

**India-UNDP Project on**  
**“Strengthening of Institutional Structures to Implement the Biological diversity Act”**

**Highlights of the Report of the Consultant- Documentation**

**JHARKHAND**

The State of Jharkhand is endowed with rich biodiversity and genetic resource. Forests spreading over an area of 23605 square kms and constituting about 29.61% of the total area of the state form an integral part of the socio-economic set-up and largely contribute towards the economy of the state. The protected areas of the state are represented in sanctuaries and national parks. Some of the important forests and national parks of Jharkhand are: Betla National Park, Hazaribagh Wild Life Sanctuary, Dalma Wild Life Sanctuary, Lawalong Wild life Sanctuary, Udwa Bird Sanctuary, Saranda - The Sal Forest, Mahuadar Wild Life Sanctuary, Koderma Sanctuary and Crocodile Breeding Centre - Muta -Topchanchi Sanctuary. Tropical Dry Deciduous, Moist Deciduous, Dry Peninsular and Dry Mixed Deciduous Forests are the main forest types. These forests form the catchments of the Koel, Damodar and Subernekha rivers. The Department of Forest and Environment, Government of Jharkhand takes care of the forests dealing basically with the protection, conservation of forest and environment, wild animals and birds, Biological Parks Management, control of Forest Development Corporation, and Environment Research and Education.

The ecosystem diversity in the state has been largely influenced by the people through the agricultural and pasture, and change in land use patterns for various developmental activities. The tribal communities composed of Munda, Ho, Oraon, Santhal, Paharia, Chero, Birjea, Asura and others do have influence upon different eco-systems with varying practices of agriculture, pasture and dependence on forests for livelihood and conservation.

The state of Jharkhand is bestowed with rich domestic animal biodiversity such as cattle, buffalo, goat, sheep, pig, donkey, poultry etc. A large number of breeds of livestock and poultry have emerged largely due to wide range of agro-ecological zones and the years of evolution within specific agro-climatic conditions, conscious/subconscious selection, animal husbandry practices and development. It deserves a mention that each breed or strain is an aggregate of specific genes.

It is found that the livestock genetic resource in Jharkhand is very much ethnic group and location specific. More than 95% of livestock population in Jharkhand is of non describing indigenous breed.

The major factor limiting the scale and efficiency of livestock production are the limited local feed resources and higher cost of purchased inputs. Besides, the diseases among the cattle/buffalo, pig and poultry are also the matter of concern. Livestock keepers are cash starved and formal banking system is unapproachable to them. There is need for a well designed sample survey of livestock keepers and ex-livestock keepers besides identifying key points for technical, institutional and policy interventions. Cattle Haat can provide information on the breeds, choice of community for particular breed or nondescript for specific use etc.

***Hazaribagh and Latehar districts***

Hazaribagh has 107 and Latehar only 28 educational institutions which range from secondary to higher secondary schools to degree college level. The districts have different institutions or departments directly or indirectly relevant to certain aspects of biological diversity conservation and management. These are concerning forestry, mining, industries, fisheries, land conservation survey, agriculture, horticulture, tourism, medical, veterinary, cattle development,

public administration, Directorate of statistics etc. Agriculture in both districts is largely subsistence based. The farmland production is not sufficient to meet the annual requirements of the growers. Cultivation is mostly rainfed during the rainy season and the main crops are rice, wheat, pulses, oilseeds, maize millet, potato, and vegetables.

### ***Institutional structure***

The institutions such as Birsa Agricultural University (BAU), Ranchi University, National Bureau of Plant Genetic Resources (NBPGR), ICAR Gum and Resins Research Institute, Institute of Forest Productivity under ICFRE, Birla Institute of Technology, Mesra, Tasar Research and Training Centre and the local institutes contribute towards the study of biological diversity and its conservation. NBPGR maintains 219 collections of *Jatropha curcas*, 172 strains of rice, 2536 of pulses, 3123 of cereals, 1377 of oilseeds, 1619 of vegetables, 941 fruit bearing plants and 104 of tuber crops.

### ***Country Market (Haat)***

A country market (Haat) at Demotend near Hazaribag was visited and noted following salient features of biodiversity importance: an elderly person of over 60 years, named Birbal was found with assorted raw materials of plant origin in the form of roots, stem, bark, dry fruit, seeds, mushroom of medicinal value for selling. It was learnt from him that he has been bringing his produce for the past over seven years and the collection of the materials is largely from Parasnath hills of the state. The vernacular of the medicinally valuable produce typical of forest origin are gulendi haat, dudhraj (*Holorrhena antidysenterica*), kaan raj, bhrigraaj (*Eclipta* species), satmul jash (*Chlorophytum tuberosa*), tarmuljai, hensekre, kenjari, banhaldi (*Curculigo orchioides*), ramdatun (*Streblus asper*), kadan kola, borotala, gaindura aitha (*Helicteres isora*), bhilawa gach (*Semecarpus anacardium*), rambasak (*Adhatoda vasica*), giloe (*Tinospora cordata*) fruiting bodies of *Polyporus* species etc. Deserving to mention that the person is known as *Vaid* in nearby village for his knowledge on the uses and usage of produce of medicinal properties against different ailments.

### ***Biodiversity Heritage Site***

Field study shows that the forest- cum- rural landscape of Taimara – Dassam Falls near Ranchi may be considered for characterization as Heritage site. This is also due the fact that the aspects of rural and forest landscape, social, environmental, biological values and traditional practice of lac culture of significance do still exist. The heritage valuation could be made following National Biodiversity Authority (NBA) guidelines.

### ***Medicinal Plants***

Common medicinal plants of the districts are Amla (*Emblica officinalis*), Harre (*Terminalia chebula*), Bahera (*Terminalia bellirica*), Chiraita (*Swertia chirayata*), Bel (*Aegle marmelos*), Satawar (*Asparagus* species), Piar (*Buchanania lanzan*), Neem (*Azadirachta indica*), Dudh koraia (*Holorrhena antidysenterica*), Kend, Kanwad (*Casearia speies*), Patal kohra (*Pueraria tuberosa*), Seez (*Euphorbia tirucalli*), Kujurum, Rawad, (*Acacia pennata*), Dumar (*Ficus racemosa*), Kari chhakh (*Gloriosa superba*), Seneduar (*Vitex negundo*), Karanj (*Pongamia pennata*) etc.

### ***Native Fish Diversity***

The water bodies in the village clusters of Bargada, Pandua khunti and Picherry are reported to have diversity of fish fauna with 30 species distributed among 21 genera, mainly of Telpia, Chital, Mangur, Rita, Singhni, Tengra, Boari, Bagaria, Garai, Chenga, Sor, Mola, Plat, Pothia, Jebra, Gachia etc. Presently Mangur fish is only commonly found. In the peripheral water bodies of the Palamau Tiger Reserve, Betla in Latehar district have the fish diversity represented by Puthi, common carp, Bata (*Labeo bata*), Kalibous (*Labeo kalbasu*), Catla, Magur, Mirgal and Rohu (*Labeo*

*rohita*). During 1950s the fish diversity of Hazaribag was very rich with representation of species belonging to families Cyprinidae (5 species), Rasborinae (9 sps.), Cyprininae (27 sps.), Pisilorrhynchidae (11 sps.), Sisoridae (12 sps.), Bagridae (6 sps.) etc. There is need to carry out further inventory of the Piscean fauna of the water bodies near the village clusters involving expert institutions of the district and the state.

