333.9516 P04 (CES)

Deploying student power to monitor biodiversity: Five years of School Biodiversity Registers (1999 – 2003)

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ENVIS Technical Report No. 17

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December 2004

1. Introduction

India is a land rich in diversity of life. But its ecological resource base is under threat, with extensive destruction of natural habitats, widespread degradation of agro-ecosystems and a growing burden of air and water pollution. Simultaneously, and most regrettably, India's knowledge base of uses of biodiversity is also being eroded, with the younger generation becoming increasingly alienated from the natural world. This is happening at a time when technological advances have greatly enhanced the potential of uses of biodiversity, so that organisms thus far considered insignificant may turn out to be of considerable applied value. Such organisms may be present anywhere, even in highly degraded habitats. Much of India's diversity of domesticated organisms and their wild relatives is also being rapidly lost. Life in India's rivers, lakes, estuaries and the seas is under even greater stress than that on the land.

Clearly we need to look after the ecological well being of our lands and waters, not only of the few remaining natural forest habitats, but also of our farm lands and irrigation tanks, of overgrazed pastures and eroded hill slopes, rivers and seas. We need to carefully plan on conserving, sustainably using and restoring the biological diversity across the length and breadth of the Indian sub-continent. We also need to conserve and benefit from the knowledge of uses and the traditions of conservation of this biological diversity. Finally we must ensure that benefits flowing from our heritage of biodiversity and related folk knowledge percolate down to the people at the grass-roots.

India's Biological Diversity Act is a step in the direction of addressing this challenge. This formidable task can only be undertaken through making conservation, sustainable use and equitable sharing of benefits of biodiversity a people's movement. For biological diversity can be cared for only with the co-operation of masses of our people, many of whom still depend on it for their day-to-day sustenance. In recognition of this reality, the Biological Diversity Act proposes to decentralize management of biodiversity to the level of Panchayati Raj institutions, municipalities and city corporations.

Much of the knowledge of the status and dynamics of biodiversity also resides with the people at the grassroots. Thus the only reliable information on the status

and dynamics of the natural medicinal plant populations, albeit limited to their own localities, resides with forest produce collectors who are employed by agents of pharmaceutical companies, or with folk practitioners of herbal remedies. Since effective action can only flow from a sound base of knowledge, we need to support the management effort by a countrywide system of inventorying and periodically monitoring biodiversity. Given the tremendous variation from place to place in the distribution and uses of biodiversity, this documentation has to be highly locality and time specific. The Biodiversity Management Committees that will be set up under the Biological Diversity Act are expected to undertake this detailed documentation. We simply do not have enough technical experts to undertake such an endeavor on their own. Hence, the experts will need to be an integral part of a network involving participants from many different segments of the society, from every village and town, from every fishing community, from every tribal hamlet, from every camp of herders. We may visualize six groups of players being involved in such a network: [1] School and college teachers and students, [2] Technical experts in the area of life sciences and resource management, [3] Technical experts in the area of information management, [4] Government functionaries, [5] Workers with Non-governmental Organizations and Community-based Organizations, [6] Community members.

The Biological Diversity Act visualizes a system of decentralized management of biodiversity at the level of Panchayati Raj institutions, namely, Gram, Taluk and Zilla Panchayats, as well as Municipalities and City Corporations. The ***Biodiversity Management Committees*** (BMC) functioning at the level of these local bodies would complement the activities of the State Biodiversity Boards and the National Biodiversity Authority. These BMCs are expected to prepare local level databases in the form of ***People's Biodiversity Registers*** (PBR) to support their own activities, as well as to feed into the State and National level Biodiversity Information Systems.

The PBRs will constitute continually up-dated databases, not just one-time printed documents. They will primarily be in local languages, and where appropriate include an English language version to facilitate links at the national level. They will be generated through a broad-based process led by the local community, and supported by appropriate technical and administrative inputs. The local educational institutions, in particular High Schools and Colleges along with Eco-clubs, National

Green Corps and other relevant programmes will obviously play a significant supportive role in this context serving to generate and compile a part of the relevant information, especially information pertinent to the status and dynamics of biodiversity resources, by preparing ***School Biodiversity Registers***. These inputs may be complemented by compilation of information relating to management and intellectual property rights issues by Community Based Organizations such as Yuvak Mandalis, Mahila Mandalis, Self-help Groups, Village Forest Committes and Co-operative Socieities.

It is in this context that the Centre for Ecological Sciences at the Indian Institute of Science in Bangalore has been actively engaged in working with school and college teachers and students to evolve a methodology of building the capacity of and engaging this vital human resource in inventorying and monitoring of biodiversity. The programme has involved three major steps over the last five years: (a) Working with students at the primary school level in a programme called Nisarga Adhyayana, (b) Working with high school and junior college students to generate inputs for a Karnataka state level Biodiversity Strategy and Action Plan, and (c) Working with high school and junior college students to generate inputs for preparation of People's Biodiversity Registers as a follow up of the Biological Diversity Act. The educational institutions involved were contacted with the help of three voluntary organizations, namely the Nagarika Seva Trust, Belthangadi, Tumkur Science Centre, Tumkur and Bharathiya Gyan Vigyan Samithi, Bangalore. The teachers involved in this project were mostly, though not exclusively, with a science background. A total of 175 education institutions including primary and high schools and pre-university colleges from 17 districts representing all eco-regions of Karnataka have been involved in this programme.

2. Nisarga Adhyayana:

The project 'Nisarga Adhyayana' (study of nature) was launched by a local active organization, Nagarika Seva Trust and the block education officer at 125 schools from primary and higher primary division of Belthangadi Taluk of Dakshina Kannada district and at 2 schools in Karkala Taluk of Udupi District. These schools were identified on the basis of the earlier programmes like identification of medicinal plants, elocution, essay and painting competitions. Two special training and a review meeting for the school teams was conducted by the organization with the technical inputs from Centre for Ecological Sciences, Indian Institute of Science, Bangalore. The school teams were trained to carry out fieldwork at their respective places for duration of three months. The main component of the study would be, identifying the study area and mapping the locality by plotting the landscapes, water bodies, man made constructions, orchards and plantations. The team would then visit each patch and list out the plants, animals, birds, reptiles, and insects and further document the values of the species with the help of knowledgeable individual. They would then note down any conservation or awareness programmes held in that locality.

