

EXTENSION STRATEGY AND INSTITUTIONAL MECHANISM FOR BIODIVERSITY CONSERVATION

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Nature provides us with food and all the raw materials we make use of in both traditional as well as modern societies. Conservation of natural resources is, therefore, by extension, the conservation of human life. The Brundtland Commission's report "Our Common Future" highlighted the need for mobilizing the forces of change for achieving better balance between humankind and nature, ensuring thereby a safer and better world for all (WCED, 1987). One of the ways for maintaining such balance was suggested at the United Nations Conference on Environment and Development in 1992 (otherwise known as Rio Summit and "Earth Summit"), to hold an intergovernmental convention on ways and means for protecting species and habitats. Environmental groups and the press nicknamed it as the "Bio Diversity Convention". "Bio Diversity" is in real term a contraction of "Biological Diversity". At the most general level, it refers to the variety to be found among the living organisms throughout the earth. This variety enriches the Universe and our own culture by virtue of its existence and the desire that it should be maintained in the best way possible. Accompanying this feeling, is the fear that species are getting extinct at a rate unprecedented in recent history, and therefore, the variety of organisms is being eroded. These views, and the fear are shared by most of the environmentalists. Along with the variety of species, biodiversity should also take into account the genetic diversity reflected in the entire global gene pool. In that case, it is not only species we must preserve, but the genetic variation within each population of every species also has to be taken into account. Alternatively, we might seek to protect eco systems by identifying and safeguarding each small area of habitat (Allaby, 1996).

Need for Biodiversity Conservation

The biodiversity conservation and its manifestation on human society can be viewed from two different perspectives : Utilitarian and Aesthetic. While the utilitarian manifestation reflects the interdependence between human kind and the biological resources in their surrounding environment for meeting varied requirements of food, fibre, fodder, shelter, medicines, garments, timbers, implements etc., the aesthetic dimension relates to the influence of living entities on the psyche of human being as evidenced through their attempt in beautification and decoration of the immediate environment, as expressed through their specific actions like literature, art, music and culture etc.

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In a developing country like India, with its burgeoning population and widespread poverty, the need for biodiversity conservation has to be viewed more from the utilitarian perspective, as the dependence on nature for meeting the basic livelihood requirements is overwhelming for a majority of the population, especially those who inhabit the countryside. Moreover, for enabling India to play its role as one of the fastest growing partner in the world economy, need for adopting a well knit biodiversity conservation strategy has attained supreme importance in the post GATT regime.

Biological Diversity : Global vis a vis Indian

Global biodiversity can be traced across the universe, broadly categorised into six bio - geographical regions, the palearctic (including the Nordic countries); the nearctic encompassing north America) ; neotropic (South and Central America) ; afrotropic (African continent except for the Northern parts of Africa, resembling very much the palearctic region) ; the oriental (Far East and Indian subcontinent) ; and the Australasiatic (mainly Australia, New Zeland and some of the surrounding islands). These regions are different, both in respect of the types as well as the number of species they sustained. However, most of the global biological diversity is found in the third world countries. If one takes the pain of scrutinizing various components of such biological diversity (like plant materials, insects, animals including amphibians, reptiles and mammals), the three regions, out of the six mentioned above, the oriental, afrotropic as well as neotropic regions, covering the entire range of developing countries are found to be the most species-rich.

India, coming under the oriental bio-geographical region, is recognized as a country, uniquely rich in all aspects of biological diversity – her ecosystem level to the species and gene pool. It is estimated that over 75 thousand species of fauna and 45 thousand species of flora are found in India. Of the estimated 45 thousand plant species, about 15 thousand species of flowering plants are endemic to the country. Most of the Indian population, be they forest dwellers, farmers, fishermen, livestock owners or umpteen number of people belonging to other types of diverse vocations derive livelihood and meet their survival needs from such diverse living resources.

The regulation of biogeochemical cycles, maintenance of predator-prey relationship by various types of food chains and food webs and finally the balance of nature are maintained through biodiversity. It also indirectly influences the climate, soil characteristics, composition of air, constituting the abiotic elements of an ecosystem. In addition, modernization of the productive sectors like agriculture, animal husbandry, fishery, forestry, silviculture etc. largely depends upon the diverse biological resources of the country, as the reserve of gene pool, the decisive factor, depends upon the biodiversity. Keeping in view these implications, biodiversity

management and conservation attains significance in the process of ensuring our survival and progress (Ghosh, 1999).