### ***Bamboo and its Conservation Strategy***

There is urgent need to develop strategic planning towards the development of bamboo resource in the districts. National Bamboo Mission aims at developing the resource in non bamboo growing areas. The *Turia* are the only community in Jharkhand known for their skills in making bamboo product. But the thin distribution of the bamboo resource in the district and the marketability of the product impact upon their dependence for economic derivatives.

The Consultant made a presentation in a National Seminar on “*Productivity enhancement & value addition of bamboos*” during March 2010 organized by Jharkhand State Forest Development Corporation Ltd and Institute of Forest Productivity, Ranchi. The presentation of a paper was on “*Bamboo biodiversity management and value addition for sustainable development: Need for strengthening institutional structures and capacity building*” followed by interactive discussion laid emphasis on livelihood of the communities and the management of bamboo diversity in the districts and the state largely. Emphasis was laid on the need to integrate modern pre- and post harvesting techniques for the supply of quality and certified materials to bamboo based units involving the communities through participatory approach, characterizing the traits and associated traditional knowledge and the grass root innovation by the communities for the value addition, development of Bamboo Biodiversity Management Units and registration of grass root innovation with emphasis on site and community specific indicators including bamboo landscape associated with the virtues of religious, artistic or cultural practice that are intangible, Intellectual Property Right (IPR) related issues, gender initiative particularly the role of women on harvesting and marketing trends.

### ***Invasive Alien Species***

Convention for Biological Diversity (CBD) visualize “*biological invasion of alien species as the second worst threat after habitat destruction*”. Biological invasions may be considered as a form of biological pollution and significant component on human-caused global environmental change and one of the major causes of species extinction. There is high opportunity of accidental introductions with exchange of biological produce with rapidly increasing global economy and commerce. An invasive is defined as an introduced (non-native, exotic, alien) species, that can consistently reproduce and sustain populations over many generations without (or despite) direct intervention by humans. The species become naturalized after having become established locally. Some Invasive species disperse and produce viable offspring in areas distant from the sites of introduction. An invasive makes social, environmental, ecological and economic impact adversely. Indian region accounts on 173 invasive alien species belonging to 117 genera under 44 families [Life Science Journal. 2008; 5(2): 84 – 89]. Almost 80% of the alien species are reported to have been introduced from neotropics. Invasive alien flora of the country is represented by the elements from tropical America (74%) and tropical Africa (11%). There is need to develop national and state level action and strategic plan to monitor and control, early detection and reporting of infestations of spread of new and naturalized species.

The invasive species of the region and the districts under study belong to *Asteraceae*, *Fabaceae*, *Convolvulaceae*, *Caesalpiniaceae*, *Solanaceae*, *Amaranthaceae*, *Poaceae*, *Euphorbiaceae*, *Mimosaceae*, *Tiliaceae*, *Apocynaceae*, *Araceae*, *Arecaceae*, *Balsaminaceae*, *Cactaceae*, *Liliaceae*,

*Melastomataceae, Nyctaginaceae, Oxalidaceae, Papaveraceae, Passifloraceae, Piperaceae, Polygonaceae, Rubiaceae, Salviniaceae, Typhaceae, Urticaceae* etc

Invasive alien species found on different aspects of village and forest ecosystems of two districts covered are *Argemone mexicana*, *Argemone ochroleuca*, *Cassia tora*, *Ipomoea carnea*, *Lantana camara*, *Eupatorium odorata*, *Cuscuta reflexa*, *Parthenium hysterophorus* and *Hyptis suaveolens*. The species were found colonizing and invading into the original habitat of the flora. The fallow agricultural land was found with the abundance of the obnoxious invasive such as *Argemone* and *Lantana*. The stray cattle and goats can be considered as the dispersing agents of the invasives. *Lantana camara* could be brought to utilization by involving certain local institutions such as Institute of Forest Productivity (ICFRE), Ranchi and others in imparting training in converting this wasteful resource in making *lantana* furniture, baskets and other items.

### **Land races, Wild relatives, Folk varieties**

Article 41(1) of Biodiversity Act defines “*Landrace*” as a primitive cultivar that was grown by ancient farmers and their successors; “*Cultivar*” means a variety of plant that has originated and persisted under cultivation or was specifically bred for the purpose of cultivation; and a “*folk variety*” is referred to as cultivated variety of plant that was developed, grown and exchanged informally among farmers. Farmers’ seeds are most often brought in one broad category called ‘*landraces*’. The term *landrace* can be traced to the time when ‘*modern*’ varieties of cereals were introduced to European farmers in the late nineteenth century. The farmers’ varieties of the time were called ‘*landraces*’ and understood as seeds adapted to local growing conditions through natural adaptation usually with no intentional selection. But the term was quickly adopted as generic for all farmers’ varieties including those that are bred and maintained by active seed selection on-farm. Such farmer-bred varieties are better termed ‘*folk varieties*’. Thousands of locally-adapted rice varieties (also called “*landraces*”) were created by farmer selection to withstand fluctuations in rainfall and temperature and to resist various pests and pathogens. Most of these varieties, however, have been replaced by a few modern varieties, to the detriment of food security. “Traditional crop *landraces* are an important component of sustainable agriculture because their long-term yield stability is superior to most modern varieties. An ample body of evidence exists to indicate that whenever there is a shortage of irrigation water or of fertilizers-due to drought, social problems, or a disruption of the supply network *land races* do better. Under optimal farming conditions, some *folk varieties* may have lower mean yields than high-yield varieties but exhibit considerably higher mean yields in the marginal environments to which they are specifically adapted” [*Debal Deb (2009): Valuing Folk Crop Varieties for Agroecology and Food Security, Centre for Interdisciplinary Studies, West Bengal*]

Red rice varieties such as *Bhama*, *Danigora*, *Kaladani*, *Karhani*, *Ramdi*, *Muru*, *Hindmauri* and *Punaigora* typical of the Jharkhand state are considered very nutritious. The consumption of starchy water out of such varieties by the farmers keeps them fresh and energetic while working in field throughout the day. In Jharkhand and Bihar *Karanga* variety of rice is used in all types of dysenteric ailments. The rice paste of the variety is rolled in banana leaves and cooked in steam. *Karhani* variety has medicinal property and cooked rice is given to those suffering from urinating irritation, breathing problems and epilepsy. Traditional drink, *Handia*, is made out of this rice. *Danigora* rice is used as tonic and rice beer. However, while making an inventory to document the folk varieties and land races information gathered from the communities of the villages visited indicate that the high yielding varieties of rice and wheat are grown for restriction of holding land closer to forest such as along the Hazaribag Wildlife Sanctuary. The people are oblivious of traditional varieties. Deserving to mention that information on the *landraces* of agriculture and vegetable crops can be observed in local *haat*, that is, country market and village shops. *Kodo dhan*,

botanically known as / *Paspalum scrobiculatum* / *Eleusine concana* which was once grown in large area is no more permitted by the local authorities on account of intoxicating property of the millet.

### **Local level Conservation efforts**

Visit to Palamau Tiger Reserve (PTR) at Betla in Latehar district showed that there are 35 forest villages within the radius of 5 km radius of PTR. The tribal population is composed of Oraon, Cheros, Mundas, Birhors etc. The forest is composed of tropical deciduous types. The management plan proposes four zones such as Habitat Management, Wilderness or Core, Tourism (overlapping) and Multiple Use or Buffer Zones. The reserve has 39 species of mammals, 8 species of reptiles, 4 species of lizards, 21 species of insect and 8 of piscean diversity. Out of about 200 species of the flora nearly 60 have medicinal value.

