a workshop organized by UNDP on behalf of MoEFCC, Govt. of India to compile India's national report 6 (NR-6) to Convention on Biological Diversity (CBD)

c. IEC for MGB project reported in Annual reports of CEE which are placed in both Houses of Parliament

d. Presentation and informal sharing of IEC for MGB project activities in ESD ExpertNet comprising members from 4 countries of Germany, India, Mexico and South Africa

e. Submissions made to Maharashtra State Biodiversity Strategy and Action Plan (MSBSAP) development process by BVIEER, Pune, on behalf of State Biodiversity Board

Knowledge Outcomes

Interesting / unknown/ unrealized facts which you came across during the work

a. Extreme low level of mathematics subject competencies among teachers and students

b.Still prevailing knowledge of uncultivated, wild food resources among students and teachers, who reported 135 unique names of wild food sources such as Angot, Karunde, Tohi, Damoda, Mekh, Pevandi, Ghotfal, Dhaman, Shelani, Bibba, Kamoni, Ghagori, Khira, Chibhad, Pakharkaji.

c.Significant difference between individual and collective repository of names of local biodiversity elements like plant and birds

d.Majority of teachers, students are aware of characteristics and benefits of local varieties of crops

e.Significant market size of relatively cheap and low quality educational materials purchased for school projects

Stories emerged

a. Bugabai Ajji (http://www.gotul.org.in/bugabai-ajji/)

b. Edible and useful aquatic plants of tanks in Bhandara, Gondia districts (http://www.gotul.org.in/%E0%A4%AD%E0%A4%82%E0%A4%A1%E0%A4%BE%E0%A4%B0%E0%A4%BE/)

c. शिवारफेरीत मिळाल्या ढीगभर प्रकल्प आयडिया (http://www.gotul. org.in/shivaferit-milalelya-dighbar-prakalp-idea/)

d. मंदा केशव गावडकर: गोंदियातील बीज रक्षक (http://www.gotul. org.in/manda-gavadkar/)

e. वडाळ्याचं गवताळ माळरान (http://www.gotul.org.in vadlyanche-gavtal-malraan/)

f. प्रकल्पातून विद्यार्थी आनंदाने शिकते झाले (http://www.gotul.org. in/prakalpatun-vidhyarthi-anandane-shikte-jale/)

g. वीरपूरचं जंगल (http://www.gotul.org.in/virpurach-jungle/)

h. माधव गाडगीळ यांच्याशी गप्पा (http://www.gotul.org.in/madhav-gadgil-yanchyashi-gappa/)

i. निलांबरी (http://www.gotul.org.in/nilambari/)

j. निळी भिरभिरी, सुरस्सू आणि इतर गोष्टी (http://www.gotul.org.in/निळी–भिरभिरी–सुरस्सू–आणि–इ/)

k. विद्यार्थ्यांनी घेतली प्रकल्पातून सेंद्रिय शेती समजून (http://www.gotul. org.in//विद्यार्थ्यांनी–घेतली–प्/)

l. जीविधेची जाणीव करून देणारी आनंदशाळा (http://www.gotul.org. in/जीविधेची–जाणीव–करून–देणा/)

m. आनंदशाळा अन जैवविविधता संवर्धनाचे शिक्षण (http://www.gotul. org.in/आनंदशाळा–अन–जैवविविधता–स)

Realizations about human nature/ human-nature relationship

a. Low priority to education reflected in general lack of adequate appreciation for significance of education in conservation and developmental activities by public at large including educated ones.

b. It is mainly womenfolk and from relatively remote

areas and materially modest background which are caring to preserve local seeds. Related observation is creation of irrigation facilities have largely led towards mono-cropping and it is rainfed farmers who have maintained agro-biodiversity.

c. While appreciation and to an extent understanding about biodiversity and its importance exists in public including young ones, it is lack of enabling systems which creates this gap between appreciation and reality.

d. Persons like Bugabai ajji, Himmatrav Pawar, Patiram Bhau and many such we met hold treasure of experiential knowledge but it is for the coloniality of process of generation, recognition and exchange of knowledge they not only continue to remain unrecognized by formal systems. With all adversities and poverty, they are able to show remarkable resilience in survival and contributing to positive change in their communities and towards conservation.

4. Observations about ecology- regeneration/ depletion/ conservation

a. Ecological justice is key to ensure participation in conservation

b. Material benefits form basic motivation for regeneration/conservation by communities

c. Communities are capable of sustainably managing commons if larger political and economic system is enabling

d. It is necessary to move beyond creating a buzz about aspects such as local seeds and create protocols for standardization and quality control and capacity build these seed savers.

New understandings/ philosophy/ realizations emerged

a. Young generation of communities still largely dependent upon ecosystem resources are not ready to engage with any conservation efforts which is focused on strengthening traditional livelihoods. Their aspirations are more modern and shaped by urbanization process.

b. Out of box thinking is needed towards smart networking among smaller conservation efforts/groups /institutions to survive in a emerging market and large capital based entities influenced reality of life

c. When it comes to ideas, experiences, histories it is highly unlikely that what is not digitized will survive in future.

Failure stories

a. Maharashtra Knowledge Corporation Limited (MKCL)'s participation in the larger MGB project did not materialize, effectively ruling out use of local ICT Hubs owned by MKCL for sustained monitoring activities. This required focus on largely offline methods of engagements with different stakeholders, esp. schools. With this course correction at the initial stage itself, this project component could effectively design and test biodiversity education curriculum and project ideas at a state wide scale.

b. Schools developing school biodiversity registers did not work to the expected level of more than 50% schools developing it. Schools did it at varying degrees depending upon a range of factors – teacher interest, time, facilitation by PSMs. For this to be achieved to a satisfactory level, much higher level of inputs than once a year training and hand holding, facilitation is required.

c. Subject linked projects has much more potential to be internalized by school system as it is mandatory and mainstreamed

Way forward

a. Website based participatory information management and further innovative programme designing

b. Developing extra-textual/non-textual pedagogic tools for bio-cultural diversity and sustainability learning and ESD, with an objective of facilitating effective participation by learners from diverse socio-cultural backgrounds esp. disadvantaged communities.

c. Understanding linkages between Biodiversity – Food & nutritional security and –economic development through action research

d. Educational resource development esp. audio-visual

e. Citizen science projects on useful plants, varietal diversity, status and conservation actions

f. Policy advocacy towards mainstreaming bio-cultural diversity and sustainability education with dossier development, co-creation of curriculum, text books, teacher training materials

g. Focused, learning led change programmes for indigenous community youth

Support structure? How are you planning to raise it?

Organizational support through a deliberative process within the organization as well as with different partners to develop a common understanding and collaborating to raise resources through new proposal development and networking.

How the learning/ achievements from MGBP should be taken forward (at organizational level/ thematic level/ regional level)?

Institutionally, MGBP learnings form an important base to further built the bio-cultural diversity and sustainability education work profile. These learnings are likely to further develop partnerships within organization involving different thrust areas and teams beyond biodiversity conservation and education such as sustainable rural development, education for children,

experiencing nature, eco-tourism and nature interpretation and communication for sustainable development. At thematic level meta learnings would help developing future strategies for intervention areas and approaches. Organizationally we should be having MGB experience sharing process towards cross pollination of ideas and developing similar initiatives in other regions/states.

How are you planning to make use of work done under MGBP in the work ahead?

- Synthesize meta learnings with a peer reviewed process
- Engagement with formal education system to integrate bio-cultural diversity learning as both content and constructivist methods in curriculum and textbook development, teacher capacity building and support learning resources.
- Strengthening and diversifying public communication including in Marathi in terms of media, content and outreach strategies
- Institutionalizing Biodiversity Educators Network in the state
- Strengthening participatory study and citizen science methodologies in areas of bio-cultural diversity study and conservation.
- Analyzing local and state level experiences from MGB using National and International frameworks such as Convention and Biological Diversity (CBD), Sustainable development Goals (SDGs) and Ecosystem Approach to Climate Change and Education for Sustainable Development (ESD)
- Showcasing the experiences and networking at National and International levels.
- By informing other programmes/activities with learnings from MGB
- MGBP has generated many ideas and areas needing further work
- Building upon resources created such as website to further enrich with content
- Developing partnerships with MGBP partner organizations in areas of biodiversity conservation and education with specs of climate change, sustainable livelihoods and learning especially focused on youth.

List of staff involved in the project with their posts and one liner introduction

a. Satish Awate, Principal Investigator and Programme Director, Biodiversity Conservation and Education, CEE. His interest areas include photography, indigenous art forms, biodiversity and cultural interactions, sustainability education, decolonization of history, education and methodologies.

b. Baswant Dhumane, Project coordinator (01/09/2016 onwards). Can speak Telugu, Kannada, Marathi, Hindi and English languages and grassroots networking, studying local plants, tree climbing, paper recycling are some of his interest areas.

c. Aparajita Rajwade, Project Coordinator (11/09/2014 to 09/09/2016).

d. Yuvraj Shingate, Project Officer. Has keen interest in reading, cultural politics of history, traditions and language.

e. Abhijeet Kamble, Project Officer. Geo-informatics, nursery techniques, multimedia trainings, agriculturally significant insects are his interest areas.

Besides these individuals who worked as project staff, other core staff who contributed in their different capacities are Tushar Patil and Ashok Thorve, both graphic designers, Rajendra Shivgan, documentation assistant, Kishor Choudhary, Asso. Accounts Officer, Dinesh Waghmare, Office Assistant. Shruti Kulkarni, Pravin Thete, Swapnil Newale, Vijaya Padekar and Interns at CEE Central contributed in number of ways. Avinash Madhale, Programme Coordinator, CEE and team Environment Service Scheme enriched the project with constant cross-fertilization of ideas and teacher training campaign support. Sanskriti Menon, Sr. Programme Director, CEE Central was instrumental in conceptualizing this project and ensuring overall institutional support at CEE. We are immensely grateful to 16 Paryavaran Shikshan Mitras Ravi Garud, Nandlal Meshram, Sahdeo Dahikar, Prashant Kasdekar, Sahebrao Rathod, Jageshwar Pal, Dhananjay Padghan, Vikas Kamble, Eknath Tatya Bagul, Datta Wadhekar, Kiran Kakade, Punesh Mochda, Santosh Agale, Vinod Ghodse, Meena Devre, Baburao Gaikwad, Vilas Sonawane, Subhash Khandare, Pravin Yannawar, Vandana Deore, who were based at MGB partner organizations as educators and implementation of school based programme components and various participatory studies and documentation was only possible with their enthusiastic support.

ANNEXURE 1

Comparative Study of effectiveness of learning approaches under MGB against the baseline - 2016

Shivarferi – neighborhood biodiversity exploration and documentation and habitat linked learning activities were designed under IEC for MGB component. With an objective of measure the effectiveness of these learning approaches and activities a baseline study was conducted in 2016. This is perhaps first of its kind study done to create a baseline for school level biodiversity learning in the state.

Baseline 2016

This study was done with 321 students and 187 teachers from 179 schools from 18 districts of the state. Some chose not to respond so actual sample size from this group for each dataset analyzed varies.

Number of trees recorded by students and teachers

As groups students and teachers recorded 183 and 180 respectively, unique names of trees. Together they recorded list of 257 unique names of trees. These need not necessarily number of tree species as same species is likely to have multiple local names, highlighting importance of photo documentation/herbarium development and arriving at standardized data bank with botanical names and regional variations of them.

As individuals, majority of students and teachers fall within bracket of 6 to 10 tree names with 36.2% and 41.2% respectively recording 6 to 10 tree names. Highest individual recording was done by a lone student in 36 to 40 names bracket.

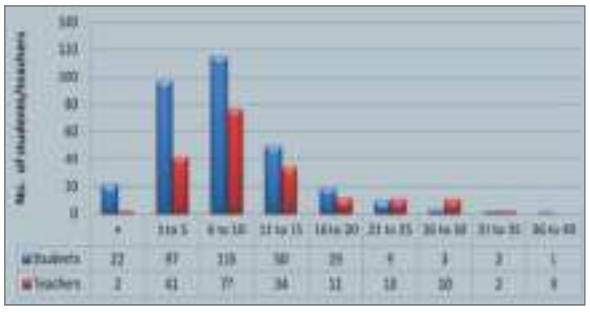


Diagram no. 1: distribution graph of students and teachers recording tree names

Seed identification

From a set of over 30 types of seeds of trees generally found in all parts of the state, 53.1% students and 50.7% teachers could recognize 6 to 10 seeds. Highest number of 21 to 25 seeds were identified by teachers.