Factors Influencing Loss of Biodiversity

However, a series of factors, referred to as the “evil quartet” had been responsible in some way or other, for causing losses in respect of biodiversity in our country. They are : (i) deterioration of the eco system through destruction, fragmentation, pollution and other kinds of interference; (ii) over-exploitation of bio sphere ; (iii) introduction of foreign plants and animals and resultant competition and (iv) indirect effects of extinction of species on ecological balance. Though these factors both individually and as a whole act as threats to the biological diversity of any region or the entire universe, the first two are probably the most important, requiring considerable ecological insight if they are to be avoided. (Stenseth, 1999)

i) Deterioration of eco system through destruction and fragmentation of species habitat :

Destruction of species habitat generally takes place in two different ways. Firstly the human- beings alter the use pattern in a totally different way than the previously followed one, and secondly by pollution caused by local or distant sources.

Examples of such kind of destruction of species habitat in our country are many, with a few instances cited below :

- Replacement of climax vegetation (traditional tree species, endemic to an area and being grown over a long duration) with sub-climax species (like introduced forest species, which are not a component of the traditional flora). The controversy in respect of replacement of traditionally found Oak and other broad leaved forest species with the import of coniferous species like Chirpine etc. in UP hills.
- Large chunk of forest land along with diverse fauna/flora and genetic resources as well as villages inhabited by indigenous tribal population in Madhya Pradesh and Gujarat being inundated through the construction of Sardar Sarovar Dam on river Narmada and the ‘Narmada Bacho Andolan’, as a mark of protest.
- The controversy over the threat posed by Silent Valley project on biodiversity in Western Ghats forest and subsequent stalling of the project by the then Prime Minister of India Mrs. Indira Gandhi.
- Large scale release of effluents from the industries into the riverine systems resulted into depletion of certain species of fish stock. Example, depletion



of Hilsa population in the river Ganga, as a result of increase in the extent of pollutants released in the system.

- With the introduction of aquaculture as a form of land use option in the coastal eco system, large scale conversion of agricultural lands, traditionally being cultivated with crops, resulting in loss of diversity in the cropping system and resultant salinization creeping into the agricultural lands.

ii) Over exploitation

The pressure of human being and animals, particularly in the developing countries and their increasing dependence on various natural resources, leads to depletion of biodiversity due to over exploitation. In order to stop vandalisation of diverse biological resources through over exploitation, it is necessary either to keep the growth of human and animal population under control, so that they do not go beyond the carrying capacity of the stock of natural resources in any given area, or to maintain a sustainable stock level of these natural resources, corresponding to their levels of consumption.

Examples of the ill consequences of over exploitation of natural resources on the bio diversity reserves of our country are:

- Along with the largescale denudation of forest reserves in our country, we are witnessing continuous withering of a large number of medicinal plants species, a rich heritage of Indian biodiversity.
- Injudicious exploitation of mangrove forests, specially in the Sundarban regions, had depleted the reserve of various important mangrove species from our country's biodiversity.
- Species like blackbuck, great Indian bustard etc. are fast becoming extinct due to problems of poaching and continuous shrinkage of habitat. Over exploitation of fish stock through injudicious deep sea fishing in the EEZ of our country has been causing concern as a number of marine aquatic species population is continuously getting depleted.
- Pressure of huge, unproductive cattle population and the practice of free grazing in the forests, affect regeneration of tree species and thereby cause depletion in biodiversity.
- Shifting cultivation, otherwise considered to be an ecologically beneficial practice, has become one of the worst factors leading to biodiversity depletion along with reduction in the cycle of jhuming due to increased population pressure.

iii) Introduction of foreign plants and animals

The ecological network can often be disturbed in such a way that individual species are forced out and replaced by intruders entering naturally or are introduced within an eco system. Species introduced in this way, often put the indigenous species' future existence in danger, leading to great ecological changes in the eco systems.

Examples of this form of changing the pattern of biodiversity in our country are :

- India, traditionally the habitat of a large number of rice strains (more than six thousand), is today witnessing loss of most of them as a consequence of import and subsequent development of high yielding strains.
- Traditional cattle breeds like Tharparkar, Ongole, Siri etc. are very fast becoming extinct, in view of fast expansion of cross breeding programme with the help of semen, received from exotic breeds as part of Operation Flood programme.
- Spectacular yield increase through cultivation of high yielding varieties (mostly of paddy and wheat), have drastically reduced the cultivation of a number of traditional cereals and lower millets (like ragi, kodo etc.), threatening their extinction altogether from the cropping system.

iv) Indirect effects of extinction

Sometimes, the changes occurring with a species becoming extinct due to any of the above reasons, lead to a cascade of dynamic ecological changes resulting in a number of other species being faced with extinction. The possibility of occurrence of this type of dynamic cascade effect sometimes becomes one of the main reasons for taking action to check loss of every species facing the threat. In addition to the fact that each species is regarded as having its own value, they are to be seen in conjunction with all others in the biosphere for reasons of maintaining ecological balance.