The denizens have been found environmentally conscious using solar light provided by the State Forest Department at the cost Rs. 700.00 per piece and LP gas. Damage to the agricultural crop of the communities by the elephants was reported. People are involved in lac culture. Parhiya community of Ker makes use of bamboos found growing in the homestead. There is need to carry out PRA in the villages in order to develop strategy for strengthening of any local level institution. The villagers venerate the *karma* tree (*Adina cordifolia*) during Karma festival in Hazaribag district. There are sacred grooves, *sarnamsthal*, and individual trees being preserved for worship by the communities and bear religious taboos.

Institute of Forest Productivity (IFP) located at Lalgutwa, Ranchi maintains a herbal garden with medicinally important species introduced through *ex situ* measures. Nuclear Broodlac Farm under Institute of Forest Productivity (ICFRE) located at Chandwa, Latehar contributes towards the rearing and release of lac/ kerr insect, *Kerria lacca* (syn. *Laccifer lacca*), an important element of forest biodiversity and livelihood of the communities. Field explorations in Palamau (named after *palash +lah* or lac + *mahua*) region particularly in the vicinity of Latehar, Garhi, Kerr, Betla show that the trees of *kusum* and *palash* were in abundance and require sustainable development through extension activities.

State Biodiversity Board and the State Forest Department activities for the development of community forest of *Shorea robusta* (sal) through the involvement of local institution such as EDC (Eco-development Committee) at Jhelima in Hazaribag district can be considered as role model deserving great appreciation. Biodiversity conservation could be made in the precise localities, namely Horai, Keyale, Bargada, Jhelima in Hazaribag district, and Gari, Ker, Betla and Garu villages in Latehar district.

Following programs relevant to the state of Jharkhand have been initiated by the Government of India for strengthening the farmers' livelihood and income security which can be very useful in the development and strengthening of institutional structures in the implementation of Biodiversity Act.

- Bharat Nirman, with special emphasis on rural roads and additional irrigation covering 10 m ha.
- National Rural Employment Guarantee Program
- National Horticulture Mission
- Expansion of institutional credit to farmers
- Establishment of a National Rainfed Area Authority
- Establishment of a National Fisheries Development Board

- Watershed Development and Micro-irrigation program
- Reforms in Agricultural Marketing and Development of Market Infrastructure
- Agribusiness development through venture capital participation by the Small Farmer Agribusiness Consortium ( SFAC)
- Reform and support for Agriculture Extension Services
- National Food Security Mission
- Rashtriya Krishi Vikas Yojana
- Integrated Food Law
- Legislative framework for Warehousing Development and Regulation
- National Bee Board
- National Bamboo Mission
- Knowledge connectivity through *Gyan Chaupals*
- Protection of Plant Varieties and Farmers Rights Act (2001)

Species specific orchards and monumental trees of *Bombax ceiba* (Semul), *Schleichera oleosa* (Kusumi), *Madhuca indica* (Mahua), *Butea monosperma* (Palash), *Mangifera indica* (Aam) *Ficus benghalensis* (Bargad), *Ziziphus mauritiana* (Ber) etc observed during the field tour should be recorded with biogeographical features for further studies.

### **Role of Women**

There is great role of women in the conservation and the management of biodiversity and genetic resource. In context to agriculture biodiversity the activities of women in pre- and post harvesting of the crop and food processing clearly illustrate their key-role in conserving diversity. During the field interaction with the women in different areas visited in Jharkhand it has been found that most of the women are interested in receiving training to know about species suitability, intercropping, raising nursery, cultural practice, supply of quality planting materials and information related to high-yielding varieties, growing fodder yielding species to make the livestock stall- fed, economic important plants such as medicinal plants med besides, interested in receiving financial support and extension education programs. Many women wished awareness-raising programs through mass media to help in understanding the importance of biodiversity in terms of their role and responsibility under BMCs and other institutions. The main reasons for interest by the women in conservation activities are: source of food and food security, source of alternative income, earn and save money and energy. For a greater role of women in conservation of biological diversity there is needed to develop and formulate guidelines, strategies and plans for the empowerment and involvement of women. This can include the promotion of women's literacy training, nutrition and health, and supporting women's participation in key decision-making positions, particularly as they pertain to access to bioresources. To support individual initiative and entrepreneurship, there is need to facilitate an access to women to all forms of credit, particularly in the informal sector.

In the present area of study it is observed that the women's institution largely depends upon the marketability of non-timber forest produce obtained from mainly *Madhuca indica* (Mahua), *Terminalia chebula* (Harra), *Terminalia bellirica* (Behra) and *Amla* (*Emblica officinalis*) in the local market, being an important economic activity for the women. Besides, the women play very important role in the pre and post harvesting of the agricultural crop and vegetables.

Mahua liquor made out of the dry flowers of *Madhuca indica* and filled in bottles were found being sold by the local women. One kilogram of flowers worth the cost of Rs. 35.00 yield 4 bottles of

fermented liquid and sold in the local market per glass for Rs. 10.00. The women largely being the sellers of the produce in the local market are found to take the income of the sale.

### ***Actions suggested***

In addition to the points suggested above, the following suggestions have been made.

Videography, sound clippings, posters and other extension materials are required to be developed by the board. Engagement of students of different local educational institutions of the districts and outside was suggested to assist in gathering information and documentation, and carrying out activities.

There is need to conform the species diversity of fauna and flora with that of the forest working plans of different divisions falling in the assigned districts. There is need to impart training and engage personnel to record and document various aspects of biodiversity in the assigned districts.

There is need for making an inventory on the vaid and hakim of those areas to be undertaken for BMCs with information on their profile covering experience, scientific authentication and conformity of the materials used.

Institutions may be identified in the districts/ state to control the invasion of species such as *Eupatorium odoratum* and *Lantana camara* in forest to sub rural and *Ipomoea carnea* in aquatic ecosystem. Extension materials on the impact of invasives on the biodiversity should be developed in local and English language and awareness programme on the subject made by the board. · Research institute such as IFP, Ranchi engaged on studies on lac culture can be considered for strengthening for carrying out studies on the non destructive methods of removal of lac, microbial and molecular characterization of parasite, genetic traits of host species variability, study on the impact of factors such as climate change on the population of lac and greater role of BMCs, if formed with regards to benefit sharing on the produce.

There is need to promote species specific community development for the conservation sustainable management of resource, for example bamboo by Turia community.

The forest- cum- rural landscape of Taimara – Dassam Falls near Ranchi may be considered for urban biodiversity characterization and Heritage site following National Biodiversity Authority (NBA) guidelines.

The Board needs to submit the duly filled PBR formats developed by NBA on the identified sites for further study and documentation.

### **MADHYA PRADESH**

State of Madhya Pradesh is endowed with rich biological diversity and genetic resource. Major forest types, typical of the tropical and sub-tropical part of the country are represented. Together with that of adjoining Chhatisgarh as many as 38 subtypes of forest occur. The ecosystem diversity in the state has been largely influenced by the people through the agriculture, pasture, dependence on forests for livelihood and conservation, and change in land use patterns for various developmental activities.

