

NEW MEANINGS FOR OLD KNOWLEDGE : THE PEOPLE'S BIODIVERSITY

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Abstract.

three streams of folk knowledge, slow science (eg. Ayurveda, Yunani or Tibetan medicine) and fast applying it in practice; it lacks a formal, institutionalized process of handling it. Folk ecological ecological resource base. Today both are eroding at a fast pace for two reasons; because people now dependent on local medicinal plants and animals as before, and secondly people are increasingly knowledge and wisdom with their detailed locality and time specific content are of value in many

contexts. They must therefore be supported in two ways; through creating more formal institutions for programme of "People's Biodiversity Registers" is such an attempt. It documents folk ecological level educational institutions. It also seeks to create new meaning for folk knowledge and wisdom by local communities in the framework of the Convention on Biological Diversity. About sixty such states of India. They provide extensive information on the status and dynamics of folk ecological

Humans stand out from the rest of the animal world in their highly evolved symbolic language, in applying these to deliberate manipulation of the external world. These capabilities have evolved over more amongst themselves in the ways that they organize knowledge and apply it to manage the world. in this issue of Ecological Applications. This presentation concentrates on the experience in this experiment, that of People's Biodiversity Register.

1. Information

ical world in form of conceptual categories.

3. Wisdom : Rules of prudent behaviour flowing out of knowledge

back into enhancing their predictive capabilities

6. Codified science : Science based on written transmission of information

of prediction

predictions.

works and use these models to forecast events to come. To begin with, these are simple models, for

would return to finish it next morning. Then they grow more complex, relating phases of moon, for

As predictions of such models are tested and found true; for example, highest tides are always

as old as symbolic language; perhaps as much as 100,000 years old. And the human store of

We now know that even Chimpanzees chew on leaves of particular trees when they are feeling

kind of plant would bring relief when afflicted with what kind of malady. When such observations are

effective against what kinds of maladies that we have the beginnings of science.

efficacy of leaves of different species of plants for this purpose may then be assessed through a

developed, for instance, that bitter tasting leaves are more efficacious in healing wounds and tested.

elements of testable predictions, would very much depend on ongoing practice for its persistence and

and how rigorously the predictions verified. An important advance in those directions would be made

broader dissemination and promote, though by no means assure more rigorous definition of categories,

the stage of codified sciences of medicine, such as Siddha, Ayurveda, Yunani or Tibetan systems of

fuzzy definitions of categories and unrigorous modes of verification. This would mean that it may

science. These codified sciences such as Ayurveda may then remain slow sciences.

period, perhaps from the time of Buddha and Greek and Chinese science in sixth century B.C. Of

rates in different parts of the world as the observational categories become more defined, and the

men and women of Europe as they continued to seek knowledge in the 15th -17th centuries.

produced modern science; some may call it western science, but we may most appropriately call it

Thanks to its speed, "fast" science has overtaken and overwhelmed all earlier systems of knowledge,

The uncodified folk herbal treatments of diseases, the codified more organized systems such as

"fast" science. The "fast" science is far more specific in what a particular remedy is

for instance, to a particular kind of alkaloid or some other molecule, present in a well defined species

many molecules, derived from a plant which is not well

occasionally go under the same name. In Ayurveda too there has been far less rigorous testing of the

far more confidently with specific drugs targeted to specific maladies.

PRUDENCE AND PROFLIGACY This brings us to the issue of wisdom. The

conduct; as soundness of judgment in the choice of means and ends. In the ecological context an

term yields are enhanced even at the cost of some immediate harvests.

foragers, concentrating at any time on prey that maximizes the energy or nutrient returns per unit time, it is only because they have better options. Humans too behave as optimal foragers much of the time (Mulder 1988). In the Torres Strait, fishing may be stopped in localities where fish yields temporarily abandoned if their population declines (Eaton 1985, Nietschmann 1985). These responses returns possible from alternative species or localities. But in other cases humans seem to refrain from residents of the village Kokre Bellur near Bangalore in south of India strictly protect painted storks the breeding season. Obviously the nesting birds are far easier prey, that is nevertheless left alone, practices too include examples of deliberate restraints on resource harvests, whether these be mesh