2.1 Some highlights:

It is very interesting to narrate few incidents that prove the extreme knowledge and interests of the students, no matter what remunerations or recognition they get from their school. One of the students studying seventh standard at Mala School of Karkala Taluk of Udupi District had gone to the extent of identifying 62 insects with local names. He did not know the scientific names but could easily distinguish individual insects from the list by their interesting characters. He was a tribal boy who walks daily 4 km in the midst of the forest and hillocks to reach his school. In yet another incident, students from primary schools in Belthangadi Taluk of Dakshina Kannada District had identified 200 plants with local names.

2.2 Details:

Each team comprised of two teachers, maximum of ten students and 2-4 knowledgeable individuals. The team had collected brief details like the name of the place, history and the approximate area of the study locality*.*

For the convenience of the school team, Landscape Element Type was simplified into four broader categories: 1. Evergreen forest 2. Thicket 3. Scrub Jungle 4. Grassland. There were provisions to add up more categories if existed in the study area. The exercise was only to tick against the category if existed in the study area. The school team had identified these broader categories and documented the same. Thickets and Scrub land were recorded maximum at about 70% of the study area while the evergreen forest and the grasslands were recorded at about 15%.

The plantations existing in the study locality were classified as Eucalyptus, Acacia, Casuarina and Hopea. Casuarina and Hopea plantation were recorded the maximum and Acacia was moderately present while the Nilgiri, Cashew and Mangium were recorded the least. Orchards were also classified in to four broader categories like Coconut, Areca, Rubber and Flower Garden/ School garden. Coconut and Arecanut orchards were recorded the maximum while Rubber plantation and Flower Garden were recorded to a moderate extent. Paddy fields were also observed more and other crops and vegetable cultivation were recorded to a lesser extent. About 200 Sacred Groves were also documented along with folklores existing in that area.

The team also had documented waterscapes like the river, tanks, open wells and tube wells present in their study localities. Open wells were observed to about 60% while tube wells were observed to be 30%. 10% of the study localities had small tanks, ponds and rivers.

The school teams had also documented life forms like Plants species (which includes medicinal, NTFP and useful species), Animal species (which includes all beings other than plants known to the students). It is very interesting to know that an average of 75 sp. of plants of which 65 sp. were having medicinal values, 10 sp. were having NTFP values and other uses. 80 sp. of animals (including fish, insects, birds, reptiles and animals) were recorded. Some teams had recorded about 134 plant species (of which 72 species had medicinal values) 140 animal species. The students had documented from insects like termite, grasshopper, and spider to animals like rats, hares, jackals. They had also documented fishes, snakes and birds with common names. Interesting to note that students had taken extra care to document all common insects and animals found in their study area. The team had also documented details on the conservation efforts taking place in their localities like the herbal garden, flowering garden in and around the school campus. The

whole study brought out a spectrum of information like documenting landscapes, life forms and conservation efforts that enables us to understand the study locality and could get a glimpse of it. Opinion of the students had also been documented where in, they felt that such kind of study outside the classroom is very much required and useful in terms of creating awareness, interest and studies rather than the usual monotonous marks oriented kind of teaching inside the classroom.

3. **Karnataka Biodiversity Strategy and Action Plan**

The Centre for Ecological Sciences at the Indian Institute of Science served as the nodal agency at the Karnataka state level in the formulation of a strategy and an action plan to conserve, sustainably use and promote equitable sharing of benefits from the use of biological diversity resources as a part of the national effort co-ordinated by the Ministry of Environment and Forests, GoI. The Karnataka effort focused on six themes, namely. (a) Protected areas (b) medicinal plants (c) freshwater fishes (d) wetlands (e) cultural traditions of conservation, and (f) land races of cultivated plants.

3.1 ***Methodology:***

49 schools distributed through the length and breadth of the state was involved to prepare School Biodiversity Registers (SBR) that focused on 5 themes as given above. The SBR exercise involved a background study and one to five thematic studies. These were conducted as special high school student projects on a voluntary basis under the guidance of one of the school teachers. The background study involved a larger team of upto 16 students; the thematic studies were undertaken either as individual student projects or as projects by groups of up to five students. The training for this programme, supported by resource literature were undertaken in January -February 2001.

The thematic studies included ten modules, namely (1) Current Status (2) Ecological history (3) Forces driving ecological change (4) Knowledge and beliefs (5) Gainers and losers (6) Values (7) Scenarios (8) Aspirations (9) Strategies and (10) Action plans. Their coverage encompassed the entire area utilized by people residing within a radius of 3-4 kilometers from the High School. The thematic studies involved an element of field-oriented investigations in association with, as well as interviews of local knowledgeable individuals by the students and teachers. The interviews were conducted in or close to the homes of knowledgeable individuals in their free time on a voluntary basis.

3.2 ***Wetlands***

The theme on Wetlands was undertaken by 9 High schools and 5 P.U colleges from 8 districts of Karnataka, covering 45 wetlands which includes river,

huge wells, tanks and water springs. For this purpose we had prepared a list of target water plant (including weeds), and water bird species, with sketches and local names. The material on 60 target freshwater fishes mentioned above was also useful in this context. The investigation involved identifying a set of one to ten wetlands near the study area and knowledgeable members of local community, including those engaged in fishing, or use of irrigation water and familiar with the history and current status of these water bodies. On the basis of field observations and interviews of key informants the set of water plant, bird and fish species out of the target set currently present in the water bodies under investigation were identified.

3.2.1 Results

The results got during this project were amazing with concrete strategies and action plans made by the team in consultation with the villagers to conserve and sustainably use the water bodies of the study locality. They had also discussed in detail about all the components that were the part of the thematic study.

3.2.2 Current Status:

Many of the local fish species have been lost. Department has information only on the exotic species. Many of the fishes that are being bred are exotic.

3.2.3 Ecological history:

In earlier days, many of the tanks had native lot of native fish species that used to migrate for breeding in to the tank. Many of the tanks have dried up and there is scarcity in fish population. Native fish species have reduced drastically which were found in large numbers earlier.

3.2.4 Forces driving ecological change:

Excessive fishing and poaching, using explosives and poison to catch fishes, pollution of water, use of pesticide in paddy fields, Introduction of exotic fish species, fishing during the banned season are the main forces driving the ecological change.

3.2.5 Knowledge and beliefs:

Earlier, villagers used to fish together and were self-sustained. After the introduction of exotic fish species, this system stopped as the contractor came into picture. Villagers say that many local fish species were tastier and were

recommended as medicine for certain disorders. Catching and consuming mahaseer fish were not entertained as it was related to god.