For the preparation of state's Biodiversity Strategy and Action Plan (BSAP), the state Government established a Biodiversity and Biotechnology Board under the chairmanship of the Chief Minister, that in turn constituted three Standing Committees viz., Committee on Biodiversity Conservation, Committee on Sustainable Use of Biodiversity, and Committee on Equitable Sharing of Biodiversity; and Environmental Planning and Coordination (EPCO) was appointed as the executing agency. The state government also created a separate Department of Biodiversity and Biotechnology to act as the nodal department for BSAP of the state. Under this department, State Biodiversity Board has been established.

### ***Rewa district***

Rewa district has total of 849 BMCs. Deserving to mention that the Rewa Forest Division of the State Forest Department has *Van Samitis* under different ranges such as Rewa Range has 16 Samitis, Samariya : 57, Dabhora : 31, Atraila : 29, Mauganj : 32, Hanumana : 30, Chakghat : 17. The area has landscape with dissected hills, ravines, plain plateau, water-fall and alluvial plain. Forest in the district is spread over 1044.48 sq.km. There are 827 Gram and 9 Janpad Panchyats.

### ***Balaghat district***

District Balaghat is geographically divided into three distinct parts: The southern lowlands, a slightly undulating plain, comparatively well cultivated and drained by the Wainganga (Ben Ganga), Bagh, Deo, Ghisri and Son rivers. The long narrow valley known as the Mau Taluka, lying between the hills and the Wainganga river, and comprising a long, narrow, irregular-shaped lowland tract, intersected by hill ranges and peaks covered with dense forests, and running generally from north to south; and The lofty plateau, in which is situated the Raigarh Bichhia tract, comprising irregular ranges of hills, broken into numerous valleys, and generally running from east to west. The highest points in the hills of the district are Peaks above Lanji (760 m), Tepagarh hill (790 m), and Bhainsaghat range (910 m). The Banjar, Halon and Jamunia rivers, tributaries of the Narmada, drain a portion of the upper plateau. The town of Balaghat is on the Wainganga, which flows north and south through the district and forms part of the boundary with Seoni District. District Balaghat has its significant biodiversity in its Southern Dry Deciduous Mixed Forest 5A/C3 covering over 97 % and Slightly Moist Teak Forest 3B/C1c 3 % of the forest types.

### ***Hoshangabad district***

River Narmada forms the northern boundary of the district. The Tawa River is a tributary of the Narmada, rising in the Satpura Range to the south and flowing north to meet the Narmada at the village of Bandra Bhan. The Tawa Reservoir lies in the south-central region of the district. Other small rivers are the Dudhi and the Denwa. The district enjoys an average annual rainfall of 134 cms. Pachmarhi in Satpura range of Hoshangabad district is in the southern part of the district. The Pachmarhi Sanctuary (461.37 sq.km) is part of the larger Pachmarhi Biosphere Preserve, which extends into Betul and Chhindwara districts. A lake in Pachmarhi forms an important wetland.

### **Institutional Structures**

Institutions of Rewa district such as State Forest Department, educational institutions like APS University, Ayurvedic Medical College, Veterinary and Animal Husbandry college, Government Science College, College of Agriculture, New Science college, Girls Degree college, number of schools and NGO such as Sanskrit Bharti (Prakriti Sangrakshak Samiti), Rewa, on account of their contribution in environmental and biodiversity studies, raising awareness, carrying out research and bringing out extension materials, could be involved on different aspects of biodiversity conservation through awareness and training programmes to the communities and public.

Strengthening of institutional structure of the Department of Zoology and Aquaculture of Barkatullah University, Bhopal, Madhya Pradesh, Indian Institute of Forest Management (IIFM) and International Centre for Community Forestry (ICCF) can play pivotal role in carrying out community-driven research, training and extension activities with regards to the biological diversity of districts Balaghat, Hoshangabad and Rewa. The authorities and the researchers can work on survey of fish diversity, development of innovative techniques of aquaculture, enhancing the productivity of reservoirs, developing training programmes for fishing beneficiaries of Madhya Pradesh, etc. It is learnt that the training programme together with materials on different aspects of biodiversity of the state in local dialect is under development for the use by State Biodiversity Board at IIFM and ICCF in particular.

District Balaghat has several Post graduate level educational institutions capable for building capacity, raising awareness, and imparting education and training in the field of biodiversity conservation. These are State Forest Rangers College, Jata Shankar Govt P.G. College, Govt Kamla Nehru Girls College, Govt SSP College Waraseoni Sikandra Road, Waraseoni, Govt. Arts College Katangi, Govt. College, Baihar, Govt. College, Paraswada, Govt. College Lanji etc. In 8 Blocks of the district there are 1120 Primary, 42 Pre- Middle, 200 Middle, 39 High and 38 Higher Secondary schools.

### **Biodiversity Heritage Sites (BHS) and Heritage/ Monumental Trees**

Biodiversity Heritage Sites (BHS) are well defined areas that are unique, ecologically fragile ecosystems having rich biodiversity comprising of any one or more of the components such as species richness, high endemism, rare and threatened species, keystone species, species of evolutionary significance, wild ancestors of cultivated/domestic or landraces or their varieties, past pre-eminence of biological components represented by fossil beds and having cultural or aesthetic values (*vide Guidelines on Biological Diversity Heritage Site, Ministry of Environment & Forests, Government of India Notification dated 5th April 2008*).

History of the natural and production forests typical of tropical forest types in the mentioned districts of Rewa, Balaghat and Hoshangabad is very significant and referred to as heritage forests. In 1999, there were 33 World Heritage tropical forest sites in Asia, Oceania, Latin and South America, and Africa, covering a total area of over 26 million ha. A further 63 sites of high biodiversity values merit consideration for World Heritage nomination. Some existing World Heritage sites are highly threatened by large-scale developments.

The heritage or monumental trees are needed for the record of information on their exact geographical location using GPS along with photo documentation, local and common name, scientific name, and measurement of height, girth and crown, variability, status in terms of health, restoration, preservation and conservation.

### ***Biodiversity, BHS and Heritage/ Monumental Trees of District Rewa***

Studies were undertaken in Shivpurva Panchayat and Gaddi village of Rewa range of the district with reference to the dependence of the communities on agriculture, crop, herbal wealth, forest diversity etc. The geological formation between the two village ecosystems reveals the elements of biodiversity significance. The floristic and faunistic elements of the site are represented by the species of ferns (*Selaginella*), *Euphorbia*, *Diospyros*, *Butea*, *Dendrocalamus strictus*, *Madhuca indica*, *Mangifera indica*, *Ficus* species, *Buchanania lanzan*, grasses typical of Vindhyaan agro-climatic region and environmentally sites etc. Medicinally important plants acquiring lithophytic habit were found. The scats and excreta both fresh and past of fauna seemingly that of nilgai, sambhar, langoor and that of nocturnal visitors were observed on this rocky watershed and habitat

with aquifers at places. Amphibians and reptilians too were found. The rock shelters with paintings on wild and domesticated animals age between 9000 to 100 years express the common union and dependence of the early man with the nature and wildlife. The colours of the paintings appear that of natural origin. *The site is being proposed for Biodiversity Heritage Site of national and global significance, it could be considered next to that of Bhimbetka or contemporary of that period.*

*The organization such as Archaeological Survey of India could be associated for activities of relevance and significance.* Among the heritage trees in Rewa district mention is made about the monumental trees of *Ficus benghalensis*, *Ficus religiosa*, *Madhuca indica*, *Tamarindus indica*, *Mangifera indica* growing at various sites of different landscape and vantage points. Heritage or monumental trees of Pachmarhi and vicinity belong to *Ficus infectoria*, *Ficus benghalensis*, *Bombax ceiba* growing mostly closer to venerated places. It is suggested that the institutions such as SBB (MP) and State Forest Department should document such heritage trees along with the details on their girth, height, age and measures for preservation, rejuvenation and germplasm characterization.