Example of this form of loss and the resultant response from environmentalists is :

- Introduction of eco development projects like, tiger project, elephant project etc. The major ecological rationale behind this project is the need for maintaining balance in the food chain through effective interaction between biosphere-herbivores-other carnivores and tigers. The essence of these projects lies in the mechanism for maintaining sustainable herbivore-carnivore balance in the eco system.

Options for Biodiversity Conservation

Biodiversity conservation should not be viewed in isolation from the overall framework of economic development, specially in the context of developing countries like India. Hence, strategies are to be evolved for balancing those practices, damaging to the environment in a way, that they do not threaten the sustainability of the ecological - economic system. This can be done through adoption of two basic approaches of environmental protection: avoidance of damage and compensation for damage. The avoidance of environmental damage is a direct response to the increasingly accepted need to maintain ecosystem function and resilience, so that economic opportunities for future generations are maintained (Macdonald, 2000). One possible mechanism for introducing avoidance of damage is through commercializing nature in order to conserve it. A number of potential and commercially viable options, beneficial for biodiversity can be cited through projects like eco-tourism, organic farming, sustainable forestry and fishery etc. Besides such commercially viable options, keeping in view the importance of maintaining a healthy and prosperous global society, awareness building and motivation towards accepting practices conducive to attain ecological objectives should also be pursued.

However, the value of marketable nature will never be sufficient to forestall many environmentally damaging activities. The need for considering options capable of compensating the damage to the biodiversity becomes imperative. There are many instances of development projects, where compensation for damage may be the only way to balance the losses. Under such circumstances there can be stipulation made by the government to allow sites to be damaged, provided compensation is arranged. Such compensation is likely to involve designation of another site for protection or restoration. The principle of compensation, therefore, might be used, for example, when considering the restoration of degraded eco-system to offset the consequences of environmental damage to the intact ecosystem. In the case of compensating for loss of biodiversity, this pragmatic perspective does not allow that extinction is acceptable, but does accept that change is inevitable and proposes that compensation is possible for, say, local changes in biodiversity.

Within the framework of these two broad options, there are a number of possibilities of maintaining biodiversity interest, even after fulfillment of economic objectives:

i) Biodiversity conservation through minimization of environmental damage

Environmental damages are inflicted due to varied types of unsustainable human and other forms of biotic interference, dabbling with environmental resources of different kinds. While such interferences cannot be removed altogether, steps can be taken to minimize such damages by way of adopting corrective measures.

Examples of these forms of damages are too many, like, large scale denudation of forest resources in India for meeting the demands of usufructs, revenue earnings and other subsistence requirements of huge human and cattle population of the country, poaching and killing of animals and birds, either for trading or due to ethnocultural reasons (generally associated with tribals) or practicing of shifting cultivation in the hilly terrains and so on and so forth. While the above mentioned damages are caused by indiscriminate denudation of flora and fauna, pollution has also become an important causal factor for biodiversity degradation. Primarily, modernization in the form of chemical based agriculture, rapid industrialization etc. are responsible for release of pollutants into the environment, thereby depleting flora and fauna, thriving there.

In order to offset these damages, corrective measures like, establishment of new plantation, preferably with multiple species endemic to the area, prevention of monoculture, practicing settled cultivation, judicious use of chemicals while cultivating crops and setting up of effluent treatment plants in the industries etc. need to be widely adopted. For facilitating such actions, appropriate extension strategy, with suitable technology back up are of supreme importance.

ii) “Like-for-like” compensation:

In this form of compensation, acknowledging the legitimacy of development needs which inflict specific environmental damage, actions are suggested for mitigation of the severity of damage by way of creating another similar resource elsewhere.

An example of this form of compensation can be cited through the directive of government to mining industries to raise similar types of forests on the land, vacated after the mining operations are over. Power companies are also quite often instructed to establish plantations on land of similar dimension on which generating plants have been established through clear felling of trees, thereby causing damage to the environment.

iii) “Like for unlike” compensation :

This form of compensation involves allowing the exchange of an environmentally “bad” (such as pollution) project for an environmentally “good”(such as habitat protection) compensation, or exchange of different forms of natural capital (sacrificing a coastal marsh for inland forest), or exchange between natural capital and manufactured capital. The latter form of compensation involves exchange of ecosystem goods of services for manufactured goods or human services (social infrastructure, like health, education, amenities of various kinds).