Modern resource management practices are based on explicitly stated rationale; they are motivations underlying particular practices may be different from the stated ones, and that the explanations cast in an idiom acceptable to modern science based societies. Traditional resource community members may accept certain restraints on use of biological resources so as not to offend

deities, or because their violation would attract social sanctions. It is unlikely that they would state purpose, such as provision of an ecosystem service. It has therefore been often argued that the incidental consequences that they are in no way indicative of ecological wisdom (Diamond 1993). It traditional societies might have arrived at practices that promoted sustainable resource use through conferred an advantage on the concerned community, other communities might also acquire such system of religious beliefs or social conventions without their secular function being explicitly

One may address this question in two ways; on the basis of models of human decision making Gadgil (199) explore a model based on the postulate that many kin based, small scale societies, sensitive to signs of depletion of their resource base. As a group they would be aware of levels of them. The simplest, most general rule of thumb that such societies may employ to adjust harvesting the harvesting pressures to increase if there are no signs of problems. There are many ways in which at all times and over the entire range. It may take the form of a closed season during which all harvests

are suspended, or immunity from harvests to certain life history stages such as pregnant females. Joshi
immunity from harvests of all species in specific localities. Such localities then serve as refugia for
of such refugia established by societies outside the ambit of modern western resource management
demonstrate that adjusting the extent of the total habitat maintained in the form of a refugium will often
population. It is thus plausible that societies that have not as yet made the transition to the stage of
on the basis of simple rules of decision making.

experience of the fate of sacred groves in northeastern India. Much of northeastern India lying between
self -and
and they left somewhere between 10% to 30% of their lands and waters as sacred sites not exploited
to mainland markets and came under the influence of commercial demands for timber, fuelwood and
rationale of protecting refugia as sites sacred to nature spirits. As a consequence most of them
some of the erstwhile sacred groves has been revived in several villages of this region. This

-Christian societies.

practices that genuinely served positive functions and that had been arrived at on the basis of some that complex ecological systems highly variable in their behaviour in space and time can be most interventions on the basis of ongoing observations of their ecological consequences at the local scale.

-called "fast" science

large failed to do any better and in certain cases may indeed have done worse. This is because the of more effective management regimes. In absence of any such laws the prescriptions of fast science consequences (Ludwig -

But the superiority of Allopathy is not so overwhelmingly clear. For Allopathic treatment has to

- that of highly variable human physiologies, often

may therefore often go awry. As the famous Cosmologist Stephen Hawking narrates in an interview

-and -half

he has always wondered how they were so sure of the half!

health, or natural ecosystems, as it has done while handling simpler systems. This is because it is relating to the behaviour of complex systems with real rigour. On the contrary, "fast" sciences are at

- Indian Science of

- has been totally overtaken by modern Chemistry; the latter probably has nothing to learn

can use with great profit. Quite analogously, tribal and village systems of management of local forests management science.

the modern systems of industrial production and marketing. So the Allopathic system has marketed systems. Equally, the so

traditional systems of management of village woodlots. The modern intellectual property rights patent protection are tailored to the methodologies of say Allopathy and would reject any claims by

quinine was derived from an age old remedy of Amerindians of Andes and reserpine from tribal of turmeric powder as an antiseptic against wounds an age

as human health or natural forest or pond ecosystems. The "fast" sciences dealing with such complex refuse to give them any real credit or share with them profits of commercial exploitation of

The natural resource management regimes supposedly grounded in "fast" science have contributed uncodified resource management practices grounded in folk science and other folk belief systems.

rapid erosion. This is because these uncodified systems depend for their persistence on continual decisions on the ground, it will not be handed over to the next generation, and thereby be inevitably

contracting for two main reasons. Firstly it is contracting because increasing market links are now animal resources. Thus medicines based on local living resources are giving way to allopathic drugs

service centres are uniformly practitioners of modern allopathic medicine, and the state health

Similarly, folk theatre now uses cheaper synthetic dyes obtained from the market in place of locally therefore tends to disappear. Along with knowledge of uses other knowledge pertaining to phenology,

habitat preferences, behaviour of the organisms involved also tends to disappear.

such wisdom, such as regulation of harvests from village woodlots or protection of sacred groves

rule, with Francis Buchanan, a surgeon of the East India Company recording as early as 1801 that he

claiming its rightful ownership over all the forest resources of the country. Subsequently, the British