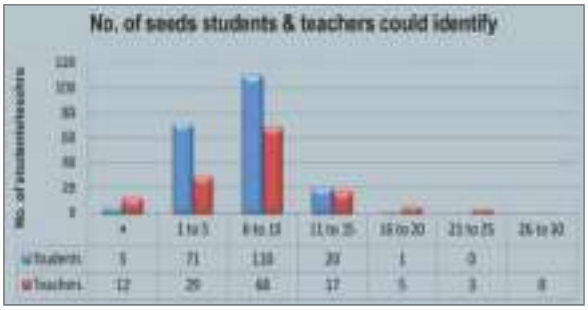


Diagram no.2: Distribution graph of student's and teacher's ability to recognize seeds

Non-cultivated food

Non-cultivated food items generally referred in Marathi as Ranmeva include plants derivatives such as fruits, tubers, resin as well as insect derived food such as honey. In this case, 43.1% of students and 54 % of teachers could name 1 to 5 non-cultivated food sources, while 20.1% students and 33.2% teachers recorded 6 to 10 names of Ranmeva. Two students recorded highest 21 names. As groups, students recorded total 91 unique names, while teachers recorded total 96 unique names of non-cultivated food items. Combined, the list grows to 135 unique names, indicating scope for co-learning between students and teachers. This also emerged as a significant area for research from food, nutrition and conservation point of view.

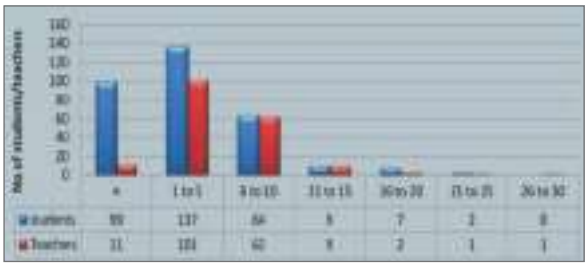


Diagram no.3: Distribution of students and teachers based upon number of non-cultivated food sources they recorded

Birds I know

All together students group reported 142 and teachers group reported 140 unique bird names. Among the student's highest recorder recorded 22 bird names. While 67 bird names were common between students and teachers, but the list of exclusive names was over 70 unique names with both the groups.

Butterflies I know

Overwhelming majority of 72.7% students did not report any name of butterfly. 25.3% were able to report 1 to 5 names and just 1.8% reported 6 to 10 names. Among teachers 64.6% did not report any name, 33.5% reported 1 to 5 names and 1.6% 6 to 10 names.

Fishes I know

Among students, 42.9% did not reported any fish name, 47.9% reported between 1 to 5 names, 6.8% reported 6 to 10 names and 2% reported 11 to 15 fish names. The figures for teachers were 19.5%, 54.8%, 21.8% and 4.3% respectively.

Situational questions

Out of 115 students and 156 teachers who responded, 66.9% students and 66% teachers chose 25% low yielding traditional variety against higher yielding hybrid variety. While as a group who supported traditional Jwari (sorghum millet) varieties were clearly able to report qualities like climate resistance, low water requirement, pest resistance, taste and nutritional superiority, low costs of inputs, good for soil health and good quality fodder. While the group which chose hybrid variety sighted reasons such as need to feed large population, low water requirement, higher yield in less space, low seed requirement, climate resilience as against local varieties. This indicated large scale awareness upon benefits of traditional varieties and typical misconceptions about hybrid seeds, Also indicating towards need for systems understanding about why traditional varieties have declined over time.

In response to another question on lower wages for women workers than male workers for same work, 83% students and 78% teachers opined that it was wrong to discriminate against women. While respondents were trying to form their opinions referring to their context and normative realities by ignoring the mention of same work in the question and attributing discrimination to men ability to do heavy works, also sighted reason was women are less sincere in doing work and arrive late at work. A male student argued in his response that even if women arrive late at work, one should not ignore the fact that she has to attend to domestic chores for whole family including men.

Use of google earth

9% students and 33% of teachers and educators responded positively of using google earth. Upon further enquiry they were found to be confusing it with using google map in the smartphones.

Mathematical competence

Students and teachers were asked to describe method to calculate height of a tree without physically measuring it and calculate volume of rain water that could be potentially collected on a roof of a building given its length, width and rainfall data. For measuring tree height no one from students as well as teachers could describe precise method using geometry. Only one teacher and no students could calculate the volume of rain water. It turned out to be an exciting experience for teachers when method of measuring tree height was demonstrated to them later during the Anandshala shibir.

Learning process and comparative study 2019

CEE designed a curriculum for bio-cultural diversity and sustainability learning as a guiding framework to design and implement learning activities in about 200 schools participating under the MGB from project areas of partner organizations.

Towards orientation and hands on learnings of educational approaches CEE designed a teacher-students residential training modules, as 'Anandshala Shibir' (A joyful learning camp). First module was focused on Shivar-Feri and other on learners' habitat linked projects-based learning (LH-PBL). Beyond these Shibirs the local learning process was facilitated by grassroots educators from partner organizations, also separately trained by CEE.

In 2019, a third module of Anandshala-Shibir was organized to share learnings across the schools and do a comparative study of learning outcomes and effectiveness of the learning process under MGB against the baseline created in 2016.

In 2016 baseline was created with participation of 318 students while it was possible to do comparative study in 2019 with 103 students who went through learning process under MGB. Following table provides information on standard wise distribution of 2016 and 2019 students' participation in the study.

Sr. No.	Classes (Std)	Baseline 2016	Baseline 2019
1	3rd	6	0
2	4th	18	2
3	5th	14	0
4	6th	11	0
5	7th	58	17
6	8th	69	16

Sr. No.	Classes (Std)	Baseline 2016	Baseline 2019
7	9th	56	40
8	10th	17	16
9	11th	19	4
10	12th	10	4
11	Other	1	0
12	Std not written	39	4
	Total	**318**	**103**

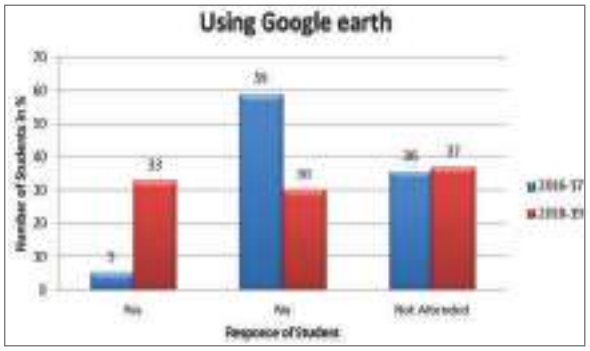
For comparative study, we randomly selected 17, 16 and 40 students of Std. 7, 8 and 9 respectively from 2016 sample to compare against 2019 students of same sample size.

Sr. No.	Classes (Std)	Baseline 2016	Baseline 2019
1	7th	17	17
2	8th	16	16
3	9th	40	40

Below presented is graphical representation of this comparative study.

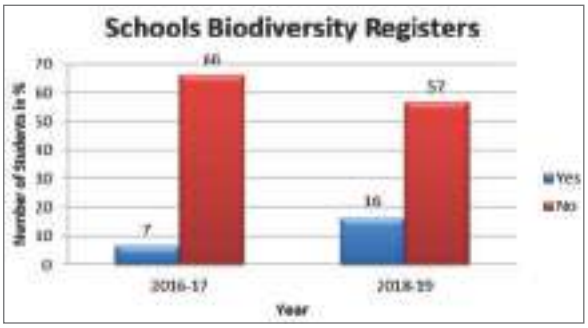
Using google earth

Familiarity of students with google earth went up from 5 to 33%.

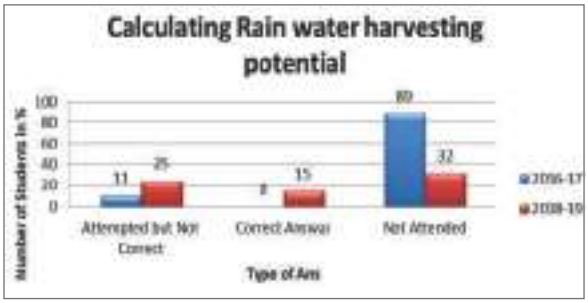


Whether you have prepared school biodiversity register

Change from 7% to 16% was against anticipated change under the project and it emerged as a learning that while schools carried out Shivar-Feri enthusiastically and even repeatedly, meticulously documenting these in the register was not realized in absence of systemic incentives for schools and teachers. In present situation, more inputs are required to get schools prepare school biodiversity registers.

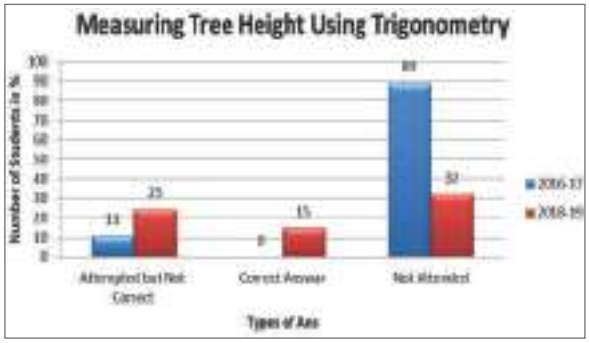


Basic Mathematical competency among the students: calculating rainwater harvesting potential of a hypothetical school roof of given dimension (110ft x 40ft) if rainfall was 890 mm.

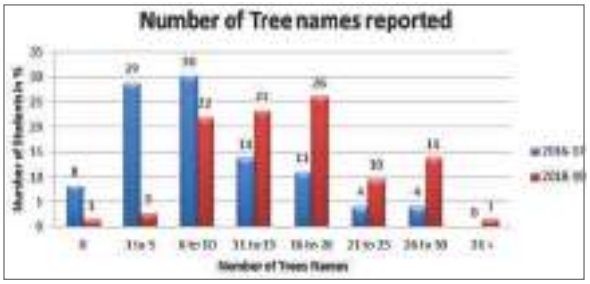


Poor basic mathematical competencies, at 7th grade such as calculating area, volume and conversion of units; prove limiting to effectively conduct environmental education activities using real-life problem-solving approach, which are inherently multi-disciplinary. This was very clearly established during the baseline, which is in line with regular studies conducted by government and non-government agencies to assess learning levels for basic math and language. With this challenge learning approaches esp. habitat linked projects-based learning (HL-PBL) promoting using various subject competencies showed potential to be beneficial to improve basic subject competencies including mathematical.

Measuring tree height using trigonometry

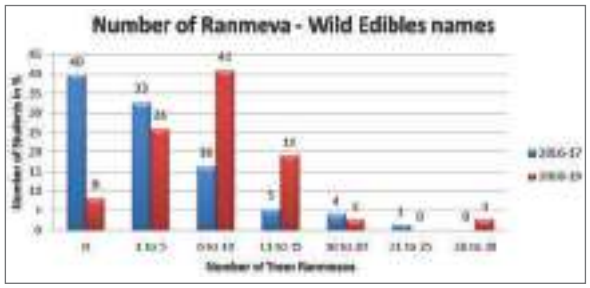


Name the trees you know



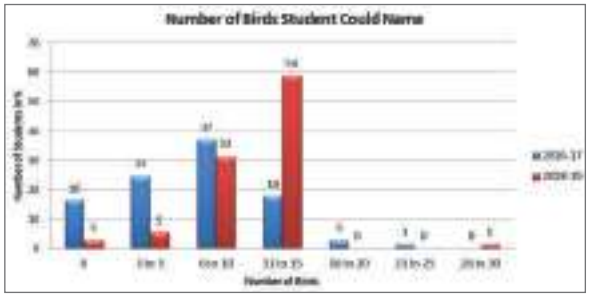
It is clearly evident that Shivar Feri and other learning activities exploring neighborhood are effective in improved learnings as reflected in retention, recall on tree species.

Raanmeva- Wild edible foods (Ready to eat without any processing)



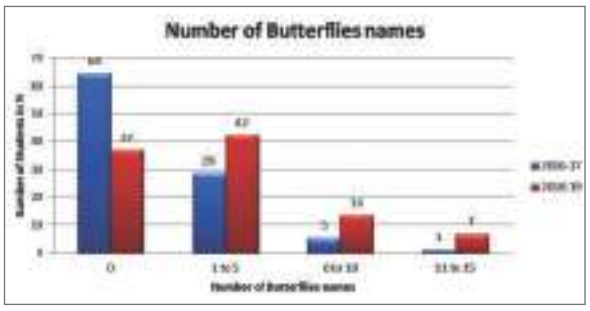
Largest number of students shifted positively from being able to tell up 5 names to up to 10 names in 2019. Also, there is significant increase from baseline in 11-15 category. Ranmeva has emerged as an significant topic for further work with student community in terms of botanical identification from over 130 local names generated, and nutritional analysis, communication and conservation actions.