Sirmaur range of Rewa district has classical examples of heritage sites of natural wonders, conservation of biodiversity and antiquities. Case of Basawan Mama site with *Ficus (Peepal)* tree with temple along the son river is in memory of a person who committed suicide after the original tree of *Peepal* which the person had grown and preserved was indiscriminately lopped and felled for the fodder of the elephant of a zamindar (Landlord) of nearby Garhi fort. It is said that after the death of Basawan Mama soon the curse fell on the ruler of the area exterminating his whole family and the generation. The site with temple in his name is highly venerated and visited as pilgrimage by the people from near and far in large numbers.

The Chachai falls in Sirmaur Range of Rewa district has a fall of water from the river Biher (Bichhiya) and Sone down to over 500 m. The water falls appears similar to that of world famous water fall of Guyana. The falls do not hold its importance from the tourism and landscape point of views only but also from the conservation of biodiversity developed under stressed state over 10 acres of the site. Deserving to mention that the Chachai water fall provides misty silvery smoke, "*Rupela dhoan*" enhancing the beauty of the landscape. I spotted certain species of vulture or eagle flying along the sides of the rocky gorge providing them safe haven of breeding and nesting. *The site is recommended for protection and conservation of the bird and its population.* Chachai falls covering an area of around 254 sq km has already been proposed as Wildlife Sanctuary under Wildlife Protected Area network in India by Wildlife Institute of India, Dehradun. The germplasm variability of *Dendrocalamus strictus*, rhamnaceous species and others growing as stunted form binding the rocky formation is typical of the ecotype. Keoti falls in the same range with biodiversity typical of the habitat deserves inventory and conservation of the microhabitat.

A visit was made to the type locality of the white tiger in the ecotone of sal and teak forests between Govindgarh and Baghwar located in Govindgarh exhibiting the locality factors of the past with water hole still existing in the area. The site could be further studied for the prevailing microclimate. *There is Asia's biggest pond (Taalab) in Govind Garh. It is suggested that the aquatic biodiversity of this tank should be studied for the diversity and conservation of the species by the regional institutions such as by the APS University, Government Science College, both of Rewa and Department of Zoology and Aquaculture, Barkatullah University, Bhopal. The man- made tank could be taken for assessment for its heritage value.*

### **Biodiversity Heritage Sites (BHS) and Heritage/ Monumental Trees of District Hoshangabad**

In district Hoshangabad, Bori forests and environ of hill top such as that of Dhoop Ghar (highest peak-1352 msl) and surrounding of Pachmarhi are suggested for characterizing them as heritage forests and site respectively. Bori forest has the ecotone of Teak (*Tectona grandis*) and Sal (*Shorea robusta*) with its limit of distribution in central India having history of cultural planting and monumental trees of teak. Dhoop Ghar peak has the elements of flora akin to other hill tops of the country and unique topography.

### **Medicinal Plants**

Some of the common medicinal plants of the state are sarpgandha (*Rauwolfia serpentina*), Ashwagandha (*Withania somnifera*), Safed musli (*Chlorophytum tuberosum*), Kali musli (*Curculigo orchioides*), Kali haldi (*Curcuma caesia*), Jangli haldi (*Curcuma aromatica*), Jangli Pyari (*Urginea indica*), Tikhur (*Curcuma augustifolia*), Bach (*Acorus calamus*), Baichandi (*Dioscorea deamna*), Kalhari (*Gloriosa superba*), Nagarmotha (*Cyperus scaroisus*), Pipramool (*Piper longum*), Keokand (*Costus speciosus*), Mulhati (*Glycerrhiza glabra*), Aonla (*Emblca officinalis*), Harre (*Terminalia chebula*), Bahera (*Terminalia bellirica*), Chiraita (*Swertia chiryata*), Bel (*Aegle marmelos*), Satawar (*Asparagus species*), Neem (*Azadirachta indica*), *Holorrhena antidysenterica* etc. For incorporation of information on the medicinal plants in PBRs, Format 12 of NBA on Medicinal Plants can be used for studies under different BMCs.

### **Vaid and Hakim and flora of District Rewa**

Vaid, Mr Jai Bhan Singh, aged 90 years, hale and hearty was met in Shivpurva village of Rewa who has knowledge on the herbal wealth and its use for different ailments. Some of the commonly used medicinal plants belong to *Boerhaavia diffusa*, *Cissus quadrangula*, *Terminalia arjuna*, *Terminalia bellirica*, *Terminalia chebula*, *Pueraria tuberosa* (patal kohra), *Emblca officinalis*, *Bombax ceiba* (mochras), *Butea monosperma*, *Plumbago zeylanica*, *Tinospora cordifolia* (gurchi), *Gloriosa superba* (kalihari), Gursakri (*Grewia species*), *Adiantum* (vattolank), Tirkhur, Kalihaldi, Bhoo aonla, Chaurisia, Jal janir, Satavar, Anantmul, Dodri, Bala (maha, ati) etc.

With an aim at studying the traditional herbal remedies for the treatment of viral hepatitis from the flora typical of Rewa district in particular and Vindhaya region of Madhya Pradesh in general, 5 development blocks (Rewa, Teonthar, Sirmour, Jawa and Hanumana) sparsely located in the district were studied by a team of biologists and the use of plants for the cure has been documented (Ref. Dwivedi S, Shrivastava S, Dubey D.: *Traditional herbal remedies from the Vindhaya region of Madhya Pradesh in the treatment of viral hepatitis. International Journal of Green Pharmacy 2008; 2:17-21*).

Studies have been carried out on 32 species of plants typical of Vindhyan region and adjoining regions covering district Rewa for veterinary medicine [Ref. Dwivedi et al. 2009: *Role of plants as veterinary medicine from Madhya Pradesh, India: a status survey, Journal of Pharmacy Research 2 (4): 688-690*]. The herbs are used by rural and tribal communities of the region for the cure of disease such as respiratory problems, mastitis, maggots, wounds and injuries, intestinal worms, digestive problems, diarrhoea, dysentery, bone fracture, skin diseases, foot and mouth diseases, fever, stomachache etc. Common plants of the region used are : *Achranthes aspera*, *Adhatoda vasica*, *Aloe vera*, *Azadirachta indica*, *Bombax ceiba*, *Calonyction muricatum*, *Calotropis spp.*, *Chrozophora rottleri*, *Cissus quadrangularis*, *Cleome gynandra*, *Eclipta alba*, *Ficus relegiosa*, *Helicteres isora*, *Nyctanthes arbor-tristis*, *Ocimum sanctum*, *ricinus communis*, *Sorghum vulgare*, *Terminalia chebula*, *Vernonia anthelmintica*, *Vitex negundo*, *xanthium strumarium*, *Ziziphus nummularia*. It is recommended that the information should be gathered regarding the status of distribution of medicinal flora with respect to the proximity to village level institutions, occurrence,

mode of usage, vernacular names, knowledge holders, aspects of intellectual property rights, access and benefit sharing should form the part of PBRs.