-1880 resulted in the very extensive network of the sacred groves

sacred groves nevertheless survived, and by 1970 they were the only good stands of forest surviving

after independence. The result was that in 1972 the Government of Karnataka opened up most of the

have met a similar fate, being poisoned to get rid of the indigenous fish communities, then stocked with

Folk knowledge and wisdom that is thus being eroded through the twin forces of substitution by

still has a great deal of value to offer in a number of contexts :

Modern medical treatment continues to absorb drugs based on traditional Ayurvedic or tribal

relating to an energy enhancing drug derived from a plant _____ . The original clue to

A new drug has also been recently developed from the resin of the plant _____ that can

traditional codified Ayurvedic system. Other useful folk knowledge pertains to sources of vegetable

uses of plant based pesticides such as leaves of _____ .

There is a great deal of detailed uncodified knowledge with tribal and rural communities, on the south Indian forests harbouring wild elephant populations have extensive knowledge of daily rubbed their backs against tree trunks. Similarly nomadic shepherd groups such as Gollas of the dry of plants poisonous to sheep.

-being of people and their livestock on a moment to moment

term perspective. One such management issue is that of regulation of harvest of fruit of _____

emblica

triphalachurna. A group of scientific researchers from Bangalore has been investigating the possible

P. emblica

Mysore district. The local tribal Solligas who have been involved in the harvests have suggested to

the researchers that by focussing on harvesting they are ignoring a more significant factor, namely, effect of forest fires. The Solligas believe that regeneration of P. emblica is favoured by ground fires, which have been controlled by the Forest Department in recent decades. This suggestion appears entirely plausible in view of the high densities of P. emblica in tracts regularly affected by forests fires (Murali, personal communication).

One of us (MG) was engaged by the Ministry of Environment and Forests, Government of India to assess the ongoing changes in the 7 biosphere reserves of the country. One of the rivers of interest in this contexts is Moyar of the Nilgiris Biosphere Reserves with essentially undisturbed riparian vegetation and driftwood along one of its stretches (----N lat and ----- E long). However the river has been affected substantially by the construction of a hydel project upstream of this stretch. There was however no information on the changes in the fish communities of this part of the river with the biosphere reserve authorities, the fisheries department, or any scientific organization. Instead it was noted that Kaliappan, a local fisherman who had been fishing in that river stretch for over two decades had very detailed knowledge of such changes. K.C. Jayaram (pers. comm.), an authority on freshwater fishes of India; confirms that the changes in fish communities as reported by Kaliappan, as well as Kaliappan's interpretations of why these changes have occurred appear entirely plausible. Such folk ecological knowledge is then the only source of information on many facets of ecological change in a society like India. This brings out another relevant point, namely that such ecological knowledge is not traditional ecological knowledge. This knowledge of Kaliappan of ongoing ecological changes was not handed down to him through some tradition; it was acquired by him in the course of his own practice of fishing. It is therefore appropriate to term it practical ecological knowledge rather than traditional ecological knowledge. Such PEK of ecological changes is of considerable relevance in working out location specific adaptive management strategies.

(c) Ecologically prudent practices

A number of ongoing folk practices of restraints on harvests of living resources promote conservation of biological diversity and sustainable use of biological resources. Thus in many south Indian villages the giant fruit bat Pteropus giganteus is not hunted at its large day time roosts, but is trapped at distances of more than a couple of kilometers from the roost. Similarly nesting colonies of storks, pelicans, cormorants may be fully protected, although the same birds may be hunted outside the breeding season. Fish may be totally protected in certain sacred pools along the rivers, but harvested downstream of the pools. There are regimes of regulated harvests from village woodlots and regulated grazing on pastures managed by local communities as well as nomadic herders. Again such practices are not necessarily all traditional, there are newly emergent regimes of strict protection as well as regulation of harvests. Thus in the Pithoragarh district of Uttara Pradesh in Himalayan tracts near India-Nepal-China border, a sacred grove dedicated to ---- was newly established in ---- and continues to be protected effectively. In the eastern Indian state of Orissa a very large number of forest protection committees have started functioning spontaneously over the last 15 years to promote sustainable harvests.