Birds I know



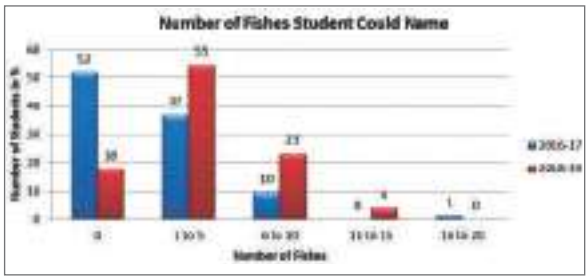
Bird watching was among popular activities conducted by schools during Shivar Feri, aided by field guides, binoculars and facilitation under MGB project. Impact of this is clearly evident in 59% students able to name 11 to 15 birds and one student reaching up to 26-30 category.

Butterflies I can name



Butterflies and insect are among the groups with least local names available in any community setting, as reflected by majority of students not able to name any butterfly in 2016. With butterfly field pocket book developed and exploration activities in 2019 majority of the students could name 1 to 5 names and 7% naming 11-15 names.

Fish names

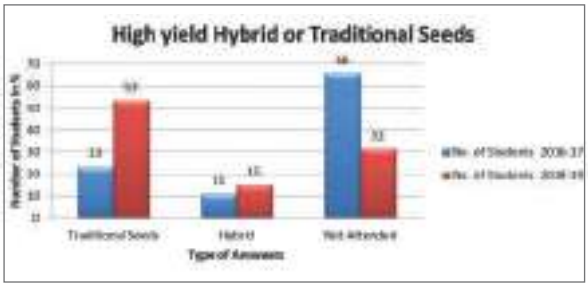


Similar improvement can be observed in case of fishes as well.

Situational questions to understand values and perceptions

Choice between comparatively low yielding local variety of Jowar and HYV

Question asked was: What would you choose between traditional/local variety yielding 800kg/acre and a hybrid variety yielding 1200kg/acre? And Why?



In 2019 students who responded to this question doubled, resulting in increase in both the choices. In both the years more students chose traditional/local variety over hybrid though in 2019 the number increased by more than double.

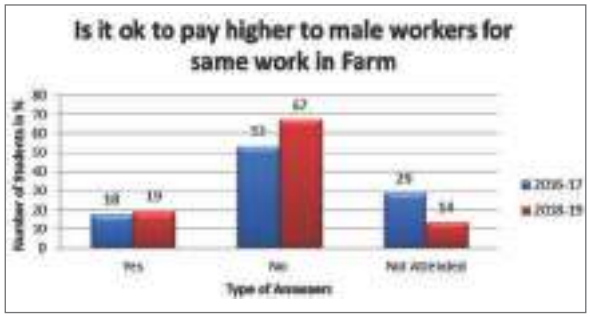
The reasoning provided for making these choices is summed up in below table

Choosing traditional/local variety	Choosing hybrid variety/HYV
Good for health, no need of fertilizer application, tasty and nutritious, high in nutritional value, fetches better price, hybrid food causes diseases	Yield is higher

This can be understood either as possibility of 'playing to the gallery' by the respondents or influence of recent buzz around traditional/local/organic food in various media. It also highlights the complex pathway towards desired change from appreciation of local and nutritious foods to changes in agricultural system. Consumers,

markets and policies all play crucial role in bringing about this complex change.

Is it OK to pay higher wages to male workers than women for same work in the farms? Why?



2019 survey showed increase in those opining it as OK and not OK, though later increase is bigger. It is interesting to understand the reasonings provided and how learners contexts and prevailing social norms play an important role in shaping such values.

Below table summarizes the reasoning provided for both the opinions.

Not OK	OK
Women too work equally, there should be equality, same work-same wages, women should get more wages	Men work more, women work less, women waste time in chatting, men work more in same time, because wages depend upon quantum of work done.

Gender perspectives are still largely shaped by learners' family and immediate social norms and experiences. Schools need to critically engage with these issues and can play positive role in exploring complexities and developing sense of gender equality and sense of justice. This potential was demonstrated by two opinions expressed by students in 2016. First, a student opined that 'since agricultural produce do not get fair prices in market, farmers are unable to pay more/equitably', and another opined that' if women generally came late to work on farms, and men earlier it was due to the fact that women have to take care of home chores like preparing food, while men did not. We should be considerate to this fact'.

Learning approaches designed and tested under MGB demonstrated their effectiveness as discussed above. Following are concluding remarks

Teacher capacity building in areas of constructivist learning facilitation is critical for they being able to play role of effective facilitators.

Quality learning material which is accessible and useful in learners' diverse contexts is an important input towards effective learning about bio-cultural diversity.

For something like School Biodiversity Register (SBR) to be effectively implemented, presently continuous external facilitation is required by persons/ organizations with that mandate. A policy recommendation, Shivar-Feri and SBRs need to be acknowledged as effective methodologies to develop constructivist learning capacities at schools, benefit from learners environment and communities social/cultural capital as enriching learning resources and also develop skills and competencies among learners to face local as well global challenges such as climate change and environmental degradation and realize potential of education as a driver of socially just and economically and ecologically sustainable developmental process.

ANNEXURE 2

Seed Germination Testing by School Students under IEC for Maharashtra Gene Bank Project

Context

Germination percentage forms an important quality of seed for both local seeds as well as proprietary seeds procured from market. In 2011, Maharashtra saw unprecedented large-scale failure of seed germination affecting crop on over 34000Ha in 25 districts. With over 31000 farmer complaints, the State Government in 2012 banned 15 seed production companies permanently with acknowledgement that as many as 70 to 80 companies were providing seeds with sub-standard, low germination potential. Problem has become recurring with over 1.6 lakh complaints and 83 FIRs lodged against the seed companies in 2020.

Activity

Recognizing this challenge CEE undertook hands on learning activity introducing students seed germination testing using specially designed paper procured from manufactures in Hyderabad, Telangana. A comparison was also carried out with use of newspaper in place of this special paper. This process was facilitated by Paryavaran Shikshan Mitras (PSMs) with partner organizations.

[1]https://www.downtoearth.org.in/news/maharashtra-bans-15-seed-companies-permanently-38114

[2]https://indianexpress.com/article/cities/pune/more-than-1-5-lakh-complaints-83-firs-against-soyabean-seed-germination-failure-in-maharashtra-6534975/

Findings

Students tested 19 different crops and varieties within. One test report has no clear mention of name hence that's been excluded. Total 91 sample tests were conducted, largest being rice samples including varieties Tamsal, Havla, Ghansal, Jai Sriram, Hiranakki, 1010, RPN, Sri Krushn. Tur or pigeon-pea was second in terms of samples tested with 17 samples, followed by wheat (11), Green Gram (9) and Black Gram (8).

Traditional rice varieties being conserved under MGB project such as Hiranakki, Tamsal, Havla, Ghansal showed germination potential between 91 to 95 %. One rice sample tested in Bhandara gave lowest 38% germination was an exception and perhaps older sample with naturally reduced viability.

Among 4 samples of Jowar/Sorghum millet, Gidgyap showed highest 95% germination while Talaki variety showed lowest 88% rate.

Queries and discussions happened in student groups

During the process of carrying out this process, students inquired about

1. What is the cost and where to access germination test paper from?

2. Can this paper be reused?

3. Are there alternatives to this germination paper?

4. What is good the germination percentage?

5. Why to soak seeds before testing, how long?

6. When to unwrap and check germination?

7. What is Dubar Perani (Repeat Sowing), can farmers get faulty seeds replaced? What to do if seed merchant refuses to replace the faulty seed?

Paryavaran Shikshan Mitras (PSMs) facilitated this process and clarified the queries raised by students.

Comparison with newspaper

Students were curious to check if other to this special paper can be used with same effectiveness. Students tried this using newspaper with 12 seed samples of rice, wheat, coriander, Bengal gram and beans.

The results ranged between 91 to 100 percent, suggesting newspapers as good for testing as special germination paper which is available at Rs.200/250grams. Students were told about possibility of using cloth, gunny bags as well for this.

Crop wise germination tests results summary

Sr. No.	Crop Name	Days needed for Germination	Percentage Range	No. of Tests
1	Black gram	3 to 7	80 to 98	8
2	onion	3	81	1
3	Wheat	3 to 6	56 to 97	11
4	Bengal gram	4 to 6	88 to 100	6
5	Black-eyed pea	6	96	1
6	Sorghum	4 to 6	88 to 95	4
7	Sesame seed	3 to 6	84 to 96	2
8	Pigeon pea	4 to 7	78 to 100	17
9	Coriander	12	100	1
10	Rice	3 to 6	38 to 95	18
11	Pearl millet	7	97 to 99	2
12	Moth bean	4 to 6	92 to 96	2
13	Red Lentil	NA	100	1
14	*Mugti*	4 to 5	86 to 93	2
15	green gram	3 to 7	82 to 98	9
16	Black mustard	4	90	2
17	Green Pea	5 to 6	93 to 97	2
18	Soybean	6	96	1
19	Lima bean	6	96	1

ANNEXURE 3

Report on Habitat linked Projects Based Learning (H-PBL) under Maharashtra Gene Bank project

Introduction

Biodiversity education program design under MGB was consciously guided by learning focused philosophy as opposed to 'instrumentality' approach where students are considered as instruments of collecting information, doing certain actions as a contribution fulfilling some biodiversity conservation or some developmental purpose at institutional or community level other than essentially educational. Contributions to conservation and community development through action learning approaches were posited as co-benefits of an essentially a carefully designed learning process. Instrumentality approach is widespread due to traditional approach to skill focused learning, lack of training among educators and resources including time to design a well structured learning process. Annual tree plantation activity is best example illustrating this problem where children are engaged in pit digging and plantation activities but not in understanding ecology, soil, discussions on purpose and planning of plantation, understanding appropriate plants serving the purpose, does and don'ts.

Key challenge was acceptance of biodiversity learning as something very much curricular and supportive co-curricular among teachers/schools. Teacher training and adaptive designing of learning activities were two approaches followed to overcome this challenge. Contrary to expectation this emerged as serious limiting factor with Shivar-Ferii. e. neighborhood biodiversity exploration and School Biodiversity Register (SBR) development. While schools conducted Shivar Feri, even repeatedly, meticulous documentation was followed by much lower number of schools than expected. Clearly there was no incentive for schools as an institution to develop SBRs.

During first round of teacher and students training workshops (Anand Shala Shibir) through informal discussions with teachers and students, it emerged that students are doing project work as mandatory activity but quite contrary to the 'Constructivist' approach to learning as part of formal policy by way of National Curriculum Framework (NCF) -2005, which brought projects-based learning in to formal education system as one of the methods for formative and summative evaluation under Comprehensive Continuous Evaluation (CCE).

This led to MGB project wide study to understand status of school projects, topics, methods and materials used, costs and learning outcomes. This also highlights one of the key strengths of MGB project as it provided scope of adaptive management addressing emerging needs while working with communities including school community under the project.

Context

National Curriculum Framework (NCF) -2005 adopted 'Constructivist' approach to learning at school level. In 2009 Government of India enacted 'Right to Education Act' making education up to 8th standard free and compulsory. This led to designing of new syllabus and textbooks and also evaluation system and teachers' orientation. In 2010 Government of Maharashtra issued a Government Resolution (GR) in this regard providing road map to fundamental changes in education system, abolishing annual examination system up to standard 8 and introducing CCE as new method for student evaluation.[1]

As per this GR, teachers are expected to use appropriate methods for CCE from list below:

1. Daily observation,
2. Verbal expression,
3. Individuals or group activities,
4. Demonstration/experiment,
5. Project work,
6. Class work,
7. Short term unannounced tests and
8. Other such as quiz, self and peer evaluation, group work etc

Standard wise weightage between formative and summative evaluation for each of 2 semesters in a year as per this GRis presented in table below:

No.	Standard	Formative Evaluation %	Summative Evaluation%
1	1st and 2nd	70	30
2	3rd and 4th	60	40
3	5th and 6th	50	50
4	7th and 8th	40	60

[1] शासन निर्णय क्रमांक: पीआरई/2010/(136/10)/प्राशि-5, 20 ऑगस्ट 2010

Study Methodology

Students interviews as primary source and project material from market, GR and teacher experiences as secondary sources. A participatory research method was used where ParyavaranShikshanMitra (PSMs) were oriented to both projects- based learning and evaluation system and method of student interview and filling the forms. These PSMs were, in the larger process under MGB; were oriented on educational approaches, understanding education system and environment and sustainability learning approaches as well.

