

PARTICIPATORY BIODIVERSITY MANAGEMENT: APPROACHES TO INSTITUTION BUILDING TO IMPROVE ECOSYSTEM SERVICES AND WELL BEING

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***Abstract:** Economic development will be sustainable for well being when there is perennial flow of natural capital like biological resources, water, air which are the product of natural ecosystem. Over exploitation of biological resources has caused disruption of ecosystems and decline of ecosystem services. There have been number of global treaties, policies, law and development of numerous scientific approaches to conserve biodiversity without significant results. Study by IBRAD reveals that no 'Scientific Theory' or 'Policy' will be effective unless there is accountable public governance compatible with appropriate social institution for 'Participatory Biodiversity Monitoring and Management', blending scientific principles with indigenous knowledge.*

***Key Words:** Participatory Biodiversity Monitoring, Livelihood, Ecosystem Services, Well Being.*

***JEL Classification Codes:** Q2 – Renewable Resources and Conservation, Q23 – Forestry, Q230 – Renewable Resources and Conservation: Forestry*

INTRODUCTION

Economic development is assessed in terms of quantitative and qualitative improvement of the standard of living and finally well-being of the people. The continuous flow of natural resources for economic development will depend upon the functioning of the ecosystems. Terrestrial natural ecosystems such as desert, forest, or meadow or aquatic- pond, river, or lake and ocean. Ecological life support systems underpin a wide variety of ecosystem services that are essential for economic performance and human well-being. How can any economist or development practitioner plan for sustainable development ignoring the sustainable production

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and flow of natural resources which are the product of ecosystems? Realizing the importance of the ecosystems and its associated services, multiple organizations are working to develop guidelines and methods at different levels for conservation of ecosystems and biodiversity. The forest ecosystem provides ecosystem services (ES) in terms of wide range of timber, non-timber forest products as provisioning services. The forest ecosystem regulates the climate and preserve water to maintain supply, purify air and provide drinking water. The layers of foliage on forest floor of the forest ecosystem checks top soil removal against rain water, and decomposition of litter supports soil fertility and maintain nutrient cycles. Forests provide unique landscapes which have an important role of maintaining the aesthetics and have a religious value in some regions. Today, such services of ecosystem are recognized for global importance, directly or indirectly, in terms of climate regulation and maintaining livelihood security of the people.

BIODIVERSITY: THE ESSENTIALS OF ECOSYSTEM

Ecosystem is a complex structure of biotic and abiotic components. Biodiversity constitutes the biotic component of the ecosystem. The definition of biodiversity as used by the Convention on Biological Diversity (CBD) states that "Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." The main goals of CBD, of which India is also a signatory, is to ensure conservation and sustainable use of biodiversity as well as to develop mechanism for equitable benefit sharing among the stakeholders. There is need to have better understanding of status of biodiversity, the dependence of the local community on it for their livelihood and other economic activities.

BIODIVERSITY DECLINE: THE MAJOR CHALLENGES OF THE WORLD

Wild-harvested foods, such as wild meat, non-timber forest products, wild fruits and freshwater resources, remain important for food security, health, cultural identity and adaptation for many people (Golden *et al.* 2011; Nasi *et al.* 2008; Robinson and Bennett 2000).

Too often, the overexploitation of biodiversity has failed to focus on conserving the ecosystems providing these services. This has resulted in the degradation of regulating and supporting ecosystem services that are important for overall system functioning and long-term resilience and it poses great challenge to the global community.

Not only that, the climate change is an increasingly important threat to species and their natural habitats. There is widespread evidence that changes in phenology, including the timings of reproduction and migration, physiology, behavior, morphology, population density and distributions of many different types of species are driven by climate change (Rosenzweig *et al.* 2007).

The issue of biodiversity Conservation is beyond the subject matter of just flora and fauna.

“... the Conservation recognizes that biological diversity is about more than plants, animals and micro organisms and their ecosystems.....it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which they live.”..(Conservation on Biological Diversity -CBD) institutions, these resources have been viewed and used as open access resources leading to over exploitation to meet the short term and immediate monetary gain without concern for the long term consequences on the habitat of ecosystem and flow of biodiversity. Moreover, climatic variations and changing climate is also posing threat for these biodiversity resources to survive.

THE SCOPE OF THIS PAPER

The scope of this paper is to share how important it is to sensitize the community and ask them to visualize what kind of benefits they derive when their own habitat of ecosystem is well conserved and also delineate their immediate loss if not conserved by their own efforts. Once the proactive leader from among the community realizes the value of conservation of the biodiversity and the immediate benefit to them, then she/he takes initiative to involve the indigenous local community to develop their own social institutional norms and social action to work with the local government functionaries for ‘Participatory Biodiversity Management’. Further imperative is developing participatory, simple yet scientific criteria and monitoring the health of their natural forest habitat and evolving some strategic plan for conservation as well as improving the ecosystem services for sustainable livelihood in particular. Secondly, which is more relevant for conservation of biodiversity, is to present a simple yet scientific template and checklist of information needed for diagnosis of degree and nature of degradation and prescribe possible corrective action to improve Ecosystem Services that can be have a cascading effect.