It is then indisputable that practical ecological knowledge and wisdom hold much that continues to be of value in a country like India, and in many other parts of the world as well. It is also clear that there are strong forces leading to an erosion of these important cultural resources in terms of growing significance of market forces and loss of local control over resource base. It seems if difficult, if not impossible to counteract the former. Indeed it is not clear that it is desirable to try and curb greater availability of goods through market channels since most rural and tribal people also seem to welcome these developments. There are however many signs of reservation of community control over resource base, such as the successes of programmes of joint forest management or water users associations as

well as the growing authority of decentralized systems of governance such as Panchayat Raj Institutions in India. Persistence as well as future growth of practical ecological knowledge and wisdom would greatly benefit from these latter developments of empowerment at the grassroots level.

Persistence and continued growth of practical ecological knowledge and is wisdom that is largely uncodified could also be promoted by systematic documentation.

The currently dominant system of "fast" science thrives on well specified, carefully recorded information. One of the grave disadvantages of "slow" science is that its information base is fuzzy, incomplete and fragmented. It is vital that "slow" sciences too develop a proper information base - without such a base they cannot work towards developing a symbiotic relationship with the "fast" sciences, to move towards claiming a proper share of authority in decision making in the management of natural resources and of commercial profits.

Some may view this as a surrender to "fast" sciences. That is not so. The strength of "slow" sciences lies in their enormous store of information of complex natural systems - be they human health or forest or pond ecosystems. That this great store of information is fuzzily defined and poorly organized is a weakness that needs to be overcome for it to claim its rightful place in human affairs. This is the task that the **People's Biodiversity Register** programme attempts to take up.

OBJECTIVES OF THE PBR

The **People's Biodiversity Register** is a programme of organizing information available in the domain of slow science on the status, uses and management of the living resources. This is information with practical ecologists, people who deal with living resources as a part of their daily subsistence

activities - as graziers, as fisherfolk, as basket weavers, etc. It is information with simple folk, who are nevertheless specialists of slow science, such as tribal medicinemen, or expert honey gatherers. The information is almost exclusively orally transmitted. The information may be often guarded as secret, as certain herbal remedies are or may be very widely known - as the use of turmeric as an antiseptic is all over India. This information may be documented in full, or as claims that only partially reveal the information. It needs to be collated, verified, synthesized and made available to the society at large, as well as fed back to the village communities.

The objectives of the programme thus embrace the creation of decentralized countrywide databases on :

- a) Status of biodiversity resources such as populations of medicinal plants, cultivars of fruit trees or freshwater fishes.
- b) Various factors such as harvests from natural populations, changes in agricultural practices or discharge of industrial effluents, affecting the biodiversity resources.
- c) Ongoing involvement of local communities/ individuals in sustainable use and conservation of biodiversity resources, such as systems of regulated grazing on pastures, maintenance of varieties of fruit plants like jackfruit on farm bunds or protection of fish in sacred ponds.
- d) Local knowledge, widely shared and publicly disclosed of properties and uses of biodiversity resources e.g. drought-resistance of a certain cultivar, methods of preservation of food or use of certain plants in treating human or livestock diseases.
- e) Local knowledge only partially disclosed; for instance, a claim that a particular medicine woman knows of a cure for asthma.

The programme is also an attempt to:

- f) Validate the information thus recorded; for instance, through crosschecking with other published

information sources.

g) Create a network of decentralized databases, ultimately linking them to a consolidated national data base which would give full credit to the origin of information at the level of an individual, a community or a village panchayat.

h) Feed pertinent information, such as volume of trade and prices of medicinal plants back to the local communities.

END USES

It is hoped that the creation of such a countrywide decentralized yet networked system of information of slow science stream will serve several important purposes. It will for the first time create a machinery for monitoring the fate of a variety of biodiversity resources, be it medicinal plants, land-races of crops, breeds of regional livestock, or wild relatives of cultivated plants throughout the country. Such information could then form the basis of a strategy for the conservation of these resources.

Such an information system giving full and proper credit to informants would serve to give recognition and encouragement to the practical ecologists everywhere, many of whom are formally uneducated, yet have a deep fund of knowledge about the living world and its human uses.

This would also be a system of properly recording and establishing links amongst the many different strands of more formal systems of slow science, such as the Ayurvedic traditions of Kerala and Western Himalayas or the Siddha medicine of Tamilnadu and the Tibetan medicine of Sikkim.