Sample size

Total 1192 students were interviewed from 15 districts of Ahmednagar, Akola, Amaravati, Aurangabad, Bhandara, Dhule, Gondia, Hingoli, Jalna, Kolhapur, Pune, Nanded, Nandurbar, Sangli andWashim.

District wise distribution of samples is as below

Sr. No.	District	Number of students interviewed
1	Ahmednagar	45
2	Akola &Washim	172
3	Amaravati	52
4	Aurangabad	101
5	Bhandara	140
6	Dhule	90
7	Gondia	46
8	Hingoli	109
9	Jalna	123
10	Kolhapur &Sangli	18
11	Pune	96
12	Nanded	57
13	Nandurbar	121
14	Not Mentioned	22
	Total	1192

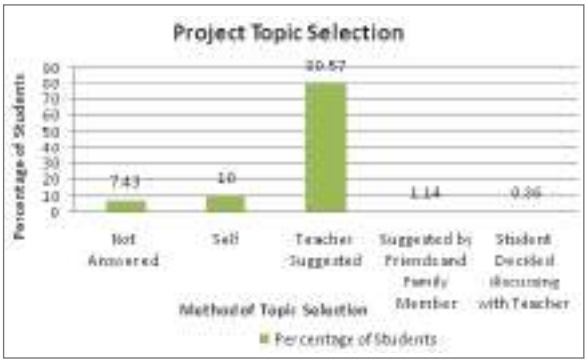
Normalization of data sample for analysis

Out of total sample size 35 boys and 35 girl students were randomly selected from standards 5th to 9^{th,} making sample selected for analysis as 350 students.

Results

1. Who chose the project topic?

Topic selection is overwhelmingly done by teachers.



Less than 1% responded that teacher and students discussed and decided topic for project. Three projects where teacher-students discussed and decided topic were:

1.Modes of transportation

2.Communication tools

3.Collecting seeds from neighbourhood

Method of Project Topic Selection

Sr. No.	Method of Topic Selection	No. Students	Percentage of Students
1	Not Answered	26	7.43
2	Self	35	10.00
3	Teacher Suggested	282	80.57
4	Suggested by Friends and Family Member	4	1.14
5	Student Decided discussing with Teacher	3	0.86
6	**Total**	350	100

2. Project topics

Great leaders, saints and scientists were found to be most frequently prescribed topics, followed by topics such as collection of Proverbs, Idioms, Stories and Poems. Fruits and flowers, Birds and Animals follow the list. Most of the projects are based on copying or readymade sticker pasting method, where students are hardly able to construct any knowledge.

List of top 10 project topics is as below:

No	Topic	No. of students reported doing it
1	Great Leaders, Saints, Scientists, Writers, Poets	58
2	Collection of Proverbs, Idioms, Stories, Poems	31
3	Collect information on trees, fruits and flowers	30
4	Write about birds and animals around you	23
5	Collection of sketches (stickers) -birds, butterflies and leaders	16
6	Synonyms and Antonyms	15
7	Mathematical Formulae and Geometric Drawings	13
8	Seed Collection	13
9	Collection of information on festivals and fairs	10
10	Information of Forts	7

Apart from these top ten topics students reported 54 more topics attached as annexure 1.

3. Project Material

Sr. no.		Materials Used
1	Books	About Leaders and Sayings/ Quotes
2	Notebook	Project Notebook, 4 liner notebook
3	Pen, Pencils	Color pens, Sketch pens and Marker pens
4	Paper	Chart Paper, century paper, Project paper, *Ghotiv* paper
5	Other stationery	Stapler, pins, scale
6	Newspaper	Daily and old newspaper cuttings
7	Color	Water colors
8	Grain	Jwari (Sorghum millet), Bajri (Pearl millet), Rice, Pulses and other grains
9	Decoration material	Cover paper, cloth, scissor, icecreame sticks, fevicol/Glue, Thermocol, Alluminium foil
10	Stickers	Birds, Fruits, Leaves, Flowers, Butterflies, Trees, Currency Notes
11	Other	Lens, Internet, Xerox/Photocopy

Materials and extent of use

Sr No	Material	No. of students reported use
1	Internet	17
2	Xerox/Photocopy	28
3	Special project notebook	140
4	Stickers	134
5	Books	19
6	Color pens	176
7	Scale	79
8	Project papers	126
9	Glue	57

4. Learnings from project works as student were able to recall

Sr.No.	What student was able to recall	No. of Students	%
1	No response or could not recall anything	26	7
2	Could recall only project topic title and couple of words	218	62
3	Recall project title and aspects of study (broad elements within project work)	86	25
4	Could recall topic, elements and able to tell details about at least one element/aspect	20	6
		350	

Random 10 examples illustrating project work process as described by students

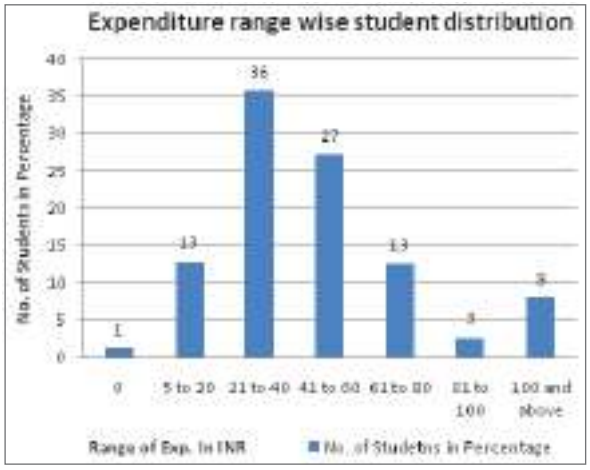
S. No.	Std	Subject	Project Topic	Method/process as reported	What you learned/can recall
1	5	Maths	Drawing	Got drawing from friend and colored it	Bird was sitting on a tree
2	6	Science	Seed Collection	Collected seeds from farm field, village and playing ground and kept them in small pouches.	I collected seeds from various places and had fun.
3	6	English	Capital, small letters and names of body parts	I wrote ABCD and names of body parts in this project	I wrote Capital and small letters and names of body parts
4	6	History	Collecting information on Forts	Bought all the project material from market	Raigad, Shivneri, Panhala, Pratapgad
5	7	History	Information of Great Leaders	I wrote about great leaders	Wrote about great leaders
6	8	English	Information of Computer	Bought a picture/image of Computer to know about it	CPU, Mouse, Keyboard, USB PIN, Monitor as parts of Computer
7	8	Geography	Information of Oceans	Took help from teacher, textbook and map to find about oceans.	Arabian Sea, Indian Ocean
8	9	Science	Collection of medicinal plants	Collected medicinal plant leaves. Bought project material and stuck leaves on it and wrote names	Wrote about 5 medicnal plants Hibiscus, Neem, Tulsi, Aloe vera, *Movari* (?)
9	9	Science	Medicinal Plants	1. Found names of medicinal plants on internet using smartphone. 2. Made separate notebook for project 3. Wrote plant information on other side of page leaf, stapled all the pages, used color pen.	1. I decorated my project with cover 2. My project notebook was blue in color 3. I collected lot of information, but now can recollect names of *Anola, Nirgudi and Tulsi*
10	9	Marathi	Collection of songs related to agriculture	Bought project material from shop, read and collected information. Prepared project notebook by drawing on left side and song on right side	Collected 12 songs but can not recollect now, neither song nor title.

5. Evaluation of project work

S.No.	Marks	Students	%
1	Marks were not told, can not remember, no response	149	42.57
2	Was not evaluated for marks	5	1.43
3	Marks were known to students	196	56
	Total	350	100

Only about 15% students reported that they received back their project works after evaluation. About 75% reported project works are kept in the school.

6. Expenditure on project work



It is noteworthy that majority of students participating in this study came from rural and remote forested areas, and generally from poor to moderate economic backgrounds and government aided schools; who reported average Rs.52.36/student expenditure. This expenditure grows manyfold in case of urban areas and private schools and in case of higher standards. Even at this average expenditure parents of 2.28 Crore students[2] in Maharashtra are spending close to Rs.120 Crore annually on school projects, with questionable learning outcomes. Adding to it invaluable time spent by students, teachers, parents, this is highly important issue for State Education Department to address by way of better teacher training and facilitating access to quality learning resources for students. Currently it is driven by market products pushing for set pattern of copy pasting ritual.

To understand market and products, a review study was conducted under MGB.

1.District wise school project material collection and review

Project resource materials available in local markets were collected from 9 districts viz. Sangli, Nanded, Aurangabad, Dhule, Gondia, Hingoli, Pune, Jalna, and Kolhapur

List of materials collected was as follows:

1. Pencil
2. Eraser
3. Sharpener
4. Project writing book
5. Color craft paper
6. Gel Pen
7. Gum
8. Scale
9. Ballpen
10. Project paper
11. File
12. Crayons
13. Color cello tape
14. Sketch-pens
15. Stapler
16. Stapler pin
17. Charts(stickers)

Overall Quality issues

Except couple of publications as exception, majority have low quality paper and printing. Even glue used on the backside of the stickers too was found to be of poor quality. Single color printing in few charts made identification of the chart elements difficult for students especially biodiversity elements.

Language

Out of 121charts we reviewed, only 24had Marathi names of elements along with Hindi, Gujarati and English. These charts were found to be printed in either Mumbai or outside Maharashtra.

Reviewed charts contained following subjects/topics

1. Birds, 2. Trees 3. Fruits 4. Famous Indian Women 5. Forts of Maharashtra 6. Famous Temples in India 7. Aquatic Animals 8. Insects 9. Tourist places 10. Body parts 11.Domestic Animals 12. Pet Animals 12. Wild Animals 13. Medicinal Plants 14. Vegetables 15. Scientists 16. Forts in India 17. Animals and habitats 18. Uses of Animals 19. Freedom Fighters 20. Saints 21. Great Leaders 22. Air pollution 23. Fishes 24. Snakes 25. Marine Animals 26. Amphibians 27. Reptiles 28. Birds and their nests 29. Life cycle of butterfly 30. Indian butterflies and moths 31. Types of butterflies 32. Indian crops 33. Cash crops 34. Tuber crops 35. Other important crops 36. Companies in India 37. Festivals in society 38. Life of the earth 39. Traffic rules 40. Global Warming 41. Pollution 42. Indoor games 43. Suryanamaskar 44. Hills and other famous places in Delhi

Content related issues

1. Species depicted were exotic species. Wild species charts were found to contain mostly African animals. Exotic species dominated in fruits, vegetables, flowers, wild animals, domestic animals charts as well.

[2]https://student.maharashtra.gov.in/stud_db/EducationSec/edusec_second_mis

1.1 Example: Chart: Types of butterfly (102918): Incorrect title, Viceroy and Sulphur butterflies are from American continents. Other exotic species such as Cynthia moth, Small Emperor moth (Atlas).

1.2 Butterfly (104317) – Species from NE India – Dark Judy, and South India – Malabar Banded Swallowtail. Lifecycle stages not named, unclear illustrations.)

1.3 Wild Animals – 105332 – 13 out of 20 species depicted are exotic

1.4 Birds – 105502 – exotic species, incorrect names. Parrots are not found in India

1.5 Flowers 110635 – overwhelmingly exotic selection

2. Missing information

2.1 Butterfly (104317) Lifecycle stages not named, and illustrations are unclear)

2.2 Leaves 100535 - Palm leaves shown with no Marathi names

3. Incorrect names/photographs such as Cicada is mentioned as cricket

3.1 Insects (103957): Quality of paper and illustrations (bed bug), Incorrect names – Dragonfly mentioned as *Tol* (locust) and *Patang* (moth), incorrect illustrations – locust with 2 legs, no application of scale – flea is bigger than honey bee.