### ***Vaid and Hakim and flora of District Hoshangabad***

Vaid and hakims in the area and sites visited show that the raw material for the manufacture of the product used by them is largely from outside its natural range of occurrence due to restriction imposed for the collection by Satpura sanctuary and Pachmarhi Biosphere Reserve. Most of the villages do not have Vaid and Hakim and they are dependent on allopathic prescriptions medicine. The local medicine men were found at a loss to practice due to sharp decline in the raw materials from the areas of collection made in past, besides communities' inclination towards medicine of allopathic base and efficacy.

### ***Ex situ Conservation Works on Medicinal Plants in Rewa***

Research and Extension Circle of the State Forest Department, Rewa has carried out commendable works on the conservation of medicinal flora, horticultural and other economic important plants of the district and the Vindhyan region in large through ex-situ measures. Studies carried out on the floristics of Vindhyan region reveals the species richness with 1459 species distributed among 721 genera of 169 families of angiosperms (Dicots : 966, Monocots: 409), Pteridophytes (61species, 39 genera, 23 families) and Bryophytes (23 species, 18 genera, 13 families). Studies show that 1375 species of angiospermic flora, 23 Pteridophytes and 9 of Bryophytes of the region fall under varying degree of IUCN category of threats ( Extinct in wild :1, Critically Endangered : 11, Endangered : 67, Vulnerable 223; Near threatened : 285, Least concern: 778 and data deficient :10) [vide *Dubey PC.2009: Plant Diversity: Botanical and standardised Hindi Names of important and common forest plants of Vindhyan region, Technical Bulletin, Forest Department Research & Extension Circle, MP*].

A nursery adjunct to the Circle located at Basawan Mama site is found with appreciable growth of plants of horticultural, floricultural and avenue planting values. *This nursery is suggested for strengthening its infrastructure so as to meet the demand of urban and rural landscape.* The activities of the Research & Extension Circle, Rewa regarding the reintroduction of rare and threatened species of plants back to the original habitat are wanting and accordingly projected activities should be undertaken. Besides, *there is need to highlight the communities of ethnic origin involved in the utilization and sustainable development of the Bioresources from the point of view of the access and benefit sharing in future. It is suggested that the nursery-cum-herbal garden of the State Forest Department at Rewa should be considered as the state-of-the art for the repository of rare, spectacular and medicinal flora of agro-climatic zone of the assigned district, and conservatories of such model could be laid and activities undertaken in other districts of the state.* The Circle brings out extension materials for display and distribution.

### ***Local level Conservation efforts in Rewa district***

The panchayat village of Shivpurva in Rewa range of the district is being supported through financial assistance by the State Forest Department for carrying out developmental activities. *Shivpurva and the Gaddi villages with kol and gond tribals are recommended for adopting as model for the BMC as applicable, preparation of PBR, awareness, capacity building, training in order to strengthen the institutional structure for the management of biological diversity and implementation of the Act. The Biodiversity Heritage Site proposed is in the proximity of the mentioned villages and the communities could be involved for the conservation and preservation of the site.*

Based on the past history of lac culture (*Lakhera*) under *Laghu Upaj Sangh* of the state in the district of Rewa, the potential of lac culture could be explored for the livelihood of the people vis-à-

vis biodiversity conservation and management based upon the forest species such as *Butea monosperma*, *Schleichera oleosa* and *Ziziphus mauritiana*. Capacity and training on the subject from Institute of Forest Productivity (ICFRE), Ranchi, and Jharkhand could be considered for imparting.

#### **Local level Conservation efforts in District Hoshangabad**

A training programme on sustainable livelihood conducted by the Centre for Entrepreneurship Development (Empowering Society) of the state was organized by SBB, MP at Matculi village. The participants numbering nearly 140 were mostly women. The participants were made aware about the significance of grassroots innovations, nature conservation, and affinity of biodiversity management of the rural and tribal communities of the Madhya Pradesh. This was particularly concerned with the role of women in biodiversity conservation and as how to strengthen and empower the women on different aspects of prospecting and management of bioresources.

Training and capacity building to the forest villagers in the field of bio-energy, pisciculture, vermin-composting, bamboo basket making, development of fire line through the removal and utilization of lantana and other weeds may be considered as viable options towards conservation and protection of the elements of biodiversity.

There is restriction to the communities on traditional collection of abundantly available forest produce like Mahua flowers, Chironji, gum, Dona Patta from *Bauhinia vahlii*, tendu leaves, bawar grass (*Eulaliopsis binata*), jharu grass (flowering sticks of *Thysanolaena maxima*), Aonla etc. There is need to understand the elements of benefit sharing out of the labour made under the short term employment scheme of the government for the plantation works, nursery development etc once the success is achieved. It is recommended that the local institutions like BMC should be constituted at Singanama panchayat and be strengthened in terms of the introduction of economic important forest species, the produce of which, as learnt, is commonly pilfered from the sanctuary area.

#### **Local level conservation efforts in district Balaghat**

Indiscriminate removal of 3-4 m tall columnar trunks of palm, *Phoenix sylvestris* sporadically growing around Lalburrah Panchayat (Tekaidi) was observed. The trunks of palms are used by the communities for making huts as there is restriction on felling trees from the nearby forests, and the palms not being the classified timber. Granary of nearly 4 feet tall and 3 feet round is used. It is made out of local bamboo, *Dendrocalamus strictus*, commonly occurring in the forests. For winnowing the wheat harvest, it was found that a two winged vertical fan is used. It is a substitution of some traditional device used by the communities in past. The important varieties of rice grown in the village are 1010, 408, IR 64. Most of these are of coarse grain (*Vajan dhan*), without any specific taste and becomes impacted by inundation. The improved varieties of wheat are N410, Mangla and Lokmat.

The wood of *Ougeinnia oojeinensis* (Tinsa) is largely used/ exploited for making toys. Limited use of bamboo by the people of the village dependent on this resource for livelihood during the current year was found mainly due to its gregarious flowering in the forest. The ample regeneration observed in the forest and the attempts being made by the SFD to introduce bamboo rhizomes from the wildlings in other areas during the present "Bans Varsha" declared in the state of Madhya Pradesh can see this resource developed. But there is urgent need for the involvement of the BMCs of the region for the strengthening of the institution through participatory approach and capacity building on the pre- and post harvesting techniques, and value addition.

Monumental (heritage) trees of different species of forest biodiversity importance were observed, for example *Pterocarpus marsupium* (girth 4-5 m), *Ficus religiosa* (7-8 m), *Schleichera oleosa* and *Terminalia tomentosa*. The forest village was observed with the invasion of *Lantana*, an obnoxious weed. The species was found colonising on the freshly laid out soil along the fish tank made by the village communities. *Aerva* and *Celosia* species were noticed predominant on the fallow lands and abandoned agriculture beds. Other invasives are *Cassia tora*, *Alternanthera sessilis*, *Ageratum haustoniana*, *A. conyzoides*, *Cuscuta reflexa*, ghoon and termites

### **Role of Women**

There is great role of women in the conservation and the management of biodiversity and genetic resource. In context to agriculture biodiversity the activities of women in pre- and post harvesting of the crop and food processing clearly illustrate their key-role in conserving diversity. During the field interaction with the women in different areas visited in the assigned districts, it has been found that most of the women are interested in receiving training to know about species suitability, intercropping, raising nursery, cultural practices, supply of quality planting materials and information related to high-yielding varieties, growing fodder yielding species to make the livestock stall-fed, economic important plants such as medicinal plants besides, they are interested in receiving financial support and extension education programs. Many women wished awareness raising programs through mass media to help in understanding the importance of biodiversity in terms of their role and responsibility under BMCs and other institutions. The main reasons for interest by the women in conservation activities are: source of food and food security, source of alternative income, and earn and save money and energy. For a greater role of women in conservation of biological diversity there is need to develop and formulate guidelines, strategies and plans for the empowerment and involvement of women. This can include the promotion of women's literacy training, nutrition and health, and supporting women's participation in key decision-making positions, particularly as they pertain to access to bioresources. To support individual initiative and entrepreneurship, there is need to facilitate an access to women to all forms of credit, particularly in the informal sector.