Such an information system is also essential to begin a process of drawing on a part of the commercial profits made from further development of this broad base of slow science. There could

be several ways of tapping such profits. Biodiversity-based enterprises may be charged some fees for accessing these information bases. They may pay a cess on their sales. Such income may be deposited into a National Biodiversity Fund which may be used to reward individuals, communities or village panchayats for their contributions towards:

- a) Ongoing conservation of biodiversity resources on their private lands/ waters or on public lands/ waters within their jurisdiction.
- b) Recording of practical ecological knowledge.
- c) Recording of more systematized slow science, such as locally available manuscripts on Siddha system of medicine.

Additionally, the information system could help individual entrepreneurs establish contacts with claimants who do not fully disclose their knowledge. The two may then negotiate and decide on equitable sharing of benefits of possible commercial exploitation of such knowledge by entering into an appropriate Information or Material Transfer Agreement.

BENEFIT SHARING

These suggestions involve making important choices in the context of sharing of benefits flowing from commercial exploitation of the biodiversity resource base and knowledge of its uses in the "slow" science stream.

The first choice relates to rewarding for creation and maintenance of biodiversity, particularly in terms of cultivars of crops and land races of livestock, but also through systems such as protection to sacred groves, ponds or individual species. We may either focus on contributions made in the past or

on the ongoing efforts. To assess ongoing contributions is easier; it may be based on recording of current stocks of biodiversity resources through the **People's Biodiversity Registers**. It would help promote in-situ conservation in years to come if we can organize a system of rewards linked to actual performance through yearly monitoring and updating of this information. We favour this alternative rather than get embroiled in the much more complicated task of deciding on past contributions and levels of rewards that they merit.

The second choice relates to rewarding of knowledge of uses. Where this is recorded only as claims, the option is clearly open for individual entrepreneurs to contact the claimants and work out mutually acceptable terms of sharing of benefits. But a vast amount of such knowledge is more widely shared within the community. It would then be very difficult to decide on who should have claims to the benefits to be shared. Nevertheless, such knowledge should surely be put to efficient use and rewarded. We suggest that in this case we should not aim at establishing specific one-to-one links amongst the knowledge and its use. Rather, we should attempt to raise a broad based National Biodiversity Fund from a cess on the whole spectrum of biodiversity based enterprises, whether it be seeds, pharmaceuticals or cosmetics. Proceeds from this fund could then be used to reward recording of knowledge of uses of biodiversity resources as evident from the **People's Biodiversity Registers**.

This may set up a healthy competition amongst various Panchayat bodies in the country to record as much as possible to attract awards. This could in turn promote the growth of biodiversity-based enterprises which would bring in more money to the National Biodiversity Fund.

POSSIBLE PITFALLS

It is important to anticipate two possible dangers in this whole exercise and work out measures to

contain them from the very beginning. These are that the availability of easily accessible data bases may promote:

- a) Over-harvest and depletion of biodiversity resources.
- b) Usurpation of knowledge of uses of biodiversity resources without equitable sharing of benefits.

It is important to point out that both these processes are rampant today. Commercial interests are able to locate resources, e.g. medicinal plant stocks such as *Mappia foetida* of Western Ghat or *Taxus buccata* of Himalayas, and prompt their overexploitation. But in the total absence of organized information we are unable to monitor these trends. The information on stocks of biodiversity resources contained in the **PBR** would facilitate such monitoring and institution of measures to check them.

Furthermore, linking the stocks of biodiversity resources to rewards for ongoing contributions to conservation could create an effective stake for local communities to participate in programmes of conservation.

Similarly, for centuries the larger society has absorbed information on uses of biodiversity from the local communities and applied it with no thoughts of benefit sharing. After all Ayurveda itself is in part a synthesis of older tribal traditions. A great deal of such information has been recorded in a series of publications beginning with Watt's **Wealth of India** series of 19th century, going on to today's computerized data base called Napralert housed in Chicago. Modern pharmaceutical enterprises or seed companies also have their own on-going programmes of acquiring such information.

But in none of these is due credit given to the individuals/ communities/ panchayats making available such information. Assignment of such credit requires proper documentation and only a

programme like the PBR could create such a documentation. Of course we must supplement the documentation with legal provisions to properly direct the sharing of benefits. Nevertheless, there is no likelihood of any proper sharing of benefits ever taking off in the absence of good documentation.

To reiterate, the exercise of documentation in itself would be an important boost to the whole stock of knowledge and wisdom residing today with the practical ecologists and other practitioners of slow science. But the full benefits of the information system would flow only when this is complemented by a system of open, public participation in conservation efforts and a just sharing of benefits flowing from biodiversity-based enterprises.