3.2 Fruits – 104617 – Exotic fruits, bad quality images, incomplete names – melon for musk melon and in chart, Fruits 110819 – inclusion of sugarcane as a fruit)

3.3 Vegetables 100232 -incorrect images given for *palak*, *kohala* (ash gourd)

4. Diversity of names for single elements was missing, with exception such as *Sonde, Toke* for rice weevil.

5. Unrealistic depiction/drawings such as mushroom with green color stem/stalk.

5.1 Example, Insects (103957): incorrect illustrations – locust with 2 legs, no application of scale – flea is bigger than honey bee.

5.2 Chart: Trees and leave (110926) – unrecognizable images, incorrect representation of cashew fruits as bigger than leaves

5.3 Reptiles – 111351 -Exotic species, incorrect names gharial as gavial, caiman, not true to scale

5.4 Fishes 111434 – Exotic, no mention of marine fishes, not true to scale, wrong image of guppy

Publishing companies and fake addresses

All the material collected and reviewed was produced by 90 publishing companies. Out of these 19 had mentioned website addresses, out of which 9founds to be fake/non-existent.

Product Prices

Price of materials used was found to be of range between 50 paise to 50 rupees. Project paper is priced at 50 paise/page and stapler was the costliest material. Following charts were found available in the market,

Habitat Linked Projects Bank developed and tested under MGB

In context of carefully studied reality of school projects as discussed in sections above, CEE developed a basket of project ideas linked to learners' habitat. This project ideas bank included total 64 projects with articulation of objectives, resources required and methodology with tips on presentation and extension ideas. 16 project ideas were developed as common across the themes and 48 theme focused project ideas. List of these project ideas is provided in Annexure 2.

Theme wise Project numbers

After hands on trials of projects during Anandshala Shibir (2017), students and teachers made a selection of projects of their interests and plan to work on those ideas, mainly in their class and wherever possible involving students from their school at large. As part of their plans, schools chose total 42 project ideas, and within a year they reported back with submissions of posters on 29 project ideas which students worked on. Below is a top 10 list of project ideas those were selected and actually worked on and reported by schools during Anandshala Shibir, 2018. By November 2018, Students from 59 schools reported 216 projects related to biodiversity theme linked with different subjects. Overview of top selected and done projects is as below.

No.	Themes	Number of Project Ideas Developed
1	Grassland Biodiversity	09
2	Agro biodiversity	18
3	Fresh Water Biodiversity	13
4	Forests Biodiversity	08
5	Common	16
	Total	64

No.	Project ideas selected	Project ideas reported back
1	What's all in my plate	What's all in my plate
2	Making greeting cards using grass species	Domestic animal breeds
3	A day in a life of my mother and father	Rock and soil types in my village, A day in a life of my mother and father, How much children spend on packaged/processed food?
4	How much children spend on packaged/processed food?	Herbarium, Making greeting cards using grass species
5	Rock and soil types in my village	Study of fodder, Young Historian – History of my village, Tree and associated life forms, Diseases of domestic animals
6	Crops and pests	News article collage on organic farming, Grass studies using quadrat method, Crops and pests, wild vegetable festival in school
7	Diseases of domestic animals	Local festivals calendar, Bio-cultural map of village, Making Dashparni Ark (herbal pesticide and growth promoter), government schemes related to agriculture, My village, food festival and local recipes, Water Tank in my village, illustrated map of water tank, visit to fishing cooperative.
8	Domestic animal breeds	
9	Making Dashparni Ark (herbal pesticide and growth promoter), Photo story, Tree and associated life forms	
10	Study of fodder	

Conclusions

- Schools projects as currently implemented in the schools are not contributing to constructivist learning as envisioned in NCF-2005 and the Government Education Policy.
- Markets are driving copy-pasting approach to projects, creating duel burden of wasteful expenditure and stymying learning and knowledge generation process. This is creating mirage of learning even after 15 years of policy change advocating learner centric approach and shifting learning from rote methods and connecting knowledge to life outside the school.[3] Latest National Education Policy-2020, released by Government of India, too has a guiding principle of 'emphasis on conceptual understanding rather than rote learning and learning-for-exams'.[4]
- There is a need for quality education resource materials to facilitate projects based learning in the school, designed in a way to facilitate constructivist learning with structured feedback from teachers/ educators at appropriate stages which could guide learning process as well as contribute to analytical and presentation competencies development.
- Teachers are not trained adequately in constructivist approaches in learning
- Habitat linked Projects Based Learning (H-PBL) received interest and acceptance from students and teachers.
- H-PBL approach showed potential of linking learning process to study, management planning and natural resources based developmental process at local level. This method of learning is found to be useful in improving learning in a joyful and experiential manner. Incidentally, H-PBL along with local bio-cultural diversity exploration approaches under ShivarFeri and developing School Bio-diversity Registers (SBRs) are well correspond to following guiding principles as articulated under National Education Policy -2020[5]
  - Multidisciplinarity and a holistic education across the sciences, social sciences, arts, humanities, and sports for a multidisciplinary world in order to ensure the unity and integrity of all knowledge
  - Promoting multilingualism and the power of language in teaching and learning;
  - Life skills such as communication, cooperation, teamwork, and resilience
  - Respect for diversity and respect for the local context in all curriculum, pedagogy, and policy, always keeping in mind that education is a concurrent subject
  - A rootedness and pride in India, and its rich, diverse, ancient and modern culture and knowledge systems and traditions;

[3]https://ncert.nic.in/pdf/nc-framework/nf2005-english.pdf, pg.5
[4]https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf, pg.5
[5]Ibid

Annexure 3.1: Prevailing School Project topics other than top 10.

1 शेतकऱ्यांची मुलाखत
2 आपली घरे
3 कीटकांची माहिती
4 खडकाचे प्रकार
5 गाव दरवाजाचा इतिहास
6 गोष्टी तयार करणे
7 ग्रीटिंगकार्ड बनविणे
8 चुंबकीय प्रयोग
9 जीवनसत्वांचा अभ्यास करणे.
10 ठिबक सिंचनचे मॉडेल
11 थर्मोकॉल कटर
12 दळणवळणाच्या साधनांची माहिती
13 नफा तोटा
14 नागरिकशास्त्र (भूदल, नौदल, वायुदल)
15 नान्या विषयी माहीती गोळा करणे
16 नायट्रोजन सायकल
17 नैसर्गिक साधन संपत्तीचा वापर फायदे व तोटे
18 पंचनइंद्रीय व त्यांचे कार्य
19 परिसर- (अन्न पदार्थातील अन्नाघटकांचा उपयोग)
20 परिसरात आढळणाऱ्या गवताचे प्रकार व माहिती
21 पवनचक्की माहिती
22 पाच प्रसिद्ध महिलांओ की जानकारी करो
23 पाण्याचे शुद्धीकरण, श्वसन, लगेच होणारे बदल अनुभवने
24 पालेभाज्यांची माहिती लिहिणे
25 पावसाच्या पाण्याची बचत
26 पेशीची माहिती
27 प्रतिकृती तयार करणे
28 प्रदूषणाची माहिती
29 फुलदाणी बनविणे
30 बटरफ्लाय गार्डन
31 बश्यानपासून वस्तू बनवणे
32 भूगोल- विविध देशाची माहिती
33 मराठी-(टीव्हीवरील जाहिराती)
34 माळा बनवणे
35 मॅग्नेटिक स्क्रीन
36 मेजपोश
37 मेरा देश महान
38 मोज्याचा स्नो मॅन
39 लसीकरण प्रतिबंधाचा उपाय
40 लेटर पॅड बनवने
41 लोकर पासून ताटावरचे झाकण तयार करणे
42 वाचन कोपरा
43 वातावरण संतुलित ठेवण्यासाठी माहिती लिहणे
44 वाद्यांचा संग्रह
45 वाहत्या पाण्याचे व्यवस्थापण
46 (पाणी आडवा आणि पाणी जिरवा)
47 विज्ञान-(अन्नपदार्थातील अन्नघटकांचा चित्राचं संग्रह व त्यांचे उपयोग)
48 शेती विषयक माहिती
49 संगणकाची माहिती तयार करणे
50 संदेश वहन व त्याची साधने
51 समुद्राची माहिती गोळा करणे
52 सिंचनाच्या आधुनिक पद्धती
53 स्वच्छ भारत अभियान
54. हिंदी- पाणी के फायदे

Annexure 3.2: List of project ideas developed under MGB (in Marathi)

मजको अंतर्गत शालेय प्रकल्प बँकेतील विकसित प्रकल्पांची यादी

कॉमन शालेय प्रकल्प

- जैवसंस्कृतिक नकाशा बनवणे
- आई बाबां दिवसभर काय काय करतात
- चला फोटोंची गोष्ट करूयात
- झाड नावाचे गाव
- पावसाचा अंदाज व पाणी शोधायच्या स्थानिक पध्दती
- माझ्या ताटात काय काय?
- विकतचा खाऊ अभ्यास.
- स्थानिक रेसिपी (पाककृती) आणि खाद्यमहोत्सव
- स्थानिक सण व शेती, जंगल, गवताळ कुरण, तळी यांचा सहसंबध तपासणं

स्थानिक पिकं व जनावरं वाण विविधता

- कलर चार्टच्या साह्याने पिकांमधील अन्नद्रव्यांची कमतरता जाणून घेणे
- गाव शिवारातील दगड – माती
- गावातल्या पिकांच्या किडीचा अभ्यास
- गावातील जनावरांच्या स्थानिक जातींचा अभ्यास
- बियाणे उगवण क्षमता आभ्यास
- वर्तमानपत्रात सेंद्रिय शेतीसंबंधी येणाऱ्या बातम्यांचे संकलन व प्रदर्शन करणे
- विद्यार्थी समितीने बनवलेले गावचे बजेट
- आम्ही शोधलेला आमच्या गावचा इतिहास
- कधी आणि का बरं कमी–जास्त होतात शेतमालाचे बाजारभाव ?
- चारा अभ्यास
- गावातील जनावरांना होणारे आजार
- दशपर्णी अर्क व हंडी औषध करणे व वापरून पाहणे
- शेती संबधित सरकारी योजनांचा अभ्यास

गोड्या पाण्यातील जैवविविधता

- आम्ही बनवला तलाव परिसराचा नकाशा
- शाळेत आल गाव तलावाचं छोट पिल्लू
- आपल्या तळ्यात आढळणाऱ्या माशांची विविधता, साधने, तळी यांची चित्रं काढणे
- गावातली तळी आणि मासेमारी
- तलाव, मासे, मासेमार यांच्या गोष्टी, गाणी अन म्हणी
- तळ्यातला खाऊ
- नवेगाव बांध पर्यटन अभ्यास
- मच्छीमार सहकारी संस्था आणि मच्छिमार व्यवसाय
- माझा गाव
- आमचं तळं (परिसंस्था अभ्यास)

गवताळ माळरानं व कुरणांमधली जैवविविधता

- का बरं लागतात वनवा
- गवतांपासून ग्रीटिंग कार्ड बनवणे
- मिश्र पाटा आणि खाऊला नाही तोटा
- हे बघा, अशी होते मातीची धूप...
- आम्ही शोधलेला आमच्या गावचा इतिहास
- गावात नक्की किती गवत आहे ?
- स्थानिक गवतांचे हर्बेरीयम बनवणे

परिसर पुनर्निर्माण

- चला करूया आपल्या वन साधन संपत्तीचे मूल्यवर्धन...
- बाई, बापय आणि बायोडाव्हरसिटी
- आम्ही शोधलेला आमच्या गावचा इतिहास
- गाव ते देशातल्या चळवळीचा शोध
- माझ्या गावचे जंगल

(इतर प्रकल्प मसुदा)

- स्थानिक वनस्पतींच्या रोपवाटिका तंत्राचा अभ्यास करणे (किमान 5)
- गुगल अर्थद्वारे जागा वापर व अच्छादन अभ्यास (ज्या शाळामध्ये कॉम्पुटर व इंटरनेट आहेत)
- बिंदू व रेषा पद्धतीने जैवविविधतेचा अभ्यास करणे
- लहान मुलांचे खाऊ अभ्यास
- खाऊ तयार करून पाहणे
- कीड नियंत्रणाच्या विविध पध्दतींचा अभ्यास
- चला माती परीक्षण करूया
- हवामान बदलाचा पिकांवर होणारा परिणाम तपासणे
- गावातील शेतीचे प्रश्न व त्या अनुषंगाने गावचे शेतीचे धोरण बनवणे
- मधमाशी पालन
- स्थानिक शोभिवंत माशांचा मत्स्यालय बनवणं
- माशांचे जीवनचक्र समजून घेणे
- गवताच्या वस्तू बनवणे, किमती ठरवणे व विक्री करणे
- गवताळ माळरान परीसंस्था समजून घेणे
- गवताळ कुरण/माळरान व गाव याचे संबंध अभ्यास
- गवताळ कुरणाबाबत गावचे धोरण बनविणे
- मनरेगा एक योजना म्हणून समजून घेणे
- जैवविविधता कायदा काय आहे?
- आमचे जंगल आमचे नियम
- स्थानिक/आदिवासी नायकांचा अभ्यास

Annexure 3.3: Student interview form under School Projects participatory study

प्रकल्प अभ्यास मुलखात नमुना

शाळेतील मुलांचे प्रकल्प पद्धती समजून घेणे **दिनांक:**

आकारिक व संकलित मूल्यमापनासाठी शाळा पातळीवर विद्यार्थ्यांना प्रकल्प करायला दिले जातात. या प्रकल्पाचे स्वरूप व पद्धती समजून घेण्यासाठी हा अभ्यास करण्यात येत आहे. अभ्यासातील विद्यार्थ्याची व्यक्तिगत माहिती गुप्त ठेवण्यात येईल. या अभ्यासाचा उपयोग शैक्षणिक साहित्य विकसीत करण्यासाठी केला जाणार आहे.