From a conservationist's stand point, and because the values of different aspects of nature often appear incommensurable, it is important to ask how very different kinds of environmental "goods" and "bads" can be valued and whether the agreed compensation can really make up for the negative effects of environmental damage and loss of biodiversity. However, it is difficult to value nature and calculate environmental damage and opportunity costs (Brown and Shogren, 1998).

The acceptability of these two broad approaches to compensation for environmental damage is influenced by views on sustainability, which may be arranged on a continuum, varying from weak to strong sustainability. The concept of sustainability and its connotation guides the ways and means for tackling environmental problems of different kinds, particularly biodiversity loss. It is the condition in which patterns of resource utilization and conservation provide economic, social and environmental benefit in the long run.

Two broad viewpoints of sustainability are generally offered while deciding on the compensation mechanisms. The "weak sustainability" viewpoint accepts that effects of the depletion of biodiversity (natural capital) on economic well being, can be offset by re-investment in human made capital. The "strong sustainability" on the other hand, emphasizes limits to substitution between natural and human made capital, on the grounds that natural capital poses irreplaceable features (such as eco system services), which under no circumstances can be compensated by manufactured capital. This view assumes that the maintenance of future economic opportunities demand that the level of biodiversity is maintained, with the obvious corollary that contemporary bio diversity has very high value and is important for enabling sustenance of the livelihood system for posterity.

Needed Extension Strategy

In order to implement the above mentioned options for bio diversity conservation, broadly speaking, two different types of interventions become relevant. While legislative interventions are made to provide a framework, within which bio diversity conservation in respect of specific species of flora/fauna or germplasm materials are to be ensured, for more sustainable results, extension interventions, backed by appropriate institutional mechanisms are also needed.

Control of damage to bio diversity, primarily requires participation of people and their institutions at various levels, as the needed action towards correcting the ecologically undesirable practices are going to be highly decentralized in respect of their locale. For motivating people to participate in actions towards bio diversity conservation; it is necessary to understand the needs, compulsions and priorities of people in respect of utilization of various components of the eco system, which result in bio diversity degradation. On the basis of such understanding, programmes

of action towards minimizing damage to bio diversity should be planned, implemented, monitored and evaluated in active collaboration among the stakeholders – the concerned departments, people and their institutions, NGOs, environmentalists, industries and corporate bodies etc. The whole process consists of a series of inter related actions, constituting the extension strategy towards bio diversity conservation. These are: (i) understanding the setting, in which the issue of bio diversity conservation has to be sorted out – the area and the people; (ii) identification of the problems, priorities and alternatives in respect of bio diversity conservation and goal setting; (iii) carrying on with the planned extension interventions towards bio diversity conservation; (iv) monitoring and evaluation of impact of the programme on improvement in bio diversity as a result of the extension interventions.

i) Understanding the setting

The first set of actions towards organizing extension interventions, concerns developing understanding about the setting in which the particular aspect of bio diversity conservation is to be executed. The setting reflects the present scenario of the area under reference and the people thereof. Understanding the setting will provide important insights about the eco system characteristics, including the natural resource potential vis a vis the people, their use pattern of such resources, their knowledge system, practices and needs and priorities contributing to the problem of bio diversity depletion etc.

Knowing the area: Before embarking upon the task of deciding on the extension interventions, it is necessary to know the characteristic features of the eco system, surrounding the operational area, where bio diversity conservation has to be undertaken. The various types of information helpful in understanding about the eco system characteristics are:

- Land tenure,
- Land use,
- Cropping pattern,
- Livestock husbandry practices,
- Location and condition of local forests,
- Traditional and historical patterns of forest use,

- Existing use rights of common property resources, including forests,
- Traditionally available flora and fauna,
- Types of seasonal use and importance of inputs from forest to farm,
- Perception of forest users, and
- Conflicts and cooperation among various categories of interest groups having bearing on eco system conservation.