3.2.6 Gainers and losers:

Reduction in the number of native fish species has been a loss to the fishermen. The introduction of exotic species into the tank and through tender to the outsiders has hit the local fishermen economically. Outsiders who bid the tenders are benefited. ,

3.2.7 Values:

Many of the reports reveal that villagers ascribe values to economically important fish species and some give importance to the native fish species for its medicinal uses and taste. At some places, local fishermen oppose the introduction of exotic fish species, which they believe that native fish species would be lost.

3.2.8 Scenarios:

The native species of fishes will drastically decline if not properly protected. Industrialization, pesticide, chemical fertilizer and destruction of fish habitat would lead to decline in local fish population.

3.2.9 Aspirations:

People feel that:

1. The concerned departments and the local organizations with the help of the locals need to work for the conservation and protection of the tank
2. Deweeding of the tank to be undertaken
3. Flow of effluents must be stopped
4. Lessen the usage of pesticides
5. Maintain the cleanliness of water for drinking and agricultural purpose
6. Provide proper habitat for water birds and conserve native fishes
7. The tanks must be desilted properly consulting the experts

3.2.10 Strategies:

The strategies suggested by the school teams were the following:

1. Fencing tank boundaries to be undertaken
2. Promote the concept of grass-covered bunds

3. Repair tank channels
4. Protect flora around tank areas
5. Catchment areas need to be protected
6. Strictly ban borewells near tank areas
7. Ban brick kilns and querying near tank areas
8. Mechanized fishing to be banned
9. Regulate usage of tanks & clear encroachment
10. Regulate fishing, hunting of aquatic birds
11. Certain rare fish species areas need to have full protection
12. Fishing only the fully grown fish
13. No cultivation of crops during summer
14. Appoint water-regulating guard
15. Maintain tank water level by keeping the water flow by channel and promote sustainable use of water
16. Declare some of the ecologically sensitive ponds as biodiversity exclusive pond
17. Promote fish culture in tanks and introduce native fish species to tank
18. Scope for fish rearing in paddy fields
19. Promote organic farming at the water catchment area
20. Document biodiversity and know current status of it
21. Spread awareness regarding the tank to local people
22. NGO's and Government officials should play active role
23. Local committee should be formed to conserve tank
24. Desiltation and deweeding of tanks
25. Desilted soil to be given to farmers for their agricultural fields
26. Provide information tank to the farmers on desilted soil from the tank
27. Promote Swarna Jayanthi programme
28. Provide loan facilities for local fishermen

3.2.11 Action plans:

3.2.11.1. Gram Panchayat:

1. Take up cleaning of the tank

2. Empower Gram Panchayat to collect fee & regulate fishing and to protect water birds
3. Regulate the water level
4. Need to control dumping of garbage
5. Undertake the disiltation of Tanks
6. To provide financial support

3.2.11.2. Taluk Panchayat:

1. Regulate &monitor the tank
2. Empower Taluk Panchayat to collect fee & regulate fishing
3. Provide financial support

3.2.11.3. Zilla Panchayat:

1. Protect habitat of fauna
2. Take up desiltation and repair work of the tank and the fee collection authority should be given to them

3.2.11.4. Minor Irrigation Department:

1. Should regulate the water level
2. Penalty on damage during fishing must be imposed
3. Cancel license of fishing if people are hunting birds
4. Non agricultural activity must be banned at the catchment areas
5. Help local organization
6. Undertake desiltation programme
7. Needs to collaborate properly with the fisheries department

3.2.11.5. Forest Department:

1. Plant trees near the peripheral region of the tank
2. Regulate encroachment
3. Prohibit poaching of birds
4. Protect migratory birds

3.2.11.6. Fisheries Department:

1. Penalty on damage during fishing should be imposed
2. Cancel license of fishing if people are hunting birds

3. Promote fish culture
4. Provide fingerlings to the required people
5. Provide daily fish catch information
6. Fish processing &cold storage is very much essential
7. With Minor Irrigation department should collaborate properly

3.2.11.7. Pollution Control Board:

1. Setup a treatment plant for polluted water
2. Take proper action

3.2.11.8. Panchayat Raj:

1. Provide fishermen monetary benefits

3.2.11. 9. Local Organizations:

2. Protect the tank through fisher community
3. Should take the lead in tank conservation
4. Awareness programme to be conducted locally
5. NGO's to have awareness programme
6. Nature conservation Club to be started locally
7. Farmers to take desilted soil
8. Village Forest Committee must put effort to conservation of water and soil
9. Water consumer forum to be established for conserving the tank and also should also have the control
10. Fishermen union locally required

3.2.11.10. Scientific Community:

1. Must undertake awareness programme

3.2.11.11. Other Government Departments (that could not be linked separately):

1. Conserve tank in good condition
2. Protect biodiversity of the tank
3. Sustainable fishing is to be done
4. Must impose strict regulation of the tanks
5. Prohibit illegal fishing in tanks
6. Ban fishing during breeding season

7. Regulate span of irrigated areas
8. Regulate & clear encroachment
9. Check the management of agriculture land and channel
10. Eradicate weeds
11. Awareness through media
12. Provide financial support for desiltation
13. Proper management of the tank is required
14. Local consumer must be given first priority for accessing the fishes & later the market
15. Department funds to be used for local organization

3.3 Medicinal Plants

33 High schools and 16 P.U colleges from 8 districts of Karnataka undertook the theme on Medicinal Plants.

3.3.1 Current Status:

Many of the herbal practitioners felt that there is a drastic decline in the availability of medicinal plants. They also feel that medicinal plants have gained importance off late, but the practicing individuals are rarely seen. Very important medicinal plant species have declined to a greater extent and the herbal healers have to go far away places to procure them. They feel that such a change in the population is due to change in landscape, over harvesting and deweeding assuming all plants as weeds.

3.3.2 Ecological history:

Forested areas were converted into crop fields since ten years. There is a decrease in the amount of annual rainfall. Many natural landscapes have been transformed into monoculture plantations leading to shrinking of the habitats for certain medicinal plants.

Some of the rare species to be documented has been wiped off permanently in that locality.

3.3.3 Forces driving ecological change:

Lack of knowledge about the medicinal plants, assuming plants are weeds and deweeding them, urbanization and exotic weed infestation are the reason for the ecological changes.