(कंसात दिलेली माहिती मुलाखत घेणाऱ्यासाठी आहे)

(*एका शाळेतून/वर्गातून पर्यावरण, विज्ञान, इतिहास, भूगोल, भाषा, गणित यासर्व विषयातील एकतरी प्रकल्प माहिती येईल असे प्रयत्न करावे)

विद्यार्थ्यांचे पूर्ण नाव: इयत्ता: संपर्क

शाळेचे नाव व पत्ता::

1. या वर्षी शाळेत काही प्रकल्प/प्रोजेक्ट केले आहेत का? **अ. होय ब. नाही.**
2. विषयानुसार कोणते वेगवेगळे प्रकल्प केले त्यांचे विषयानुसार 'टॉपीक' किंवा प्रकल्प विषय लिहून घ्यावे.

विषय	**प्रकल्प विषय**	**विषय**	**प्रकल्प विषय**
मराठी–			
हिंदी–			
इग्रजी–			
गणित–			

(सूचना : वरीलपैकी फक्त एकाच प्रकल्पाची तपशिलात माहिती घ्यावी.)

3. प्रकल्प विषय: ----------
4. प्रकल्प कसा निवडला/ विषय कोणी सुचवला? ----------

साहित्य (प्रकल्पास वापरलेले साहित्य नोंदवून घ्या)	**खर्च**		**साहित्य**	**खर्च**
			प्रोजेक्ट वही/पेपर	
			रंगीत पेन	
			स्टीकर	
			झेरॉक्स व इंटरनेट	

5. प्रकल्पाला आलेला एकूण खर्च:	Rs:	**मिळालेले गुण :**	**किती पैकी:**

6. प्रकल्प कसा केला? (कोणकोणती माहिती व साहित्य कशी, कोठून गोळा केली? ती कशी मांडली? प्रक्रिया लिहून घ्यावे)

7. प्रकल्पातील सध्या काय आठवते? (हा प्रश्न थेट न विचारता विषयाला अनुसरून किती पक्षी, कोणते पक्षी, त्याबद्दल काय लिहिलं होतं, अशी माहिती घ्यावी.)

तुकडीतील एकूण विद्यार्थी:		**सर्व तुकडी मिळून वर्गातील विद्यार्थी संख्या**	

10. प्रकल्प पूर्ण करण्यासाठी किती वेळ लागला?
11. आता हे प्रकल्प कुठे आहे?
12. वर्गातील इतर मुलांनी हा प्रकल्प कसा केला?
13. वर्गातील इतर विद्यार्थ्यांनी प्रकल्पावर केलाला सरासरी खर्च:

(**माहिती घेणाऱ्यांचे नाव:** (अधिक माहिती व इतर निरीक्षणे नोंदविण्यासाठी पानाची दुसरी बाजू वापरा)

संपर्क नंबर:

Annexure 3.4: Documentation format for School Project materials available in local markets across Maharashtra

प्रकल्प साहित्य अभ्यास नमुना

शाळेमध्ये लेखी परीक्षांच्या ऐवजी विद्यार्थ्यांना प्रकल्प करायला दिले जातात. या प्रकल्पाच्या आधारे विद्यार्थ्यांचे मुल्यांकन केले जाते. प्रकल्पसाठी लागणारे साहित्य बाजारात वेगवेगळ्या स्वरुपात उपलब्ध आहे. या साहित्याचे **स्वरूप, दर्जा, किंमत, इत्यादीचे अभ्यास करणे** शाळामध्ये जैवविविधता शिक्षणासाठी महत्वाचे ठरेल.

(विद्यर्थ्यांनी केलेल्या प्रकल्प आपण समजून घेत आहात. या सोबतच विद्यार्थ्यांनी प्रकल्पासाठी वापरलेले सर्व साहित्याचे एक-एक नमूने विकत घ्यावे, ज्यात विविध प्रकारचे स्टीकर, पुस्तिका, पेन, पेन्सिल, खोडरबर, प्रकल्प वही, प्रकल्प पाने, रंगीत पेन, थर्माकोल इत्यादी) (सोबतच्या तक्त्यात नमुना म्हणून माहिती दिली आहे)

माहितीपर साहित्य प्रकल्प साहित्य

अ.क्र.	प्रकल्प साहित्य	प्रकल्प साहित्याचे तपशील	दुकान	किंमत
1	पक्षांची स्टीकर	..... प्रकाशनाची, 12 पक्षांचे स्टीकर आहे. यात. **गरुड, चिमणी, पोपट, मोर, कबुतर, कावळा, बदक, खंड्या, बुलबुल, होला, साळुंकी, कोतवाल, मोर,** या पक्षाचा समावेश आहे. पक्षांची नावे व फोटो	प्रगती बुक स्टोर, पुणे	25
2	भाज्यांची स्टीकर	भाज्यांची स्टीकर ..... प्रकाशनाची, 10 भाज्यांचे स्टीकर आहे. यात. **पालक, गोबी, गाजर, टमाटो, ब्रोकोली, लेट्युस, वांगी, बटाटे, मुळा आणि दोडका** या भाज्यांची फोटो व नावे दिली आहेत.	के सागर, पुणे	15

इतर पूरक प्रकल्प साहित्य

अ.क्र.	प्रकल्प साहित्य	प्रकल्प साहित्याचे तपशील	किंमत
1	प्रकल्प वही	..... प्रकाशनाची, 50 पानी रेघेची वही. पाने जाडसर असून पानावर प्रकल्प विषय, तारीख लिहायला जागा सोडलेली आहे.	75
2	रंगीत पेन	..... प्रकाशनाची, 12 कलरचे रंगीत स्केज पेन.	20

MGB Project Biodiversity Portal

The Maharashtra Gene Bank project is a collaborative effort to consolidate and conserve the genetic information on all wild and cultivated floral and faunal biodiversity of the Maharashtra State in a single repository. This involved the participation of members from various grassroots, academic, research and conservation organizations, working across the state in different fields ranging from livestock rearing and management, to conservation of native seeds, grasses, or natural forests in-situ, as well as revival and preservation of wetlands and marine eco logstems.

While collation of information and allowing for conservation action was the main driver of the project, it was envisaged that a substantial outcome of the project would be to have a large and updated repository of information in a consolidated format, accessible for use in the public domain. With the growing effectiveness of digital media and large storage capacities on Cloud servers, it is only pertinent that all this information should be easily accessible to the people in an interactive manner, rather than stay within the walls of libraries in the format of a static report. In order to make this possible, a digital database with the capabilities of search and query was created, and made available on a web-based platform "MGB Biodiversity Portal" http://mgb.iiserpune.ac.in/, from which specific information could be retrieved at will with the help of advanced searches and query building. A major component of this exercise was to specifically indicate the locations where the data was collected, and to identify the spatial distribution of the large biodiversity that is preserved in the state's biological resources. A clear and efficient display of this resource inventory would highlight the spread of the resources and their diversity across the entire state only if these data were mapped as per their occurrence and endemism. Towards this end, this component of the project involved the consolidation and conversion of all the data into spatial domain to display and make it accessible in a geospatial database.

Since the project was a collaborative effort between 19 partner organizations, gathering and collation of all spatial data and non-spatial data from each of these organizations was a humongous task. This needed regular coordination amongst all the partner organizations to understand their work and data availability. Several stakeholder meetings were held at IISER, Pune to understand the scope of work, content of data and formats that could be provided. After several such meetings, a standardized format was finalised.

MGB web portal architecture design and implementation

The portal contains mainly two datasets. The RDBMS built in the Postgres and the Spatial database.

RDBMS

The data on all the themes have been collected from the partners' of the MGB project.

Following steps were taken to build a Relational database using Postgresql server for data collected in MGBP for all the themes and partners:

1. Interaction with all MGB theme partners to understand different types of data collected and formats/ sheets used by them for data collection.

2. Identifying metadata. Deciding on organization principles for the data.

3. Creating schema/s and tables using postgreSQL server. The tables were structured to satisfy 3rd Normal form.

4. Collection of data from all the partners.

5. Creating EXCEL sheets similar to the structures of the tables in the schema and populating these sheets using the data from various partners.

6. Validating data in the EXCEL sheets for attributes which are referred in more than one table and set relations using them viz. Species names, village codes, tapu names etc. Validation for those attributes which may take certain values only.

7. Data Migration: EXCEL sheets => csv files => Postgresql server

Following data has been collected from the partners and is made available on the portal.

Details of datasets theme-wise:

- Crop (including NTFP and livestock)
- Wetland
- Wetland Information (Only 1 time)
- Water spread data (Once in a quarter)
- Flora diversity in Tank
- Species Occurrence (Birds) (Once in a quarter)
- Uses of plants
- Flora plot location
- Water Quality (Once in a month)
- Fish diversity
- Catchment Land Use pattern

- Livestock information (Once in a quarter)
- Catchment Agriculture details (Only once)
- Diversity found in farmland (1st and Last year)
- Ipomoea ext. data
- Grassland
- Fodder
- Fodder Plot in Agriculture
- Livestock
- Milk Production
- Grazing
- Grass Diversity
- Agricultural land of each farmer
- Eco-Restoration
- List of plant species & their habitat
- Uses of different parts of species
- Tapu information
- Qualitative abundance of plant species on tapus
- For tree species quantitative estimation by Point Centered Quarter Method.
- Additional observations by Eco-Restoration Gadchiroli Group .
- Information of Landscape Elements' & qualitative abundance of species on them
- For tree species- quantitative estimation by Point Centered Quarter Method on all LSEs.
- RET observations by people and separately by Taxonomist
- Marine Microbial inventory
- Marine prokaryotes
- Marine eukaryotes

These datasets are visible as tables on the portal. These datasets can be sorted or the part of the tables can be extracted based on the fields which in turn can be downloaded. The files are also available to download.

Additional observations collected by Gadchiroli Group working on Eco-Restoration for developing Forest Conservation and Management Plan (**to be included in the database**)

Part A- Status of the natural resources

1. Geographical location, details of rights, related maps and GPS demarcation of CFR boundaries.

2. Short history of village, objectives of CMP, broad planned actions and supporting organizations

3. Rules for self governance – MFP extractions, grazing, patrolling, monetory transactions etc.

4. Landuse, rainfall data, tapu list, LSE list, flora on private land

5. Detailed observations of flora listed in slide 1 and wildlife observations

6. Threat perceptions to community resource, life-cycles of important species and conservation related festivals.

Part B – Planning

1. Bamboo felling series

2. Planning for Sustainably extraction of species

3. Planning for Nursery and plantation

4. Soil water conservation works

5. Forest ponds/ tanks

6. Temporary roads for management and fire-lines maintenance

Spatial databas

The second type of dataset is the spatial dataset. It has series of maps that were created as an outcome of the geospatial database creation are appended.