For collecting this information, mapping is one of the effective techniques. Sketch mapping is one of the convenient ways of recording and illustrating information about the eco system, like the boundaries of forests, physical features such as watercourses, ridge lines and trails and type and condition of the forest etc. Such information provides a basis for identifying potential areas of the eco system needing actions for bio diversity conservation, defining various user groups, providing technical advice, discussing management options with the user groups, setting planning objectives and monitoring progress. This information can be formalized by way of transferring them from the sketch map to a topographic map using the features common to both maps to tie in various points (Nurse et al, 1993). Though effective, quite often this method suffers from poor quality of information and maps coming out, as a result of lack of skills of the workers in using the method and consultation with local forest users (Jackson et al, 1994).

Aerial photographs can also be used in some instances to overcome the shortcomings of sketch mapping. However, they are highly expensive, difficult to obtain and require skills for effective interpretation. To overcome these problems, participatory mapping technique has been evolved as a more reliable and cost effective way for collecting, storing and displaying various bio physical and socio economic information needed for implementing bio diversity conservation projects. Participatory maps can be produced at various scales to yield different types of information. Smaller scale maps can form the basis for a preliminary PRA exercise, complementing other PRA tools, such as informal interviews, focused group sessions, transects, time lines etc. Larger scale maps allow more detailed investigation of an individual user group and their immediate component of the eco system (Jackson, et al, 1994).

Knowing the people: Broadly speaking interests of four categories of people are involved in the question of bio diversity conservation. They are termed as 'stakeholder' categories, who perceive the issue of bio diversity differently. These categories are: (i) the local community, (ii) the bio diversity lobby, (iii) the natural

resources sector of government, (iv) the development agencies (Brown, 1992). While local people inevitably take a parochial, and often possessive view of the natural resources around them due to close dependence on these and often, limited prospects of support in any form from elsewhere, the bio diversity lobby is part of the broader environmental and conservation lobby. The government view on the other hand, remains unaffected by consideration of possessive interests of people in the concerned land resources, and thus pursue biological conservation in their own right, regardless of other issues. The development agencies, in pursuing the cause of bio diversity conservation remain responsive to appeals for support but without subscribing to a vested interest reflecting dependence on the area concerned.

Any effort towards bio diversity conservation will succeed only when the local people see the real and potential benefits arising out of it. The benefits accruing straight out of the conservation project (not of any other development efforts, connected to the project), will motivate people to support the cause of bio diversity.

Besides having their stake in biodiversity conservation, local communities are also important custodian of biodiversity, having nurtured and developed it over generations. Thus, indigenous knowledge and bio diversity are complimentary phenomena, essential to human development. However, the role of indigenous people and their knowledge in the conservation and sustainable use of this biodiversity has gone unacknowledged. Yet this knowledge, far more sophisticated than previously assumed, offers new models for development, that are both ecologically and socially sound (Warren, 1992). It is estimated that there are currently at least 300 million people worldwide, or about 4 percent of the entire world population, who are identified as indigenous. Indigenous people inhabit areas of North and South America, Northern Europe, Asia, Africa, Australia and the Pacific (Henrietta, 1999).

For gathering and utilizing the treasure of such indigenous knowledge towards bio diversity conservation, it is necessary, first of all, to recognize the value of traditional ecological knowledge and the role of indigenous people in the management of the world's biodiversity. With such recognition, it is also necessary to realize that protection of indigenous interests as well as indigenous knowledge are essential elements towards bio diversity conservation. However, the threats to protection of such indigenous rights emanate from modern day world orders, like, biotechnology, biopiracy and the provisions of GATT agreement, specially, the intellectual property regimes (Henrietta, 1999).

ii) Identification of problems, priorities and alternatives

For initiating any effort towards conservation of biodiversity, the next important aspect of deciding on the extension strategy is to arrange for identification, prioritize



and fix up alternatives most people would prefer to accept. The essence of such strategy lies in making the process as participatory, as possible. This is in line with the recognition that local people are very well equipped with information related to the setting. A number of options have been found to be effective in this regard for carrying out each of these activities.

□ **Problem identification and analysis for prioritization**

- A number of participatory options are available for carrying out problem identification and analysis, some of which are spelt out below:
- Open interviews and iterative group conversations (Floquet, 1989)
- Ethnohistory or ethnobiography (in the form of biography of a traditional crop, or, historical analysis of a community regarding biodiversity decline) (Rocheleau, 1987).
- Visual aids to analysis: Seasonal and other diagramming, aerial photography, participatory mapping etc.
- Preference matrix as per clients' criteria and preferences (where individuals or groups of clients, like men, women, farmers etc. articulate their reasons for preferences, and then rank them accordingly) (Chambers, 1988).
- Goal Oriented Project Planning (GOPP) where the people participate in problem identification through formulating the problem tree for identifying the root cause, followed by clustering them into groups, depending on the similarity in respect of their nature and thereby formulating objective tree for facilitating identification of solutions.