### **Domesticated Animal Diversity**

It was found that the livestock genetic resource in the state of Madhya Pradesh are very much location specific. Interestingly 5 breeds of cow, buffalo and fowl groups are distributed in 11 districts and located in as many as 40 sites of the importance of domestication. Generally the cattle breeds of 'Malwi' (districts Rajgarh, Shajapur, Ujjain, Ratlam) and 'Nimari' (Khargon, Barwani) 'Gaolao' are found in Chhindwara district covering Vidarbha region of Maharashtra, 'Kankattha' breed of cattle in Panna and Chhatrapur districts, 'Bhadawari' breed of buffalo in Bhind, Moraina and Gwalior districts, 'Jalauni' breed of sheep in Tikamgarh and Shivpuri districts, 'Jamnapari' breed of goat in different villages of Bhind district along the Chambal river, 'Berari' Goats in Nimar district and 'Malwi camel' in Mandsaur district. Among the poultry Karaknath fowl typical of the district Jhabua is known for wholly dark look and black meat of medicinal value.

### **Native Fish Diversity**

Surveys carried out between the years 1940 to 2006 in different habitats of fish diversity typical of Madhya Pradesh ranges between 105-145 species. 22 species of fish of the river Narmada fall under varying degree of threats. The water bodies of Rewa district are rich in fish diversity. 54 species of fish are known to be distributed in the wetland habitat of Tons, Govindgarh, Beehar Bichia, Gorama dam and Jarmohra. Generic richness is evident from the fact that the genus *Labeo* is represented by 11 species, *Puntius* 6, *Mystus* 6, *Channa* 4 and *Chela* 3. Mong, Rohu, Catla and carp are commonly reared in Rewa district. Six species of fish, namely *Bagarius bagarius* (Lambhar, goch), *Chanda ranga* (Khari), *Labeo calbasu* (Karouchhar), *Nandus nandus* (Chakri), *Tor tor*

(Mahasheer) and *Wallago attu* (Parin) are enlisted as threatened in Rewa district [Ref. *Varshik Prtivedan (2006-2007) Madhya Pradesh State Biodiversity Board, Bhopal : 40*]. Although there is a report of occurrence of as many as 29 species of fish in the Asia's largest artificial tank in Govindgarh but there is still need for making further inventorization and threat categorization of fish fauna .

Deserving to mention here that the survey and collection of the 'giant river prawn' (*Macrobrachyium malcolmsonii*) in the Wain Ganga river of Balaghat district by Prof. Quereshi and his team of Barkatullah University, Bhopal is indication of the potential of the activities to be undertaken in project mode. Among the exotic fishes *Cyprinus carpio var. communis* (Common carp), *Ctenopharyngodon idella* (Grass carp), *Clarias gariepinus* (Thai Magur), *Hypophthalmichthys molitrix* (Silver carp), *Oreochromis mossambica* (Tilapia) and *Hypophthalmichthys nobilis* (Big Head) are reported to have been introduced in the state and more likely in the water bodies of the districts Rewa, Balaghat and Hoshangabad also.

### **Bamboo diversity**

Making the bamboo available to the community through introduction in close by area and promotion of bamboo handicraft through extension activity can not only improve the living condition of the community but also increase in area under bamboo typical of the range. Districts Balaghat and Hoshangabad are found with abundance of common and economic important bamboo species, *Dendrocalamus strictus* and *Bambusa bambos*.

### **Sericulture**

Sericulture is yet another option for the communities of village level institutions of Balaghat, Hoshangabad and Rewa to regulate and take the pressure off from forest biodiversity and genetic resource. District Balaghat is second highest producer of sericulture in the State. The environment of Balaghat is quite suitable for sericulture production. Sericulture is a small scale industry in rural areas, which help villagers to earn extra income. District Balaghat is having two types of Sericulture Industry, Tasar and Mulberry.

### **Invasive Alien Species in Rewa and Hoshangabad districts**

Among the invasive alien species (IAS), *Ipomoea carnea*, *Salvinia molesta*, *Eichornia* and allied species in aquatic habitat, *Lantana camara* in drier, open aspects of forests and fallow lands were found invading and gregarious. Lantana has been noticed occupying over 3 km of the periphery of sanctuaries and Pachmarhi Biosphere Reserve. The shrubby impenetrable thickets are found absolutely dry and highly vulnerable to any accidental fire during the hot dry summer. *Parthenium hysterophorus*, *Argemone mexicana*, *A. ochroleuca*, *Cassia tora*, *Solanum suarttense*, etc have been observed invading into the original habitat of indigenous flora and agriculture lands.

### **Land races, Wild relatives, Folk varieties**

The economy of Madhya Pradesh is based on agriculture. The main agricultural region is located in the Chambal Valley, the Malwa Plateau, the Narmada Valley and the Rewa Plateau. Madhya Pradesh is an agrarian state with about 74% population of the state depending directly or indirectly on agriculture. Agriculture and its allied services contribute 31% share in the state's economy. About 71% of the total work force is directly engaged in farming.

The major crops grown in Madhya Pradesh include paddy, wheat, maize and jowar among cereals, and gram, tur, urad and moong among pulses, while soyabean, groundnut and mustard among oilseeds. With reference to the agricultural genetic resource in the Vindhyan and Satpura agro-climatic zones of the districts under study agricultural crops such as rice (*Oryza sativa*),

*Triticum durum* (Kathia wheat), *Triticum aestivum* (Gehu), *Triticum dicoccum*, *Zea mays* (Makka), *Sorghum bicolor* (Jowar), *Pennisetum typhoides* (Pearl millet- Bajra), *Paspalum scrobiculatum* (Kodon millet), *Panicum milliare* (Kutki millet) and *Panicum miliceum* (Cheena) are grown. Exploration, collection and conservation of wild species and landraces of rice (*Oryza sativa*) in Madhya Pradesh are being carried out by Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. Cash Crops like cotton and sugarcane are also grown in few districts of the state. Thousands of rice cultivars, a rich diversity of minor millets, indigenous cattle and poultry landraces like Kadaknath are significant elements of rich agro-biodiversity and domesticated animal biodiversity of the region. Horticultural crops that are grown in the state are papaya, banana, oranges, mango and grapes beside potato, onion, garlic, etc. Studies are being carried out by the researchers of Government Science College Rewa on the conservation and evaluation of germplasm of mango (*Mangifera indica*) of Rewa district. It is reported that certain species, for example Kali Haldi (*Curcuma* sp.), Sarpagandha (*Rauvolfia serpentina*), Kala Telia Kand (*Amorphophallus/ Arisaema* sp.) and Kali Buch (*Acorus calamus*) and Lal (Red) Kumhra (*Cucubita ?* sp.) with commercial potential have become "Extinct in Wild" from Vindhyan region [Dubey PC et al. 2007, *Biodiversity and its threat assessment in Vindhyan region, Indian J. Trop. Biodiversity* 15 (1): 1-52]

During carrying out the field study in the Hoshangabad district, it was observed that in the country market, the brinjals had wide diversity in shape and colour, for example, magenta with white streaks, deep violet but small, violet and cylindrical, oval (up to 8 cm long), green cylindrical.