The spatial database creation component of the MGB project was envisaged with the following objectives in mind:

- Develop a framework for storing spatial and attribute datasets in an appropriate format that is compatible with the RDBMS which will be used for textual and other data types
- Examine non-spatial data and assess the possibility of porting it into the spatial domain as geotagged pieces of biodiversity information
- Create a Landscape map for sites of partner organizations of Maharashtra using field level data collected through epicollect5 by Spark Fellows and other satellite data
- Create a web-based platform to show spatial and attribute data of MGB project

Data collected by the collaborating teams was available with them in spatial and non- spatial formats. Most of the data were collected and collated as tables or reports, from which they were entered into a standardized database in the RDBMS tables. All the tabular data which had any spatial information, i.e. information that could either (i) be linked to geographic coordinates or (ii) be linked to villages with their census code was deemed as spatial. In addition to the tabular and text data, there were a few datasets which were acquired directly in spatial domain - such as field data coordinates for corners of tapus (landscape compartments), digitized boundaries of field sites on Google Earth, or shapefiles from secondary data. These spatial data were regularized and converted into a standard format. Thus, the steps of development of a framework for storing spatial and attribute data, as well as assessment of each of the available datasets were initiated and then run parallely as the data became available.

Landscape maps were created for the sites of partner organizations, in particular locations where the project was being implemented. Ground truth information was collected by field assistants for informing the supervised classification approach. The ground truth information was found to be insufficient for very detailed maps of project sites at fine resolution. It was therefore decided to consider mapping for certain talukas, at a coarser resolution, and using locations from Google Earth as ground information to train the classifiers.

The following thematic datasets were converted into spatial data available to view on the portal and also available to download by registered users for their work:

a. ***Wetlands:*** For this data, which was available as point coordinates from where the field information was collected, the points were plotted and lakes identified at these plotted points in high resolution satellite imagery, on Google Earth. The lake boundaries were then digitized, and tables of data were attached to these graphic files as attributes. The attributes included information on fish, shellfish, and flora observed in these wetlands. We also created a shapefile of villages that these lakes are part of (some lakes cut across two village boundaries).

b. ***Forest Eco-restoration:*** Using the 4-point coordinates of extents for *tapus*, a rectangular envelope for each *tapu* was created. A shapefile was later created that had all the villages that were sampled for this theme. Few village level forest administrative maps were also obtained, which were digitized into shapefiles and presented in maps.

c. ***Grassland Diversity:*** Tapus or landscape elements were created by plotting the points for *tapus* from the boundary coordinates. This was done by creating a rectangular envelope with the 4 extent points for each *tapu*. A shapefile was created which had all the villages that were sampled for this theme.

d. ***Livestock Diversity:*** Shapefiles were created, and attributes attached to the spatial locations using village ID's. Some data was acquired for livestock migration, but this had errors which disallowed its ease of conversion into a portal-ready format.

e. ***Crop Genetic diversity:*** Shapefiles were created, and attributes attached to the appropriate spatial locations using village IDs.

f. ***Conservation Management (NTFP Habitat):*** This dataset has the habitat conservation sites maintained by BAIF. Google Earth data collected in the field was converted into a shapefile, and another shapefile was created which has *Mahua* trees as mapped by BAIF.

Currently the data from the spatial data from the web portal can be downloaded to use in the local desktop GIS softwares. The scope of this should be expanded to include an interactive web portal where users can visualize and analysis the GIS datasets. User should be able to do analysis, upload/import their own local data and perform analysis, download the output and print out a simple map directly from the portal or export the results to a PDF.

List of shapefiles hosted on the portal

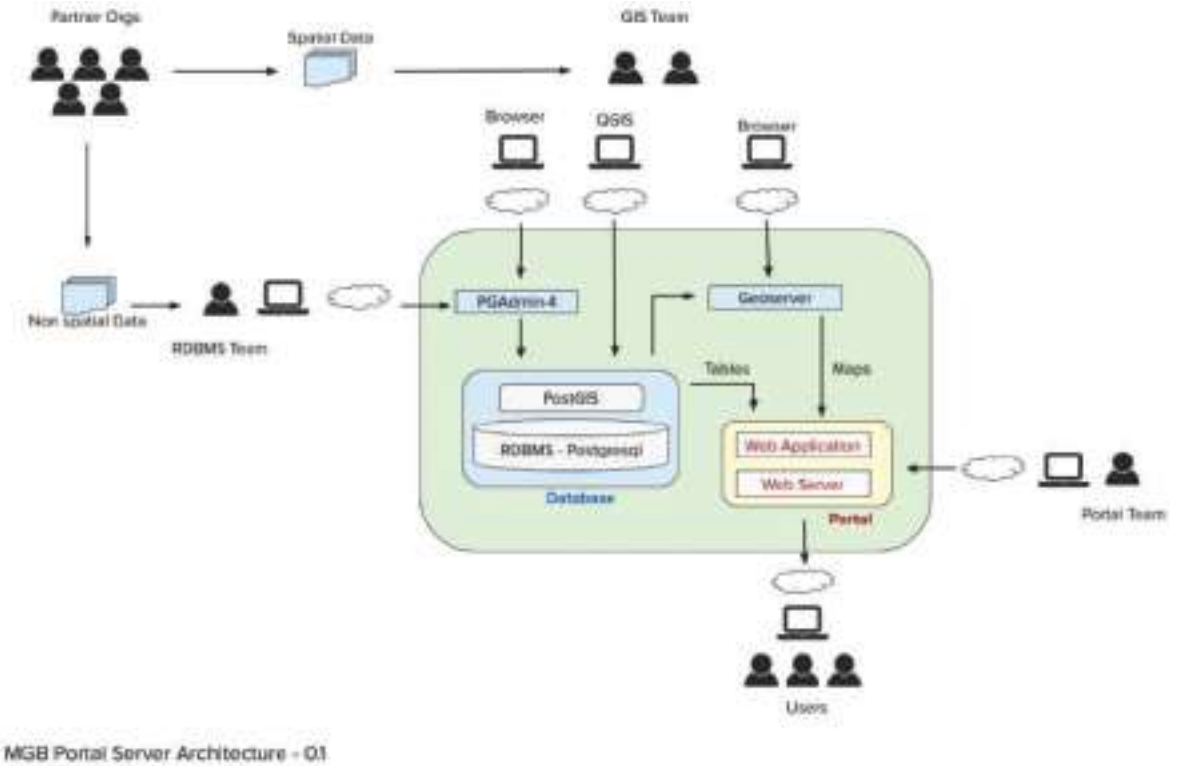
- Maharashtra Village Boundaries
- Maharashtra Taluka Boundaries
- Maharashtra Districts Boundaries
- Maharashtra Agro-Climatic Zones
- Livestock Study Villages
- Dangi Cattle Migration Routes (2)
- Grassland Tapus Rectangular Envelopes
- Grassland Tapus Location Points
- Grassland Tapu Project Villages
- Forest Ecorestoration Tapus Location Points
- Forest Ecorestoration Tapus Rectangular Envelopes
- Forest Ecorestoration Project Villages
- Forest Ecorestoration Forest Khand (Jambhala village)
- Forest Ecorestoration Forest Khand (Lawada village)
- Forest Ecorestoration Forest Khand (Payvihir village)
- Wetland Study Lakes Location Points
- Wetland Study Lakes (digitized)
- Wetland Lake Study Villages
- Crop Study Villages
- NTFP Habitat Conservation Sites (4)
- NTFP Mahua Trees Location Points
- NTFP Mahua Trees Location Study Villages

Portal design

Technology stack chosen, implemented, and used for building the portal are as follows:

- Web server: Apache
- Database Server(RDBMS): Postgresql
- Database extensions: PostGIS
- GIS server: GeoServer
- Programming framework: Django (python language based framework)
- Programming language: Python
- UI css framework: Bootstrap-4

The architecture of the portal is as follows.

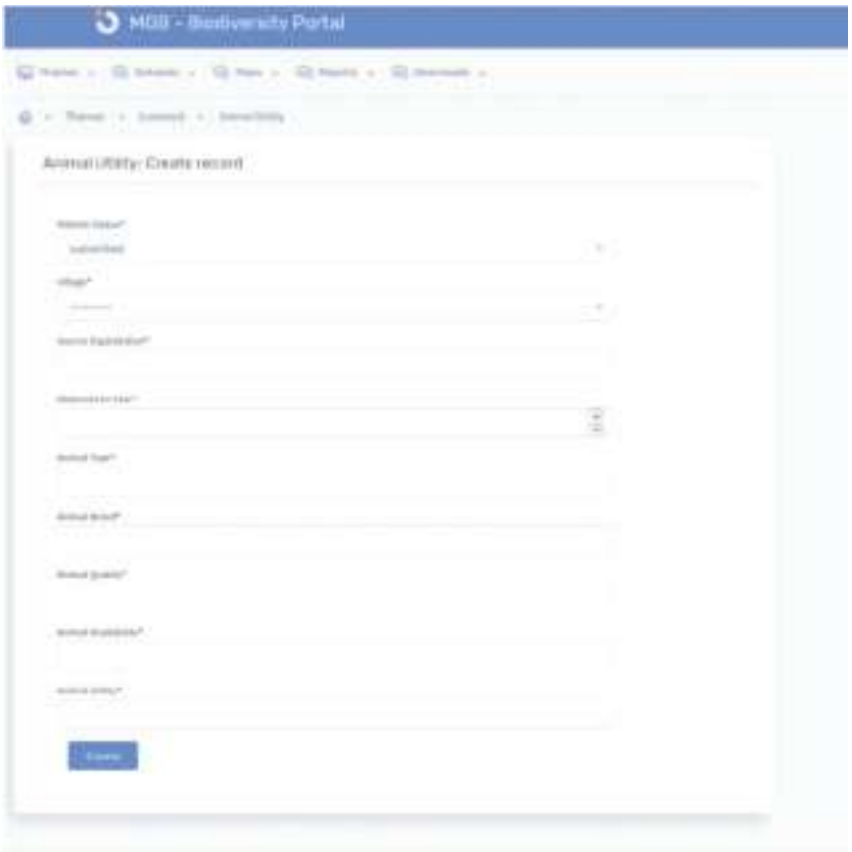


MGB Portal Server Architecture - 01

The portal has 4 main modules:

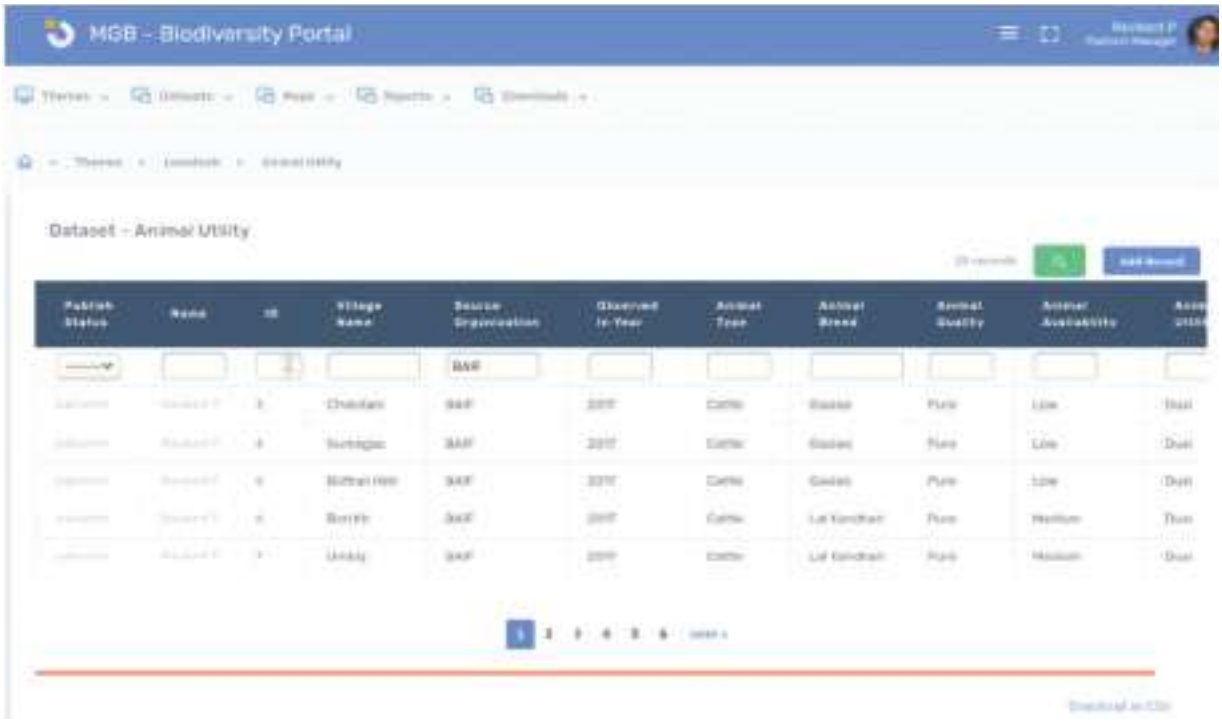
Data entry module

Through this module users can enter data onto the portal. The users who will have rights, those only can upload the data.