NEED FOR REGULATORY MECHANISM: PARTICIPATORY BIODIVERSITY MANAGEMENT (PBM)

Over exploitation of forest resources, without any effective regulatory mechanism, lead to deforestation and loss of biodiversity. Forests face enormous pressure from the expansion of agricultural activities, settlements, livestock grazing, building infrastructure, wood industries, harvesting and forest excavation for mining. While all such activities may be essential at some point, but one has to accept the fact that human cannot survive without continuous supply of the biological resources. Overexploitation of forest resources for any reason has to be guided, controlled and harvesting has to be done on sustainable basis.

We need some candid, simple, measurable yardstick or criteria to monitor and measure the limit of sustainable harvesting even if we accept the fact that there has to be some regulatory mechanism for sustainable harvesting.

Another challenge is to identify who will monitor periodically such a vast forest land? How many experts will be needed to monitor the forest biological diversity and resource as a whole? Can the deforestation be arrested just by developing the scientific principles and yardstick of criteria and measurement of sustainability? What does our experience reveal about status of conservation of forest through protection by the government officials alone? The third Global Biodiversity (CBD 2010b) mentioned that biodiversity has continued to decline since its publication of the Millennium Ecosystem Assessment (MA 2005a). The government field functionaries cannot be effective to control the over harvesting of the forest resources without the support of the local forest community. Community's participation in forest conservation has significant positive impact in controlling deforestation, loss of biological diversity and land degradation. We have many such document from Indian experience of Joint Forest Management (Roy, 1992).

A forest ecosystem can be defined on a range of scales. It is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system. Humans, with their cultural, economic and environmental needs, are an integral part of many forest ecosystems (CBD, ad hoc tech expert.). So why not to involve the community in monitoring and manage the biodiversity and empower them to assess the resources and conserve them on sustainable basis? Such practices are known as Participatory Biodiversity Management (PBM)

With passage of time and consequent population growth, technology, and consumption, it resulted in destruction of natural habitats threatening human survival. There is no doubt that the problem is severe. There is a growing realisation that it is neither technology nor policy alone can reverse the process of degradation. It demands social action in the framework of, community institution as collective partner in Participatory Management with the government institution, to work together for the great cause of conservation and well being of the people.

WHAT IS PARTICIPATORY MANAGEMENT

"Participatory Management" includes participation of the stakeholders in the process of identifying the problems, assess the available resources- trade off, set the goal, develop action plans, and come forward to take responsibility to act and monitor the progress. While the members of the indigenous local community enjoy the gift of natural ecosystem services in different forms, the degradation has causes misery to the local community first. If the communities use their experience and knowledge to review the natural ecological systems that provide the ecosystem services, they may find solution to check degradation of the forest. The participation will be effective if the community develop social institutions with codes of social action for a sustainable use. The realization of the community that the continued over-exploitation of ecosystems will degrade their own livelihood and make their future generations more vulnerable, would lead them to take corrective actions. The ecosystem is a complex

structure of biotic and abiotic components. The local community differentiates between biological resource and the dependency of the biological resource on the ground of some non living elements and water. The forest community may not describe academically classified types of ecosystem services (ES), but they have experienced the implications of deforestation in form of loss of biological resources, erosion of top soil and drying water bodies.

WHY COMMUNITY FOR PARTICIPATORY BIODIVERSITY MANAGEMENT

Firstly, deforestation has immediate negative impact on the indigenous local community so they can be involved effectively in finding solution to arrest degradation of the ecosystem. Secondly, indigenous knowledge, when applied with scientific concepts and methods, helped in building synergies among different approaches for conservation. Thirdly, encouraging results to check the deforestation through community participation under a massive program of the Joint Forest Management in India are experienced and witnessed by the world. IBRAD (Indian Institute of Bio Social research and Development) has recently been engaged in the Participatory Biodiversity Monitoring (PBM) with inspiring experiences of involving the indigenous and local community for PBM. And finally in order to operationalise the implementation of ecosystem services, it is not the scientists but the real stakeholders who have to appreciate the tools and methods. it might be one way of operationalizing the cascade model.