In district Rewa among the agricultural crops, wheat, rice, barley, rye, linseed, pigeon pea, black gram, green gram, chick pea, and mustard are grown. Kodon millet (*Paspalum scrobiculatum*) grown in past in little quantity is no more sown having been prohibited by the district authorities due to its intoxicating property. Among the fish Rohu, Catla and carp are commonly reared. College of Agriculture, Rewa has a repository of 68 numbers of accessions of rice, 294 of barley (*Hordeum vulgare*), 414 of Kodon millet (*Paspalum scrobiculatum*), 25 of Little millet (*Panicum sumtrens* , *Panicum miliare*), 5 of Foxtail Millet and 3 of Barnyard Millet (*Echinochloa frumentacea*).

### **Crops of Balaghat district**

Rice (*Oryza sativa*), Corn (*Zea mays*), wheat, chick pea, peas, Kodon (Millet) *Paspalum scrobiculatum* Kutki, Millet (*Panicum milliare*) *Sorghum* (*Sorghum bicolor/ vulgare*), Ragi, Rajgira, Sawa, Mung (*Phaseolus mungo*), Urad, Kulthi, Barabati, Sem, Popat, Tuwar, Soyabean, ground nut (*Arachis hypogea*), sesame (*Sesame indica*), sunflower (*Helianthus annus*), sunhemp.

### **Recommendations**

It is found that there is lack of working staff specifically for carrying out the targeted activities of the project in the field. There is need to impart training and engage personnel to record and document various aspects of biodiversity in the assigned districts. Inventorization and characterization could be made in the district of Balaghat for the precise localities encompassing the villages rich in copper ore namely Pindkepar, Charatola, Karmsara, Bhimjori, Jagattola in Baiher Tehsil. Botezari, Ramrama, katangzari, Naitara, Pandharpani, Miragpur villages in Tehsil Waraseoni are rich in Manganese ore; and Fandki, Mohagaon, Kugaon, Devdongari villages in Baiher Tehsil are rich in Bauxite. Biodiversity impact assessment (BIA) of the sites are needed in context to *in situ* and *ex situ* conservation aiming at preservation, restoration and reintroduction of elements of significance.

Following programs relevant to the state of Madhya Pradesh and the districts in particular initiated by the Government of India should be considered for strengthening the communities'

livelihood and income security. This can be subsequently very useful in the development and strengthening of institutional structures in the implementation of Biodiversity Act:

- National Rural Employment Guarantee Programme
- Bharat Nirman, with special emphasis on rural roads and Additional Irrigation
- National Horticulture Mission
- Expansion of institutional credit to farmers
- Establishment of a National Rainfed Area Authority
- Establishment of a National Fisheries Development Board
- Watershed Development and Micro-irrigation program
- Reforms in Agricultural Marketing and Development of Market Infrastructure
- Agribusiness development through venture capital participation by the Small Farmer Agribusiness Consortium ( SFAC)
- Reform and support for Agriculture Extension Services
- National Food Security Mission
- Rashtriya Krishi Vikas Yojana
- Integrated Food Law
- Legislative framework for Warehousing Development and Regulation
- National Bee Board
- National Bamboo Mission
- Knowledge connectivity through *Gyan Chaupals*
- Protection of Plant Varieties and Farmers Rights Act (2001)

It is recommended that the Format 6 of Model PBR with modification/addition as given below should be used for information of relevance and significance to the conservation of biodiversity and the implementation of the Act at the village level and other institutions.

1. Name of the market and location in district (rural/urban/ peri-urban)
2. Held Weekly /Fortnightly /Monthly /Biannual /Annual (week /month /day)
3. Types of animals
4. Trait (food- milk, meat /fertilizer/ cash income/ draught power/ transportation/buffer against crop failure and other risks)
5. Types and Average number of animals transacted in a day
6. Location from where brought
7. History of origin and movement/domestication/reproduction
8. Places to which the animals are sold / transported
9. Location of Poultry market
10. Types of poultry
11. Location of fish market
12. Types of fish and allied animals sold
13. Source of fish with localities
14. Status of habitat of fish in terms of threat

A site encompassing Shivpurva Panchayat and Gaddi village of Rewa range of the district Rewa with richness of biodiversity and the rock shelters with paintings on wild and domesticated animals aging between 9000 to 100 years express the common union and dependence of the early man with the nature and wildlife. The site is proposed for Biodiversity Heritage Site (BHS) of national and global significance. It could be considered next to that of Bhimbetka or contemporary

of that period. The organization such as Archaeological Survey of India could be associated for activities of relevance and significance.

The Chachai falls in Sirmaur Range of Rewa district is recommended for protection and conservation of the nesting habitat of the vulture population.

It is recommended that, till the forest dwellers of the peripheral area of Pachmarhi Biosphere Reserve are not settled elsewhere, their cattle be allowed to graze inside the reserve. There should be certain strategic measure to contain the cattle such as developing fodder bank, planting of fodder yielding trees in the homesteads, providing the fodder of non forest origin etc. There is need to hold awareness campaign and involvement of the youth of the villages in nature conservation programmes. It is further recommended that the villages under Pagara panchayat named in the text should be undertaken by the SBB (MP) to document the information resource of the communities in the PBR. Bad Kachhar village under displacement should be undertaken on priority.

It is recommended that the People's Biodiversity Register (PBR) formats developed by National Biodiversity Authority should be made to use for the collection of data from Matkuli and Pagara panchayat villages. Pagara being Panchayat is very important for having eight villages, namely Pagara, Bariaam, Khamkheri, Rorighat, Kanjighat, Kajri, Bad Kachhar and Ghora Nag.

It is recommended here that a risk assessment should be made with regards to the dominance of the exotic species of fish by reproduction under most congenial locality factors ultimately becoming invasive in the original habitat of indigenous species. The concerned institutions should take immediate measures to eradicate and contain the growth of this obnoxious invasive preferably through the engagement of the local communities of villages under different van Panchayat like Pagara, Sanginama, Bariaam, Shivpurva, Gaddi, Matculi etc living on the outskirts of the forests and the buffer zone of the protected areas in Hoshangabad district.

It is suggested that the nursery-cum-herbal garden of the State Forest Department at Rewa should be considered as the state-of-the art for the repository of rare, spectacular and medicinal flora of agroclimatic zone of the assigned district, and conservatories of such model could be laid and activities undertaken in other districts of the state.

Institutions may be identified in the districts/ state to control the invasion of species such as Lantana camara in forest to sub rural and Ipomoea carnea in aquatic ecosystem. Extension materials on the impact of invasives on the biodiversity should be developed in local and English language and awareness programme on the subject is made by the board. SBB should develop a network on the Invasive Alien Species to carry out and coordinate activities related:

- To raising awareness
- To exchange of information
- Access to technical expertise, research results and management of invasion of alien species
- To strengthen capacities of Panchyat level institutions to manage
- To develop strategies for inter- district and BMC level collaboration in combating the invasives.

There is need to promote species specific community development for the conservation and sustainable management of resources, for example bamboo and silk moths (sericulture). Funding support of National Bamboo Mission may be sought.