3.3.4 Knowledge and beliefs:

There are certain plant species like Calotropis*, Aegle marmelos, Ocimum sanctum* and *Ficus* species that are worshipped too. For treating certain aliments herbal healers do use magic words, certain days in a week, certain time of the day. Some healers even pray before plucking out the plant and try to replant it by taking out only few root parts.

But they also feel that now a days people do not have patience and they rush to allopathic doctors whenever they have some problems to get cured immediately.

3.3.5 Gainers and losers:

Allopathic doctors have gained by patients running towards them whenever there is a health problem and also the encroachers who have changed the landscape to housing colonies or plantations or crop fields. While the herbal healers do not get enough patients to treat, Lack of popularity or reorganization in the society and also the medicinal plants for preparing medicine.

3.3.6 Values:

Herbal practitioners regard medicinally important plants as species having high value, while others regard religiously important plant species having high value. Amongst these medicinal plants, herbal healers regard plant species used for snakebite as rare and very high values. Some of them regard species having economical importance as high value. Others do not regard medicinal plants with any values.

3.3.7 Scenarios:

In the next ten years from now, many of the locally endangered medicinal plant species will become extinct if not conserved. Herbal practitioners feel that these plants should be grown at a larger extent so that they need not go to far of places to get the same in case of emergency. Some of the locals feel that growing medicinal plants commercially should be encouraged with economical benefits so

that people come forward to conserve the same. The landscape transformation if unchecked will eventually engulf the natural habitat of medicinal plants and in turn erode them away.

3.3.8 Aspirations:

People feel that:

1. Encourage knowing of medicinal plants at school level and educate the students regarding the importance and its uses.
2. Encourage growing commercially at village level.
3. Promote kitchen herbal gardens.
4. There needs to be a semi-processing unit at local level so as to ensure the quality of the harvested plants to the pharmaceutical companies.
5. Encourage conservation center at local level that would provide full details, market value and its importance to the locals.

3.3.9 Strategies:

The strategies suggested by the school teams were the following:

1. Cultivation of medicinal plants as homestead garden to be encouraged.
2. Awareness programme on Medcinal plants to be conducted.
3. Medicinal plants Garden to be established at local level.
4. Documentation of medicinal plants at local level needs to be carried out.
5. Information on medicinal plants as food to be provided to promote the idea and knowledge.
6. Revitalization of medicinal plants at local level
7. Recognize the nati vaidyas and award them in public so as to encourage the importance of the knowledge.
8. Herbal medicine centre to be established at local level and encourage nati vaidyas to treat the patients at the centre and revitalize the herbal medicine.
9. Endangered medicinal plants to be grown in a demonstration garden.
10. Training on herbal medicines to be conducted regularly.
11. Women's help forum to cultivate as kitchen herbal garden and promote medicinal plants.
12. Recognize student's effort in conserving medicinal plants.

13. Some feel that regulation on harvest of medicinal plants is not required and there need not be any collection fee. While others say that, as Gram Panchayats have no rights for collecting fees, NGO's or medicinal plant conservation unit can collect fees. Few others say that Gram Panchayat has the right to collect fee and Gram Panchayat could levy 25-50% of medicinal plant collection cess.
14. Regulation on harvest, grazing and action against human intervention to be checked.
15. Permit only vaidyas to medicinal habitat and not other commercial contractors or harvesters for collection.
16. Action against fake vaidya product needs to be taken.
17. Encroachment of agricultural land to be controlled.
18. Commercial use of medicinal plants must be banned.
19. JFM can regulate medicinal plant trade.
20. Protect grazing land and the medicinal plants habitat.
21. Provide fencing material to the farmers and Prevent forest fire.
22. Medicinal plants protection force to be created.
23. Financial assistance to grow medicinal plants, seedlings, organic manure and water facilities, land to cultivate, guidance from the concerned department, information on market to be provided.
24. Government to buy medicinal plants from the growers at support price.
25. Medicinal plants planting programme at local level to be conducted annually.
26. Financial support for medicinal plants processing to be provided by Government.
27. Proper medicinal plants market to be organized at local level.

3.3.10 Action plans:

3.3.10.1. Gram Panchayat:

1. Provide free medicinal plant saplings to interested growers.
2. Financial support to NGO's for growing and conserving medicinal plants.
3. In collaboration with farmers union to permit medicinal plants collection.
4. Provide land to grow medicinal plants.
5. Regulate encroachment and cattle grazing at government land.

3.3.10.2. Forest Department:

1. To support cultivation of medicinal plants at local level.
2. Organize workshop to create awareness amongst people.
3. Awareness programmes through other media.
4. Provide free medicinal plant saplings
5. Promote medicinal plant nurseries.
6. Ban monoculture.
7. Reasonable market price to be worked out and supported.

3.3.10.3. Agricultural Department:

1. To support cultivation of medicinal plants
2. Conduct workshops regarding medicinal plants.
3. Provide information on medicinal plants as intercrop.
4. Provide scope for green fence
5. Provide literature and technical support on medicinal plants.
6. Medicinal plants benefit to be provided through proper market and processing.

3.3.10.4. Panchayat Raj:

1. Include growing medicinal plants in the yearly budget
2. Establish medicinal plants garden at local level.
3. Recognize and award Nati Vaidyas and other individuals who has contributed towards conservation.
4. Provide land to grow medicinal plants.
5. Provision for financial assistance to be made.
6. Regulation of medicinal plant collection fee.

3.3.10.5. Industry:

1. To compulsorily have medicinal plants demonstration garden.
2. Provide medicinal plants saplings.
3. Buy with a support price.

3.3.10.6 Other Miscellaneous suggestions that could not be related to any departments:

1. Local herbal preparation unit
2. Information on publicity and loan
3. Harvest only useful parts from medicinal plants
4. Regulation of medicinal plants market by vaidyas
5. Joint regulation plan

3.4 Fresh Water Fishes

The theme on Fresh water Fishes was undertaken by 9 High schools and 5 P.U colleges from 8 districts of Karnataka, covering 45 wetlands which includes river, huge wells, tanks and water springs.

Results and Discussion:

The results got during this project were amazing with concrete strategies and action plans made by the team in consultation with the villagers to conserve and sustainably use the fresh water fishes of the study locality. They had also discussed in detail about all the components that were the part of the thematic study.

3.4.1 Current Status:

Many of the local fish species have been lost. Department has information only on the exotic species. Many of the fishes that are being bred are exotic.

3.4.2 Ecological history:

In earlier days, many of the tanks had native lot of native fish species that used to migrate for breeding in to the tank. Many of the tanks have dried up and there is scarcity in fish population. Native fish species have reduced drastically which were found in large numbers earlier.