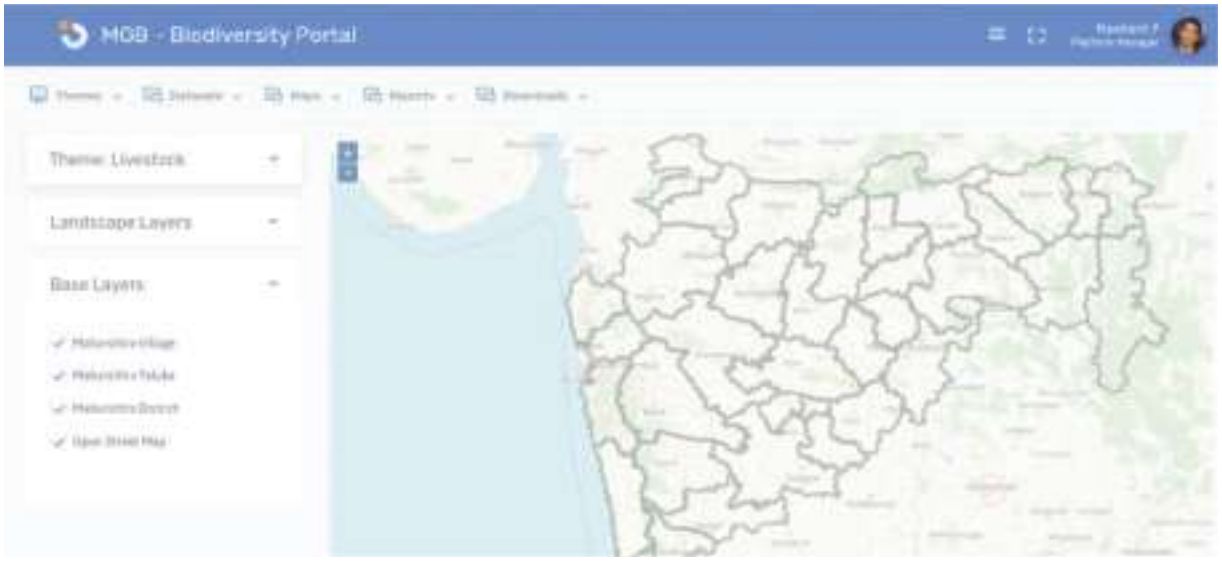
Data (Table) display module

This module shows the tables which are available in the RDBMS.



Data (Map) display module

This module has spatial datasets arranged in form of layers. These layers can be switched on/off so user can overlay various layers for visualization.



· **User account management module:**

Through this module, access can be provided to users. Depending on the rights, user can view/enter/modify and accept the modifications on the data which will be saved in the actual database.

Queries to explore Database

Real purpose of building a database is getting Reports, Summaries and Queries from different stakeholders.

Examples of some typical queries

Query 1: To find species whose roots have medicinal values, also listing its other attributes like habit, indigenous/ Exotic, storage method, if natural and/or cultivated in a village say 'Rajoli'

sp_sc_name	sp_part	plant_type	vill_name	vill_id	if_medicine	indi_exot	storage_method	if_natural	if_cultivate
Asparagus racemosus	root	Herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Hemidesmus indicus	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Mucuna pruriens	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Curcuma sp.	root	Herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Gloriosa superba	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Sphaeranthus indicus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Sphaeranthus indicus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cheilocostus speciosus	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cheilocostus speciosus	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ochna obtusata	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Tridax procumbens	root	climber	Rajoli	538982	TRUE	Indigenous	stored near house.	TRUE	FALSE
Erythrina suberosa	root	Tree	Rajoli	538982	TRUE	Indigenous	stored near house.	TRUE	FALSE
Amorphophallus margaritifer	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Celosia argentea	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Cajanus scarabaeoides	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Vigna sublobata	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Wattakaka volubilis	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Holostemma ada-kodien	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Actinoscirpus grossus	root	tuber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ceriscoides turgida	root	climber	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Ceriscoides turgida	root	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Tamilnadia uliginosa	root	Tree	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE
Solanum virginianum	root	herb	Rajoli	538982	TRUE	Indigenous	are not stored	TRUE	FALSE

Query 2: Tapus in village Rajoli where species with edible raw fruits occur:

vill_name	tapu_name	sp_sc_name	sp_part	if_food
Rajoli	Bijau khai	Phyllanthus emblica	raw fruit	TRUE
Rajoli	Bijau khai	Mangifera indica	raw fruit	TRUE
Rajoli	Bijau khai	Psidium guajava	raw fruit	TRUE
Rajoli	panyacha jhora	Phyllanthus emblica	raw fruit	TRUE
Rajoli	panyacha jhora	Mangifera indica	raw fruit	TRUE
Rajoli	panyacha jhora	Psidium guajava	raw fruit	TRUE
Rajoli	Bhatal	Phyllanthus emblica	raw fruit	TRUE
Rajoli	Bhatal	Mangifera indica	raw fruit	TRUE
Rajoli	Bhatal	Psidium guajava	raw fruit	TRUE
Rajoli	kokodyachi bodi	Phyllanthus emblica	raw fruit	TRUE
Rajoli	kokodyachi bodi	Mangifera indica	raw fruit	TRUE
Rajoli	kokodyachi bodi	Psidium guajava	raw fruit	TRUE
Rajoli	gitti khadan	Phyllanthus emblica	raw fruit	TRUE
Rajoli	gitti khadan	Mangifera indica	raw fruit	TRUE
Rajoli	gitti khadan	Psidium guajava	raw fruit	TRUE
Rajoli	macchigadda	Phyllanthus emblica	raw fruit	TRUE
Rajoli	macchigadda	Mangifera indica	raw fruit	TRUE
Rajoli	macchigadda	Psidium guajava	raw fruit	TRUE
Rajoli	vandrumary jhora	Phyllanthus emblica	raw fruit	TRUE
Rajoli	vandrumary jhora	Mangifera indica	raw fruit	TRUE
Rajoli	vandrumary jhora	Psidium guajava	raw fruit	TRUE
Rajoli	futka bandh	Phyllanthus emblica	raw fruit	TRUE

Query 3: Species-wise average number of trees per ha and their basal area in village Sinsur

vill_name	sp_sc_name	trees_per_ha	basal_area_sq_mtr
Sinsur	Acacia catechu	20.55	0.459958
Sinsur	Albizia odoratissima	10.28	0.989421
Sinsur	Anogeissus latifolia	20.55	1.334901
Sinsur	Buchanania cochinchinensis	10.28	0.400675
Sinsur	Chloroxylon swietenia	20.55	1.909175
Sinsur	Cleistanthus collinus	30.83	1.629602
Sinsur	Diospyros melanoxylon	20.55	3.585549
Sinsur	Ficus religiosa	10.28	3.173426
Sinsur	Getonia floribunda	10.28	0.039577
Sinsur	Ixora coccinea	10.28	0.094527
Sinsur	Madhuca longifolia	41.1	8.119961
Sinsur	Phyllanthus emblica	10.28	0.817704
Sinsur	Pterocarpus marsupium	41.1	8.33747
Sinsur	Schleichera oleosa	20.55	2.743886
Sinsur	Soymida febrifuga	20.55	2.061922
Sinsur	Tectona grandis	20.55	3.801014
Sinsur	Terminalia tomentosa	41.1	1.857905
Sinsur	Dendrocalamus strictus	20.55	NULL
Sinsur	Holarrhena pubescens	30.83	2.141075
Sinsur	**Total**	**411.04**	**43.497748**

Query 4: To find Tapus in a village 'Rajoli' where species 'Mangifera indica' is not found but it is present on other tapus.

vill_name	tapu_name	sp_sc_name	sp_part	if_food
Rajoli	Bijau khai	Mangifera indica	raw fruit	TRUE
Rajoli	dhivar dand	Mangifera indica	raw fruit	TRUE
Rajoli	futka bandh	Mangifera indica	raw fruit	TRUE
Rajoli	futka tada	Mangifera indica	raw fruit	TRUE
Rajoli	gitti khadan	Mangifera indica	raw fruit	TRUE
Rajoli	kokodyachi bodi	Mangifera indica	raw fruit	TRUE
Rajoli	macchigadda	Mangifera indica	raw fruit	TRUE
Rajoli	vandrumary jhora	Mangifera indica	raw fruit	TRUE
Rajoli	yerandi pahadi	Mangifera indica	raw fruit	TRUE

Query 5: Mahua flower and seed production per ha in village 'Sinsur'

Avg trees per ha = 41.10

Avg flower wt per tree = 57.22 kg

Avg flower wt per ha = 2351.86 kg

Avg seed wt per tree = 7.78 kg

Avg seed wt per ha = 319.76 kg

Query 6: Microbial diversity between lat=17 to 18 and long =72 to 73.1 for family='Staphylococcaeceae'

phylum	class_name	order_name	family_name	genus	species
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus arlettae
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus aureus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus argenteus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus schweitzeri
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus nepalensis
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus epidermidis
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus sciuri
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus arlettae
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus arlettae
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus cohnii cohnii
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus devriesei
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus warneri
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus arlettae
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus argenteus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus argenteus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus caprae
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus haemolyticus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus saprophyticus saprophyticus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus haemolyticus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus pasteuri
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus haemolyticus
Firmicutes	Bacilli	Bacillales	Staphylococcaeceae	Staphylococcus	Staphylococcus pasteuri

The Portal is now maintained by the IISER technical team.

Production of Video films

During 2019-20, Dr. Madhav Gadgil had asked a group of PIs to examine ways and means of disseminating the information generated from the MGB project to the masses and communities.

For this purpose, a Working Group consisting of the following was formed.

Shri Kaustubh Pandharipande
Shri Manish Rajankar
Shri Shantaram Pandere
Shri Satish Awate
Dr. Vijay Edlabadkar

The Working Group coordinated the documentation of several video films at the locations where the MGB project partners established linkages during the project duration. The list of video films is given below. These will be uploaded on YouTube Channel and also will be available on IISER server along with Database.

अ.नं.	संस्था	विडीयो विषय
१	लोकपर्याय	१–माझे शिवार माझी पत
		२– रानभाज्या
		३– लोकपर्याय–मजको
२	भंडारा ज्ञान विज्ञान	४– अनुभवजन्य ज्ञानातून मासेमारी
		५– महिला सहभागातून तलाव संवर्धन
		६– तलाव जैवविविधता–मत्स्य उत्पादन

अ.नं.	**संस्था**	**विडीयो विषय**
३	गडचिरोली	७– वन हक्कामुळे परिवर्तन
		८– टेक्नोलोजीचा वापर
		९– भू भागाची ओळख
४	लोक पंचायत	१०– काळभात (पारंपारिक वाण)
		११– डांगी गोवंश
		१२– बीज बँक

अ.नं.	संस्था	विडीयो विषय
५	आय.आय. आर.डी	१३– महिला शेतकरी गट
		१४– शेंद्रीय बाजार
		१५– शेतातील जैवविविधता
६	ग्रामीण युवा मंडळ	१६– आमची बीजबँक
		१७– वाण संवर्धनाचे वारसदार
		१८– पारंपारिक भाज्या
७	पर्यावरण शिक्षण केंद्र	१९– शाळा प्रकल्प
		२०– शिवार फेरी
८	संवेदना	२१– गवत संवर्धन चळवळ
		२२– कापूस कोंड्याची गोष्ट
		२३– स्थानिकांचे सक्षमीकरण

अ.नं.	संस्था	विडीयो विषय
९	जनार्थ	२४– सामुहिक वनहक्क व जैव संवर्धन
		२५– जंगल संवर्धन
१०	संस्कृती संवर्धन मंडळ	२६– टाळकी ज्वारी –पारंपारिक वाण
		२७– करडी –पारंपारिक वाण
		२८– शेवाळी मिरची (स्थानिक मिरची)
११	वसुधा	२९– कुरण क्षेत्र विकास– लामकानी
		३०– गवत संवर्धनातून गावविकास
		३१– लळिंग– कुरणक्षेत्र विकास
१२	उगम	३२– गवत उगवणारी लोकं
		३३– गवत व पिक तुलना