REQUIREMENTS: AWARENESS, SOCIAL ACTION AND BILATERAL MATCHING INSTITUTIONS

The foundation of the entire programme depends on identification of proactive leaders, sensitizing the community to monitor drivers of degradation and develop effective social institution first to reverse the processes of degradation. The social indications of the community and local government functionary's needs to organize themselves for a collective social action in the form of bilateral matching institution to conserve the ecosystem as social movement instead of a project based externally directed activities (Roy, 1996).

The methods and approaches have been designed by IBRAD in such a way that the front- line government technical staff and local people work together in the monitoring process (Roy, 2000). The data has provided information for taking decision for conservation strategy jointly with government agencies and local community. Further, it provides plan for sustainable harvesting for economic benefits for the community on equitable basis.

ENCOURAGING RESULTS FROM COMMUNITY PARTICIPATIONS

The scope of this case study is to share how the local community was sensitized to assess the amount of timber and other forest products that are harvested by them. The

community could not ignore the consequences of such act of harvest if not planned for long term. The community formed the social group as an institution and wanted to learn the procedure and regulatory processes as necessary framework for controlled harvesting. Traditional knowledge of the community for monitoring the changes in the ecosystem has helped them to take timely corrective actions for biodiversity conservation. Such traditional practices are linked to social mechanisms.

Understanding of such ideas and transmission of ecological knowledge, dynamic social institutions, and mechanisms for cultural internalization of traditional practices with associated world views and cultural values, help in sustainability.

The criteria, parameter and indicators for assessment of degree of deforestation has been developed by involving the forest community for location- specific in terms of parameters that had been used to measure, e.g., degree of forest cover fragmentation, standing biomass assessments, canopy cover, species richness, quality of soil and water found for understanding the health of given habitat. Interestingly all such concepts, selection of criteria and indicators were understood and found applicable for taking corrective measures for forest ecosystem management units (Mukhopadhyay *et al.* 2012).

Following well-accepted concepts of assessment of degradation were discussed with the community and Participatory criteria were developed which was tried in two forest patches in two different villages, Jamkanali and Jamirdiha under Simlupal Forest Division in Bankura district of West Bengal, India to translate into PBM for preparation of microplan for conservation of the forest and livelihood development.

Forest Fragmentation and its Consequences

Fragmentation of the forest was marked by the community members of Jamirdiha and Jamkanali Forest Protection Committees under Bankura district of West Bengal, India. It was recorded using GPS. Such fragmentation has caused degradation in some part of Jamkanali and Jamirdiha and a list of lost biodiversity was recorded such as *Shorea robusta*, *Azadirachta indica*, *Aegle marmelos*, *Emblica officinalis*, *Acacia nilotica*, *Terminalia chebula*, *Alstonia scholaris*, *Terminalia bellerica*, *Syzygium cumini*, *Syzygium cumini*, *Pterocarpus marsupium*, *Pongamia pinnata*, *Litsea glutinosa* etc among tree species; *Justicia adhatoda*, *Zizyphus nummularis*, *Flacourtia indica*, *Barleria cristata*, *Mussaenda frondosa*, *Urena lobata* etc among shrub species and *Andrographis paniculata*, *Ocimum basilicum*, *Colocasia nymphaeifolia*, *Boerhavia diffusa*, *Hemidesmus indicus*, *Elephantopus scabar*, *Costus speciosus*, *Leucas cephalotes*, *Mentha piperita*, *Oxalis corniculata*, *Sida cordifolia*, *Vernonia cinerea*, *Asparagus racemosus*, *Chrysopogon aciculatus* among herb species.

Ecosystem processes were severely disrupted and the members of the community recorded the diminishing rate of provisioning ecosystem services. Land-use changes were marked by the community and discussed for enrichment through silvicultural operations following the working plan of the forest department. Accordingly, plan

was made for plantation and enrichment of the area through Assisted Natural Regeneration.

Moreover, community members of both the villages identified blank areas outside the forest for plantation. Community members of Jamkanali and Jamirdiha have raised a nursery in the year 2015 and have produced 3000 and 15,000 sapling of eucalyptus respectively. People of Jamkanali have planted all the saplings in the blank areas whereas in Jamirdiha they have planted 5000 saplings in the village and rest 10,000 is sold at a rate of Re one per sapling. Thus, they have identified avenue for not only improving the biodiversity in the forest and forest fringe areas but also have explored a new avenue for livelihood generation through nursery.

Canopy Openness in the Forest under Storey is Minimized

Vertical structure of the forest and canopy is maintained within natural variation. Size class distribution does not show significant change over natural variation and species composition. Forest ecosystem state, or type, is the recognizable normal species composition and structure of the dominant trees for a given site. Change in state refers to a change in species composition of the vegetative cover.

In the above mentioned villages, the Forest Protection Committee members have developed mechanism for protection of the forest through voluntary patrolling by the members of the community so that the illegal felling of trees are checked and the forest does not become an open one.