3.4.3 Forces driving ecological change:

Excessive fishing and poaching, using explosives and poison to catch fishes, pollution of water, use of pesticide in paddy fields, Introduction of exotic fish species, fishing during the banned season are the main forces driving the ecological change.

3.4.4 Knowledge and beliefs:

Earlier, villagers used to fish together and were self-sustained. After the introduction of exotic fish species, this system stopped as the contractor came into picture. Villagers say that many local fish species were tastier and were recommended as medicine for certain disorders. Catching and consuming mahaseer fish were not entertained as it was related to god.

3.4.5 Gainers and losers:

Reduction in the number of native fish species has been a loss to the fishermen. The introduction of exotic species into the tank and through tender to the outsiders has hit the local fishermen economically. Outsiders who bid the tenders are benefited. ,

3.4.6 Values:

Many of the reports reveal that villagers ascribe values to economically important fish species and some give importance to the native fish species for its medicinal uses and taste. At some places, local fishermen oppose the introduction of exotic fish species, which they believe that native fish species would be lost.

3.4.7 Scenarios:

The native species of fishes will drastically decline if not properly protected. Industrialization, pesticide, chemical fertilizer and destruction of fish habitat would lead to decline in local fish population.

3.4.8 Aspirations:

People feel that:

Native fish species to be made available in the long term

A separate market place for selling the native fishes

Build more tanks and also conserve the existing tanks
Encourage the fish farming with emphasis on the native fishes
Provide proper habitat and conserve native fishes
Fish processing unit to be established locally in long run
To reduce destructive fishing methods
Maintain the tank water level during summer too
Documentation of the locally available fish species

3.4.9 Strategies:

The strategies suggested by the school teams were the following:
Declare the native fish rich areas as protected areas
Fish processing units to be thought of
Regulate fishing
Need to start Fish Breeding Centre
Ban fishing during the breeding season
Mechanized fishing to be banned
Certain rare fish species areas need to have full protection
Fishing only the fully grown fish
Declare some of the ecologically sensitive ponds as biodiversity exclusive pond
Promote fish culture in tanks and introduce native fish species to tank
Scope for fish rearing in paddy fields
Provide loan facilities for local fishermen

3.4.10 Action plans:

3.4.10. 1. Gram Panchayat:

Empower Gram Panchayat to collect fee & regulate fishing
To provide financial support

3.4.10. 2. Taluk Panchayat:

Empower Taluk Panchayat to collect fee & regulate fishing
Provide financial support

3.4.10. 3. Zilla Panchayat:

Protect habitat of fishes

3.4.10. 4. Minor Irrigation Department:

Penalty on damage during fishing must be imposed
Non agricultural activity must be banned at the catchment areas
Help local organization
Needs to collaborate properly with the fisheries department

3.4.10. 5. Fisheries Department:
Penalty on damage during fishing should be imposed
Cancel license of fishing if people are hunting birds
Promote fish culture
Provide fingerlings to the required people
Provide daily fish catch information
Fish processing &cold storage is very much essential
With Minor Irrigation department should collaborate properly

3.4.10. 6. Panchayat Raj:
Provide fishermen monetary benefits

3.4.10. 7. Local Organizations:
Awareness programme to be conducted locally
NGO's to have awareness programme
Fishermen union locally required

3.5 Crop and Genetic Diversity

The current theme on Crop and Genetic Diversity was undertaken by 9 High schools and 6 P.U colleges from 8 districts of Karnataka.

Results and Discussion:
The results got during this project were amazing with concrete strategies and action plans made by the team in consultation with the villagers to conserve and

sustainably use the water bodies of the study locality. They had also discussed in detail about all the components that were the part of the thematic study.

3.5.1 Current Status:

Some of the traditional varieties of crops have been lost since ten years as no one is cultivating it. Report reveals that there were many traditional variety of ragi, cotton, paddy, green gram, lentils which are very rarely found now. Farmers have gone for high yielding varieties forgetting the traditional varieties due to irrigation facilities. Yet, there are few villages that are having few traditional varieties of crops.

3.5.2 Ecological history:

In Kodagu due to Harangi reservoir, many acres of fertile paddy field were drowned. In the last ten years, due to the invasion of HYV, many traditional crop varieties were lost. Low water level in the tanks has made the farmer go for bore wells. Cultivation areas for HYV have been increased to larger extent.

3.5.3 Forces driving ecological change:

Demand for more irrigation, increased demand for HYV and less demand for the traditional varieties, forest and catchment area destruction has drastically changed the scenario.

3.5.4 Knowledge and beliefs:

Some of the traditional varieties have been grown and used for its special taste and quality. Many of them feel that the traditional varieties were having high status for all religious practices. The farmers even had the seasonal chart that was correlated with the rainy season, and they would sow the seeds accordingly. Some of the traditional crops were grown at certain season only for which it would grow well. The alternating cropping pattern was of much use to the farmers. Traditional variety crops were disease and pest tolerant. The farmers had great knowledge in preserving the seeds and grains. They even had their own method to avoid pest attack.

3.5.5 Gainers and losers:

Farmers cultivating HYV crops are benefited due to the higher production and demand in the market, whereas the farmers cultivating traditional variety do not make much money, as the production is comparatively very low and the demand for the traditional variety in the market is not much. The farm laborers feel much more profitable to go and work in perennial crop farm than the usual annual crop as the later depends on the rainfall and seasonal. Lack of customer – producer direct link has made the grower make very less profit, which is being made by the middleman.

3.5.6 Values:

Marginal farmers ascribe high values for the traditional variety crops though the yield is low and the market demand is low, because of its taste and quality. Some of the big farmers give importance to the modern technology and HYV, looking at productivity and profit. The cultural values have been ascribed to traditional variety crops as they are in demand for certain practices. Many of the farmers have converted their seasonal cropping system to the perennial cropping system due to the modern technology and irrigation facilities, hence they ascribe high values to the perennial crops.

3.5.7 Scenarios:

In the next ten years there are chances of losing all the traditional crop varieties and keeping only the HYV. Chances of more pests and diseases foreseen in future. Some farmers also feel that there may be increase demand for the traditional crop varieties, as they will be rarely seen. There is a possibility of number fields growing annual crops being converted to perennial crops. Cash crops like coconut, arecanut, and coffee likely to take over many annual crops.

3.5.8 Aspirations:

People feel that:

The concerned departments and the local organizations with the help of the locals need to work for the conservation and protection of the traditional crop variety.