The role of the development agent in such cases will remain restricted to elicit, encourage, facilitate and promote problem identification and analysis by the people. The people's own analysis, criteria and priorities should come first (Chambers et al, 1989)

□ **Choice of alternatives**

The choice of alternatives towards deciding on the options for bio diversity conservation should be left to the people for ensuring sustainability of the actions. For doing so, the people will require, firstly, relevant information and materials, and secondly, they need a range of choices, so that they can pick and choose to suit to their conditions, extend their repertoire and enhance their adaptability. To find and present a variety of choices to the people is by and large the task of the development agents. Their role, whether they are scientists, extension workers or NGO representatives, is to search for and supply the required flora or fauna, treatments, cultural practices, management mechanisms etc.

iii) Extension interventions

It is quite a challenging task to create biodiversity conservation among the huge majority of rural populace who are highly divergent in respect of their education, social status, economic characteristics, resource endowments – both physical and natural and so on and so forth. The Government of India adopted a number of interventions towards conservation and sustainable utilization of the diverse biological resources of the country. These include an array of legal and policy interventions, field action programmes, research, training and awareness building initiatives. It is worthwhile to analyze the learning experiences of some of them, to identify relevant issues.

□ Curtailment of rights and concessions

Tribals, being the traditional forest dwellers, the forest department awarded certain rights and concessions to enable them to use forest resources for their domestic and agricultural purposes. Generally speaking, such areas of rights and concessions are: (i) right to take water for agricultural purposes; (ii) free grazing in open forests (with permits); (iii) removal of stones and earth for domestic and agricultural uses; (iv) removal of timber, bamboos, reeds, canes, etc. for construction and repair of houses and agricultural implements; (v) collection and removal of headloads of deadwood for domestic use; (vi) collection of grass for feeding cattle and thatching of huts; (vii) fishing and hunting, excluding the protected fauna; and (viii) cultivation of forest lands.

With the launching of “Project Tiger”, a biodiversity project, such rights and concessions being enjoyed by the tribals were being withdrawn, specially from the core areas, for reasons of eliminating biotic interference towards facilitating habitat protection. This had been viewed by the forest dwellers as encroachment on their rights and privileges. In the absence of any alternative provision for meeting their requirements, this had in many cases resulted in animosity between local people and forest department or project authority and also created law and order problems (Alexander et al, 1988). Similarly, attempts of raising coastal belt plantations in Andhra coast, in areas used by the fishermen community for drying of nets and catamarans, was construed as an encroachment on their traditional rights and in turn resulted in uprooting of trees (Sen, et al, 1996).

Sometimes, as a result of introduction of biodiversity conservation interventions, resultant situations lead to incurring of losses in the form of crop and livestock damage, employment loss etc., which antagonize the people in the surrounding villages. As a result of introduction of “Project Tiger”, wide spread complaints of crop damage by increased herbivore population in the buffer area straying out in the crop fields and resultant economic losses antagonized people in the surroundings. Similarly, increase in carnivores, including



tigers, often led them to prey on cattle population in the adjoining villages, which often led the people to interpret the project as the cause of their misery, though, it was actually, a problem emanating out of the erroneous stocking policy and also the failure to maintain the herbivore – carnivore balance within the project area (Alexander et al 1988). The attempted introduction of fish in derelict ponds, as a measure of biodiversity and consequent employment generation by Fish Farmers' Development Agency (FFDA) in southern Tamil Nadu failed, as the people subsisting on sale of lotus, grown in those tanks, found it as encroachment on their right to eke out a living (Sen and Das, 1985)

□ **Problems of displacement**

In some of the biodiversity projects, people are displaced from their original habitations and that affects the project acceptability. In the "Project Tiger", a number of villages from some individual projects in Rajasthan and Andhra Pradesh, were relocated outside the project area. Due to lopsided arrangements, the assured conditions could not be provided, which in turn set a bad precedence and met with resistance from the remaining villages and led to law and order problem and subsequently, project acceptability (Alexander et al, 1988)