Guild Structure

A guild is a group of species or organisms which use the same environmental resources in the same way (Stork 1987).

The members of the community oversee how the abundance of selected, insects, avian guilds is maintained. Fruiting intensity is observed in well pollinated tree species. The forest floor invertebrate like earthworm, snail's communities and aquatic, if any is maintained.

People of both the villages realized the importance of maintaining the species guild. They could explain how important it is to have pollinated tree species in the forests. The pollinators help in maintaining their agriculture productivity through pollinations. They have also explained how important to have earthworms in the soil to maintain soil health, reduce compaction of soil and maintain nutrient cycling. The presence of snails, earthworms in the forest helps in maintaining the health of the agriculture field adjoining the forest areas. They have made a plan to use more of organic fertilizers to maintain the microorganisms and invertebrates in the soil.

Keystone and Flagship Species

Many species are sensitive to forest degradation, and numerous examples are available of effects of forest change on species populations, some focal species like Ficus, rare

species, endangered (i.e., flagship, umbrella, etc.), as functional species are recorded by the community. Species Abundance, or groups of species, is used commonly as an indicator for monitoring the effects and effectiveness of forest management.

The traditional practices of the people help in conserving the flagship species like *Ficus* that are worshipped by them and are never destroyed. Same way, the flagship species like *Shorea robusta* and *Madhuca indica* that support many associates of shrubs and herbs within their habitat, also have many religious connotation to the local people. These are integrated in their life through various religious practices, functions and rituals.

Plants of Different Age and Population Sizes

Plants of different ages and population sizes, effective and demographic structures of selected species are recorded in natural forest. The significant changes due to demographical change on the critical life-cycle stages will have impact if all the plants are of the same age.

Maintenance of natural forest holds plants of different ages and population sizes. Community takes efforts to maintain the natural forests. They, along with the forest department, have planned to plant small timber yielding and medicinal plants species, have assisted natural regeneration in open patches with *Shorea robusta* and *Madhuca indic*, in situ conservation of *Buchanania lanan*, *Diospyros melanoxylon*, *Emblica officinalis*, *Terminalia bellerica* etc.

Soil Structure, Quality, Moisture and Rate of Decomposition

Soils and decomposition of leaf litter play key roles in forest biogeochemical cycles; erosion causes degradation through siltation of watersheds, reduced soil stability, and reduced fertility. Protective functions refer to the intrinsic property of forest ecosystems to maintain soils, soil structure, quality and moisture levels, which ultimately contribute to forest resilience. Microorganisms, as decomposers in forests, help to maintain water and soil quality and promote nutrient cycling not only in forest land but contribute significantly to the adjacent agricultural farming field and that improve the crop quality and productivities.

Community members have planned to develop vermin compost units to produce organic fertilisers to maintain soil structure and soil moisture content.

Water Quantity and Quality

Water quantity in areas where there is forest cover is known to help regulate water flow. Water levels in rivers and streams among and within years, compared to normal level, may indicate if sufficient forest cover remains to regulate flows, especially in dry seasons. The availability of water both in terms of quality and quantity has helped in the fishery as important means of livelihood.

In these villages people, along with the forest department, have planned to create rain water harvesting structures and deepening of ponds in the forest and forest fringe areas where pisciculture is done to improve the livelihood of the people.

CONCLUSION

Since the PBM essentially constitutes community as one of the partners of forest management, the methods and approaches have been designed in such a way that the front-line government technical staff and local people work together in the monitoring process. The data has provided information for taking decision for conservation strategy jointly with government agencies and local community. Further, it provided plan for sustainable harvesting for economic benefits for the community. The Participatory Biodiversity Monitoring helped the community to identify the action to protect the forest that has negative impact on the biodiversity. This helped the community to take corrective action. One of the important actions they have taken is to identify the vacant land and they collectively planted trees. Participation of the local community with their traditional knowledge and practices for conservation helped them to take course of action to conserve forest in the context of local habitat and ecological need. That knowledge can be applied further based on monitoring changes in biodiversity detected through indicators. It is important to select indicators and methods that can meet both local and national needs. The community found some indicators of changes in local natural resources which are relevant to local or household economies, or subsistence, e.g. non-timber forest products. Establishing protocols and standards for data collection and management from local to the state level, can ensure consistency and comparability between information from diverse locations. The members of the community have planned to include spatial and temporal data for comparisons to capture different valuable and specific knowledge for better conservation

No technical or ecological 'Scientific Theory' or 'Policy' will be successful unless the public governance process is followed for getting the community inspired to form a dedicated social institution and develop a trusting relationship with the government functionaries as Bilateral Matching Institution for participatory biodiversity management, improve ecosystem services and well being of the people.

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