The traditional variety crop must fetch more money and it should be given high priority by the concerned officials and the farmers.

Some feel that the HYV should be encouraged as it fetches high price.

Organic farming must be entertained.

Proper guidance, and awareness regarding the traditional technology and method of farming should be given to the farmers so that they would cultivate traditional variety crop and compete with the modern HYV, which is possible only if it gets good demand.

Instead of pesticide biological control could be used.

Make available the seeds of traditional crop variety to all the interested farmers in future.

Encourage alternating cropping pattern

3.5.9 Strategies:

The strategies suggested by the school teams were the following:

Collection of seeds of the traditional crop varieties

Promote the concept of tree growing near the fields

Create a place in the market for selling the traditional crop varieties.

Regulate tree felling on the farm land

Regulate the use of pesticides and chemical fertilizer.

Encourage the farmers growing traditional crop variety and recognize them in the society.

Honour the farmers growing traditional crop variety and are maintaining them.

Provide subsidy or loan at very low interest for purchasing tractor and other implements to the farmers who are growing traditional crop variety.

Provide special funds to the Gram Panchayat that is growing traditional crop varieties.

Promote organic farming.

Document traditional crop varieties currently cultivated and were earlier in cultivation.

Spread awareness regarding the traditional crop variety to the farmers by documentary film.

3.5.10 Action plans:

3.5.10. 1. Gram Panchayat:

Recognize the farmer who is growing traditional crop variety.

To provide financial support to the farmers practicing organic farming.

3.5.10. 2. Minor Irrigation Department:

Build check dams to enrich the ground water table
Help local farmers
Undertake desiltation programme

3.5.10. 3. Electricity Board:
Ensure uninterrupted power supply for 8-10 hours everyday
Provide loan facilities to the farmers for purchasing generator sets, if the above is not possible.

3.5.10. 4. Agricultural University and Department:
Use modern technology and improve the traditional crop varieties and make it more disease tolerant
Carry out more research on traditional crop varieties and inform farmers about the quality.

3.5.10. 5. Panchayat Raj:
Provide farmers cultivating traditional crop variety monetary benefits
Water consumer forum to be established for conserving the tank and also should also have the control
Fishermen union locally required

3.6 Traditional Conservation Practices

The current theme on cultural traditions of conservation was undertaken by 6 High schools and 2 P.U colleges from 8 districts of Karnataka.

Results and Discussion:

3.6.1 Current Status:

Many of the sacred plant species have declined since ten years. Report reveals that there were many sacred plants and animals that have lost their importance and due to which have been exploited.

3.6.2 Ecological history:

Tree species inside the sacred groves are very unique and do not occur outside. Many of the plant species like *Aegle marmelos, Phyllanthus emblica, Michelia champaca, Butea monosperma, Mimusops elengi, Calotropis gigantea* have declined in the sacred groves. Python, Peafowl, Mongoose population have declined. Many of the sacred groves have been converted to concrete structures and have concrete walls. The belief in the past had helped in conserving the sacred species, which now has changed accordingly.

3.6.3 Forces driving ecological change:

Lack of beliefs in rituals and cultural practices has declined the sacred species population.

Modern days celebration and rituals are more oriented towards pomp and show than the actual concept.

Cultivation of commercial crops had also denuded the habitat of sacred species and sacred groves.

Demand for timber and fuel wood has also contributed equally for the degradation of sacred trees and sacred groves.

3.6.4 Knowledge and beliefs:

Many of the *Ficus* species like Peepal, Banyan and other trees like *Butea monosperma, Aegle marmelos* were treated as sacred trees.

Many of the plant species like Neem, *Cynodon, Emblica, Aegle* were used in rituals and culture.

Cobra, Sparrow, Parakeet, Egret, Langur, and Monkeys were regarded as sacred and worshipped by people.

Natural resources not to be extracted inside the sacred groves.

3.6.5 Gainers and losers:

People depending on the medicinal plants growing in the sacred groves, water sources, plant species of religious importance and the dependent animals on these sacred groves are the losers while encroachers, land buyers, contractors and land dealers are gainers.

3.6.6 Values:

People ascribe high values to plants having religious importance and timber values. They also regard high values to Monkeys, Cobra, and Peafowl with religious importance.

3.6.7 Scenarios:

Drastic decline in the area of sacred groves if unchecked.

Lack of beliefs and change in attitudes of people towards sacred groves.

Sacred groves, sacred plants and animals might become very rare.

3.6.8 Aspirations:

Proper guidance by the temple authorities and creation of awareness amongst the public to protect these sacred groves.

Local associations need to come forward to protect these sacred groves.

Species having nuisance values need to be regulated.

Concretization of the sacred groves needs to be regulated.

3.6.9 Strategies:

The strategies suggested by the school teams were the following:

Sacred groves in either private or public places need to be declared as gram panchayat property and protect them.

Fence at the sacred grove areas and prevent encroachment.

Provide incentives to the owners of the sacred groves who has conserved it in its original form.

Honour the owner of the sacred groves who has protected it.

Awareness programme at local level through NGO's to protect these sacred groves.

Temple trust and schools along with local departments to come forward to protect these sacred groves.

Incorporate study on sacred groves in school syllabi.

3.6.10 Action plans:

3.6.10. 1. Gram Panchayat:

Recognize and honour the owners of the sacred groves

To provide alternative incentives to the owners of the sacred groves.

Regulate concretization.

3.6.10. 2.Temple trust:

Establish Scared Groves Conservation Committee to protect the sacred groves.

Conduct regular workshops and awareness programme.

3.6.10. 3. Panchayat Raj:

To ensure proper protection of sacred groves at Gram Panchayat level

3.6.10. 4. Forest Department:

Provide free saplings of sacred trees for those who come forward to plant and protect.

Popularize the concept of sacred grove through advertisements.

Provide financial support to those who are protecting sacred groves and would like to expand the area.

Take action against illegal felling of trees inside the sacred groves and ban permission towards such felling.

3.6.10.5. Interesting findings:

The team from Seethamma Pre-University College, Davanagere had documented extensively on the ongoing ecological changes and the impact of human intervention on biodiversity. They had also gone to the extent of discussing the issues with the local governing bodies and had documented the immediate requirements for effective implementations of the strategies by relevant departments. The team had made subset of the main questionnaire to get the detailed inputs from the interviewee.

Students from M.G.M. Girls High School, Madhugiri had collected seeds of various crops grown in their study area, labeled it and submitted along with the report.