□ **Lack of awareness**

Quite often, biodiversity conservation projects suffer from lack of awareness on the part of people about the objectives as well as the project components. In order to create awareness among the people, it is necessary for the officials, especially at the lower levels, who frequently come into contact with the people, to develop an understanding about the objectives, coverage, methodology, etc., of the project. The Social Forestry project, introduced in India for creating biodiversity resources outside the precincts of the reserved forests, primarily for mitigating the fuel, fodder, timber and other uses of socio – ecological dimensions, was primarily construed by the field staff as well as the people, as attempt for introducing monoculture, due to its propagation of a few exotic species (Sen et al 1996). Even among the lower level staff of Project Tiger, the eco development objective was shrouded with the over simplification of their roles, merely that of wild life protection and tracking of the movement of wild animals. In respect of production and utilization of extension and publicity materials also the projects were lagging behind. Although the Project Tiger authorities in the tiger reserves were exhibiting films on wild life, such attempts were ad hoc and an end in itself, without any follow up activities to provide them with further information, so that they become convinced about the need for taking up eco development activities at their own levels (Alexander et al 1988).

□ **Withering traditional knowledge base**

India is a major region of bio diversity from the point of view of eco system as well as the species and genetic levels. This valuable resource base has been protected,

preserved and conserved by the country's indigenous people over the years. But the biodiversity based traditional knowledge systems of the forest dwellers, farmers and healers are fast becoming private property of the transnational agencies. These agencies are usurping these systems from the domain of common knowledge through IPRs. The IPR regime has expanded the domain of intellectual property to include biodiversity. However, these IPR regimes, as provided under TRIP (agreement on Trade Related Aspects of Intellectual Property Rights), recognize and provide protection only to the formal innovators, not to the informal, indigenous custodians of such knowledge and practices. The traditional knowledge of these informal custodians (farmers, indigenous medical practitioners, forest dwellers), is being pirated by the formal innovators (scientists, plant breeders and technologists), who make minor modification or advances and then seek patents, thereby claiming the knowledge as their private property. The development agencies dealing with biodiversity conservation should concentrate on ways and means of protecting the biological diversity as well as the intellectual heritage of India for posterity. Collection, documentation and awareness building efforts should be organized as extension interventions towards such protection of biodiversity based traditional knowledge system (Vandana Shiva, 1999).

□ **Involvement of women in biodiversity conservation**

Women's key role as preserver of agro-biodiversity and plant and animal genetic resources, so long remained unrecognized by the development agencies. However, for biodiversity conservation, women's knowledge needs to be specially collected and preserved by following a gender sensitive approach. Due to their multiple roles and responsibilities as providers of food, fodder, fuel, health care and other household needs, rural women generally possess knowledge of various uses of good number of plants, animals and forest products. Their management of the ecosystem and plant and animal resources is often based on knowledge preserved by women over the centuries. Besides, women farmers also experiment with plant and animal resources for improving upon their quality as well as production. Their choice of plant and animal resources is based on adaptation to local environment, as well as the multiple uses of these resources. For the development agencies, to initiate actions towards preservation of such knowledge of rural women, it is necessary on their part to adopt a gender aware approach wherein they should be ready to:

- Recognize the value of women farmers' knowledge and skills;
- Organize the activities of the agricultural research institutes and the extension agencies in such a way, so as to enable them to better understand and focus on the priorities of women farmers ;
- Ensure that women's knowledge of agro-biodiversity is preserved and guarantee their rights to use plant genetic resources; and

- Improve women's participation in setting research priorities and extension activities (Karl, 1997).

iv) Monitoring and evaluation of impact of biodiversity conservation

The impact of biodiversity conservation needs to be continuously monitored and evaluated, not only for reasons of justifying the actions towards ecological upgradation, but also for putting across before the people, the direct and indirect benefits accruing to the community. For operationalization of such monitoring and evaluation, biodiversity performance indicators need to be identified, in consultation with the local community. The use of participatory monitoring and evaluation techniques like Participatory Assessment, Monitoring and Evaluation (PAME) can be a good option for undertaking the task (Rajakutty, 1991). A monitoring format needs to be evolved for collecting data regarding changes in respect of various components relevant to the specific area of biodiversity conservation. Like any other indicators, biodiversity performance indicators must be a good proxy for the performance target, easy to measure and collate, and simple to interpret. Such performance indicators must also be easily comprehensible to the people.

Institutional Issues Concerning Biodiversity Conservation

Biodiversity conservation is essentially a multifaceted and multi organizational area of concern. It involves a number of departments, each of which takes up activities, specific to its own mandate and areas of concern. Thus, it becomes very difficult to suggest a uniform institutional framework for providing guidelines towards concerted action. Hence, suggesting institutional issues for efficient management of biodiversity conservation has to be attempted on the basis of available experiences generated through specific projects attempting such conservation. A few findings as evidenced in related areas are spelt out below:

□ Administrative Coordination

Any biodiversity oriented project essentially involves a number of problem areas, as it invariably deals with the broader ecological areas of concern. While implementing such a multi-dimensional programme, involving a number of problems, the working of the project authority should be in tandem with other relevant departments and their programme of action. Unfortunately, most of these projects, work in watertight compartments.

In respect of Project Tiger, no project authority was found to maintain functional relationship with other development departments. But, a scrutiny of the component activities of the project had shown that their effective management

required involvement of the concerned departments. For example, for mitigating the problems of cattle grazing within the project area, the cooperation of the livestock or social forestry departments might have been helpful in creating alternative grazing facilities for the people, affected through restriction on grazing. Similarly, relocation of tribal villages from the core area of tiger reserves required involvement of the revenue department, which unfortunately was not sought, resulting in poor implementation and creating resistance on the part of yet to be relocated villagers (Alexander et al. 1988). Implementation of watershed development projects, wherein a number of line departments are put under one administrative umbrella, has also not been able to bring in administrative coordination, as each department started thinking only in terms of its own area of operation. Thus, the integration of efforts of these departments, remain as mere rhetoric. Similarly, joint forest management, basically a forest department project, had conceived development of micro-plans as the corner stone for facilitating administrative coordination. However, experience had shown that preparation and execution of the plans remains the responsibility of an official at the level of Beat Officer, with other departments' presence remaining restricted on paper only (Sen et al 1993).

□ **Participatory rather than bureaucratic functioning**

Effective management of any project leading towards biodiversity conservation requires a shift in approach of the concerned functionaries from that of bureaucratic to participatory styles and a shift in responsiveness from orders from above to demands from below. The working environment in which the field staff of these projects have to function, must also be conducive to these new roles. It will be difficult for the field staff to adopt a service-oriented role when the value system they work within, encourages them otherwise. Result orientation rather than target orientation should be the basis for their performance evaluation.

With the introduction of social forestry project within the forest department, problem of role transition from that of punitive to supportive, on the part of field level functionaries had to be encountered. As the field functionaries were accustomed to adopt measures for preventing people from entering into the forest area, they found it difficult to accept their role as that of motivator (Sen et al 1996). Similarly, field staff under the Project Tiger also had to face problems of adjustment to their new roles of community organizer and motivator, as they were accustomed to punish the villagers in the event of their entry into the tiger reserves (Alexander et al 1988).

□ **Training**

In order to equip the functionaries working under biodiversity conservation projects in various aspects of its functioning, both technical as well as managerial training are of supreme importance. However, experience of various projects in the



relevant fields suggests that while training is imparted more or less regularly to the higher echelons of the respective organization, at the lower level, there has been almost total absence of such training. As a result, the lower level functionaries, while interacting with the people, followed the same prescriptive/coercive approach, defeating the very purpose of such projects.

□ **Involvement of local level community organizations**

Community organizations, like Panchayats, Cooperatives and Self Help Groups can play very important roles in securing people's participation in biodiversity conservation projects. Panchayats in social forestry projects, Tree Growers' Cooperatives in wastelands development projects and Self Help Groups in Tiger projects have proved to be quite effective in managing people's participation. (Sen, et al, 1996; Sen, et al, 1988). While these are more formal institutions, community level informal organizations, like Forest Protection Groups in joint forest management, water users' association (Pani Panchayat) in community irrigation project, suggests the effectiveness of their involvement in not only securing people's participation, but also providing a management frame work for implementing the project at grass roots level.

Conclusion

Biodiversity conservation is in other words conservation of the eco system leading towards protection of biological diversity, evidenced in its flora, fauna and genepool. Its conservation is necessary for meeting the utilitarian as well as aesthetic requirements of mankind. The Indian subcontinent, characterized by its richness in all aspects of biodiversity, sustains its huge population. The rapid loss of such biodiversity causes concern and thereby need for its conservation becomes imperative. Of the many options available for biodiversity conservation, mainly through protection from further damage as well as compensation, adoption of the right kind of extension strategy attains significance. In deciding such an extension strategy, people are important stakeholders, besides government agencies, NGOs and members of biodiversity lobby. While all these stakeholders are important, people are the corner stone for successful implementation of any biodiversity project. Hence the extension strategy should be built upon understanding the setting in which people operate, their needs, problems and priorities, various options available and the choice of solutions, coupled with the right kind of extension methods and materials, appropriately monitored and evaluated for assessing the impact. For operationalization of such an extension strategy, the right kind of institutional mechanism will facilitate the process of biodiversity conservation.

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