Few teams had also collected fish specimens by going along with the fishermen during fishing and preserved as per the guidelines and had identified the same. Some teams had prepared herbarium of the medicinal plants specimens collected in their study area while interviewing the local herbal practitioner. Care was taken not to collect rare specimens. These specimens were photographed for identification.

4. People's Biodiversity Registers

At the third phase School Biodiversity Registers were prepared focusing on the themes of Medicinal Plants and Fresh water Fishes as models of inputs towards preparation of People's Biodiversity Registers as a follow up of the Biological Diversity Act. It was learnt from the earlier exercise that a detailed study is required for a particular locality for a period of one year to document the natural resources, landscapes, interview the knowledgeable, understand the change in the species population, conservation efforts required to effectively manage and implement through local governing body. The study was redesigned and lot of novel components was incorporated into the methodology. Looking at the interests taken up by some of the teams, studies like the simple landscape classification by point method, looking at the abundance of species at each landscape element type selecting one largest and one moderate patch under each Land Scape Element (LSE) type. Unique codes where given to LSE types and other observations made to ease the documentation and analysis part. A questionnaire was designed to get the information about species turnover, landscape changes, problems to be addressed and values ascribed to the species by knowledgeable individuals. A CD based interactive key to identify plants and fresh water fishes was also developed by the center to help students for identifying the species encountered by them during their field work. The CD had simple identification characters to be looked at, simple non-technical description, and coloured photographs. The teams used the CD and they could confirm to a larger extent the species they had collected and identified with the help of the same. Few of the school teams were from the ' Mahithi Sindhu' programme (launched by Government of Karnataka, which has identified 1000 Government schools from the state and provided 10 – 15 computers to each school and teach the students in the field of computer. These few schools could take the advantage of utilizing the CD to identify the species collected by them. The remaining schools that could not avail this facility had to depend on the near by Mahithi Sindhu Schools and other computer institutions to try out the CD for identifying the plants and fishes.

4.1 Outcome of the programme:

Most of the teams had worked during the weekends and holidays to make the study more effective and also equally justifying the school curricula. They could succeed in procuring some secondary information like the village profile, ecological history of the study area, culture, tradition, census data of human population and livestock, rainfall report and revenue maps. Few of the teams had also collected data on geographical area distributed village wise in acres. The duration of this project was for a year, during which they could document the seasonal changes in the plant species and the availability in fresh water fishes, the leasing of fishing and collection. Many teams had come out with very detailed vegetation and human habitation maps that could be hardly found in any of the gram panchayat offices. Waterscape of the study area was documented effectively with the seasonal or perennial water source being utilized by the villages, or any sharing agreements there upon and the management of the same till date. The change in the availability of water source and the reason behind was also thoroughly discussed with the knowledgeable individuals. The local income generating activities like the collection of Non Timber Forest Produce (NTFP), medicinal plants and Fresh water Fishes were listed out in consultation with the collectors and the contractors residing in the same village as well as outside the village. Introduction of exotic species to the village and its impact on the native species were also documented.

A novel concept of identifying landscapes by means of sampling twenty points by moving with a compass at the extreme point from each of the four directions and noting the existing of vegetation cover, canopy, topography and any sort of human disturbances, was incorporated in order to avoid bias of visual vegetation classification. This had helped the team to appreciate deriving particular vegetation by own effort.

4.2 A sample report:

Investigating teacher: Shri B. V. Gundappa

School name: Government Pre-University College, Nagavalli, Tumkur.

Village gram panchayat: Nagavalli

Taluk and District: Tumkur

Lat. Lon.: E 077°03.487’ and N 13°13.073’

Annual rainfall: 60-110 cm.

Temperature: 17° – 37° C

Altitude: 2835 ft.

Geographical area: 4.5 sq. km.

Number of villages: 7

Meaning of the village name: Nagavalli- a special broad variety beetle leaf

Local organizations in the gram panchayat: 24

Population Census data (2001): 6160

Irrigated area: 985 acre 24 gunta

Arid land: 1297 acre 36 gunta

Land in cultivation: 2283 acre 20 gunta

Gunduthopu land: 14 acre 93 gunta

Gomala (grazing land): 344 acre 12 gunta

Crops grown: Paddy, Ragi, Jowar, Arecanut, Coconut, Plantain and grams

Water bodies: 5 tanks, 2 canals, ponds, and wells for irrigation

NTFP: 19 (includes honey, fruits, berries, green leaves, fuel wood and seeds)

Flora and Faunal diversity: 678 sp. plants (target species 146), 27 sp. fresh water fishes, 69 sp. birds, 24 sp. reptiles, 15 sp. animals, 54 sp. butterflies, 11 sp. frogs, 59 sp. insects other than butterflies.

Knowledgeable Individuals identified in the Gram panchayat: 21 (Includes Herbal practitioners, Fishermen, Contractor, Organic farming farmers, Priests, Fish seller, Plant rears, Tinkers, Carpenters, Local nurses)

Total manpower for the study: 198

Total man-hours for the study: 308 hours

Fresh water Fishes: There are about 19 species of native species and fisheries department has introduced 6 sp.. There had been notable changes since last ten years in the fish population. Out of 19 native fish species only six species occurs in good number while the remaining 13 species has declined drastically. Local people regard 12 species out of 19 target species as most useful while 2 species are harmful to other species.

Landscape Element Types occurring in the study area: Grassland, Scrub savanna, Tree savanna, Scrub land, Annual crop, Tree crop, Rocky outcrops, Human habitation, Water bodies like Ponds, Canals, Tanks.

Patterns of ongoing changes at Landscape level: Since 15 years, crop fields have been converted to Tree plantations due to sinking of tube wells, which has lead to the decline of many rare plants. Gomal (grazing patch) has been converted to housing colonies having about 300 houses since 20 years. At the western part, the gomals have been converted into Acacia, Nilgiri plantations by the forest department and it also has changed to scrub jungle. The peripheral area of the Nagavalli Amanikere Tank has been encroached and converted to plantations, brick kilns and crop fields leading to shrinking of the tank.

Changes at species level: In the last 15 years due to lack of rain, grazing, tree felling, conversion of crop fields and gomals to plantations and tree crops has declined the population of many medicinal plants. Usage of pesticides, Chemical fertilizer, over exploitation of resources, invasion of exotic weeds, hunting and unsustainable methods of harvesting natural resources has declined the fauna species diversity.

Human Values towards landscapes: People regard high values for water bodies, Grazing land and regard next higher values to Tree crops.

Human Values towards species: Species having medicinal properties, Timber wood and important for religious purposes has been regarded as species having high values by the locals. The local people regard *Prosopis juliflora, Parthenium, Eupatorium, Ipomoea fistula, Eichornia crassipis and Hydrilla* as species having nuisance value and want them to be removed permanently.

Fish species like *Lepidocephalus thermalis, Mystus vittatus* and *Heteropneustes fossilis* are regarded having high value by fishermen and consumers.

Implications of ongoing ecological changes: There is acute shortage for groundwater, irrigation purpose, and drinking water due to the expansion of agricultural land and the catchment area. There is lot of Siltation taking place at the main tanks and brick kilns are active. Invasion of exotic weeds have added up the problem. All these lead to the shortage in water availability.

Conversion of open area, grazing patches into tree crops and plantations, uncontrolled grazing in the remaining areas, tree felling, monocultures have reduced the population of medicinally important plants.

4.3 Overall results from the analysis of all the 16 sites data:

4.3.1 Plants from target species having great value:

Azadirachta indica, Pongamia pinnata, Mangifera indica, Tamarindus indica, Cocos nucifera, Ficus benghalensis, Achyranthes aspera, Murraya koenigii, Calotropis gigantean, Aegle marmelos, Hemidesmus indicus, Oriza Rice, Areca catechu, Bambusa arundinacea, Tectona grandis, Withania somnifera, Cynodon dactylon, Aloe barbadensis, Cassia fistula, Santalum album and Aristolochia indica.

4.3.2 Plants from target species having some values

Solanum melongena, Coccinia grandis, Basella alba, Lantana camara, Abutilon indicum, Canthium parviflorum, Syzygium cumini, Abrus precatorius, Amaranthus spinosus and Cassia auriculata.

4.3.3 Plants having some what nuisance value:

Tribulus terrestris, Prosopis juliflora, Pedalium murex, Tragia involucrata and Datura metel

4.3.4 Plants having greater nuisance value: Parthenium hysterophorus

4.3.5 Fishes from target species having great value: Channa punctatus, Cyprinus carpio and Heteropneustes fossilis.

4.3.6 Fishes from target species, having some values: Pseudambassis ranga, Puntius sophore, Catla catla, Lepidocephalus thermalis, Mystus vittatus, Puntius vittatus, Clarias batrachus and Ompok bimaculatus.

4.3.7 Fishes having somewhat nuisance value: Ambassis commersoni and Setipinna phasa.

4.3.8 Fishes having greater nuisance value: Oreochromis mossambica and Ambassis commersoni.

4.3.9 Overall landscape element type status at the study areas: Most of our study areas had Annual crops and tree crops to a greater extent with plain topography.

Average rocky outcrops with plain topography were not reported in any of the study sites. Scrub land, forest, Tree crop, Largely paved and built with some vegetation, Sparsely paved and built with extensive vegetation were seen in most of the study area having undulating topography while largest undulating grassland patch was absent. Hilly forest and scrub savanna were reported in most of the study areas while hilly scrubland, annual crops, tree crops, largely paved and built with some vegetation and sparsely paved and built with extensive vegetation were not seen.

4.3.10 Human Interventions in landscapes: Scrubland, forest, tree crops, tanks reservoirs and largely paved and built with some vegetation had lot of human intervention in terms of destruction.

Tree savanna, forest, tree crop, largely paved and built with some vegetation and sparsely paved and built with extensive vegetation under tree canopy were observed more.

Scrub savanna and scrubland were mostly covered by shrub.

Grassland, scrub savanna, scrubland, tree savanna and Annual crops had more herbaceous cover.

Rocky outcrops had barren land.

Largely paved and built with some vegetation had paved land and the sampling point was also observed inside a building too.

4.3.11 Abundant species: Achyranthes aspera, Cassia auriculata, Centella asiatica, Cynodon dactylon, Lantana camara, Mimosa pudica, Parthenium hysterophorus and Tribulus terrestris.

4.3.12 Common species: Abutilon indicum, Acacia nilotica, Achyranthes aspera, Alangium salvifolium, Alternanthera sessilis, Aloe barbadensis, Amaranthus spinosus, Azadirachta indica, Boerhavia diffusa, Breynia retusa, Canthium parviflorum, Cassia auriculata, Cynodon dactylon, Cyperus rotundus, Datura metel, Jatropha curcas, Lantana camara, Mangifera indica, Mimosa pudica, Oxalis corniculata, Pedalium murex, Phyllanthus amaras, Plumbago zeylanica, Pongamia pinnata, Sida cordifolia, Sida acuta, Tribulus terrestris and Vitex negundo.

4.3.13 Rare species: Aloe barbadensis, Aristolochia indica, Aristolochia tagala, Butea monosperma, Hemidesmus indicus, Santalum album and Tinospora cordifolia.

More number of interviewee had the opinion of moderately or substantial decrease in the landscape element types likes Grassland, Scrub savanna, Tree savanna, Scrubland, Forest, Streams/ rivers and Tanks, reservoirs.

They had also indicated substantial increase in the landscapes like Annual crops, Tree crops, largely paved and built with some vegetation and Sparsely paved and built with extensive vegetation and no change in rocky outcrops landscapes.

According to most of the interviewees give common names . check spellings of scientific names Oryza sativa (Paddy), Areca catechu (Arecanut) and Prosopis juliflora (Bellary Jaali) of the target species has substantially increased over the years.

Interviewees have observed substantial decrease of the following species: Abrus precatorius, Butea monosperma, Hemidesmus indicus, Holoptelea integrifolia, Madhuca longifolia, Pongamia pinnata, Santalum album, Terminalia chebula, Terminalia paniculata, Tinospora cordifolia, Typha, Vitex negundo

Interviewees have also observed substantial increase in the fish population of Poecilia reticulata and Catla catla; Substantial decrease in the population of the following species:

Ompok bimaculatus, Nemacheilus denisoni, Lepidocephalus thermalis, Mastacembelus armatus, Mystus gulio, Heteropneustes fossilis, Esomus danricus, Cyprinus carpio, Clarias batrachus, Channa orientalis and Channa punctatus

People assign greater values to LSE types like Annual crops, Tanks, reservoirs, Streams/ Rivers and Forest and nuisance value to Largely paved and built with some vegetation. LSE Types like scrub savanna and rocky out crop is of no significance to them.