METHODOLOGY

In each of the six states and one union territory 6 to 9 sites were selected for study to represent different ecoclimatological zones of the state or the union territory (Fig. 1). The overall effort is being coordinated through the Centre for Ecological Sciences, Indian Institute of Science, Bangalore under the guidance of the National Steering Committee of the Biodiversity Conservation Prioritisation Project.

The selection and study of village sites in each state was entrusted to a nodal agency - either an NGO or an educational institution - with a strong network over the state.

The field work involved surveys at the village level to gain a broad appreciation of the lifescape and peopescap of the study site. The population of each village/ village cluster was classified into user groups. Each user group was identified on the basis of distinctive socio-economic features, specially some characteristic relationship with biodiversity. Thus, user groups such as fishermen, big

landlords, NTFP collectors, labourers, artisans etc emerged. Perceptions of members of each user group on biodiversity, its utilization in the past and the present and their management options were recorded. Special attention was paid to the views of women and children. We also recorded the reactions of stakeholders from outside such as traders, migrants and forest officials. The emerging conflicts and consensus among different sections of society were noted and used as an input for proposing a rational conservation strategy.

The project teams typically consisted of 6-8 members headed by a Principal Investigator, usually a college teacher or an NGO official. The teams normally included one or more members familiar with study area, local dialect etc. In some cases, sites covered under previous studies by the NGO were taken up as BCPP sites. After an initial rapport building phase (wherever required) a series of group discussions, individual interviews and landscape mapping exercises were conducted. The observations and findings were then compiled into a comprehensive document - the People's Biodiversity Register. These registers will be the basis of the respective state reports and finally, a National Report.

The overall methodology was laid down in a detailed methodology manual titled 'Srustigyaan' developed by the Centre for Ecological Sciences, Indian Institute of Science, Bangalore.

MAJOR FINDINGS

In this section, we present the major findings of the study organized under heads consistent with the methodology adopted. The study sites differ widely with respect to ecological conditions and corresponding man-nature relations. We shall attempt to highlight the distinguishable common

elements of ecological relationships as well as those which show marked variation amongst the study site.

Peoplescape

The unit of analysis throughout has been 'user groups' defined in terms of the nature of use of (and corresponding relation with) biological resources by a group of individuals or a community. This category is more appropriate in our context than 'occupation' since an individual may use biological resources in more than one way and hence be a part of more than one user group. A user group thus relates to a functional relationship.

Biodiversity Relations across user groups:

By definition, different user-groups have different kinds of relationships with biodiversity. User groups who must depend on biological resources solely or largely for sustenance will have a relatively closer relation with biodiversity. Communities which are tribal in nature and who form a primary user group of forest products have stronger physical and cultural links with the forest as compared to communities or groups who have taken up elements of a modern lifestyle. There is a resultant variation in conservation perceptions across user groups.

It is important to understand these sectorial differences in conservation perceptions to develop a rational planning strategy. Thus, planning should be sensitive to the varying relationships of groups of people with elements of biodiversity.

Diversity of user groups and urbanization:

Diversity of user groups generally increases with increased urbanization. In a pre-urban stage of community development, people living in relatively closed societies had to depend for livelihood on a smaller number of activities and were largely primary users of biodiversity. As societies get urbanized, newer user groups such as traders emerge. The remote Karivokkaliga hamlet near Sirsi (Karnataka) or the Gramon village near Thaltokhod (H. P.) have a small number of households (around 30) all leading similar lifestyles. On the other hand, the more urbanized Kumta site (a coastal zone) in Karnataka or the Rangpur site in Rajasthan (riparian forests) have a variety of user groups with different relationships with biodiversity and with diverse cultural traditions.

Larger the distance of a community - physical and cultural - from urbanized society, the greater is the dependence of the community on biodiversity. In remote villages like Gramon, the physical separation (due to general inaccessibility) from the nearest town Jogindernagar results in near total dependence on the resources of the forests. The same can be said generally for places where transport and communication links are less developed so that a village community must live in relative isolation.

User groups and caste structure:

There is a broad correspondence between user groups on the one hand and caste, gender and socio-economic strata on the other. Certain clans traditionally possess expertise in specific activities. For instance, members of the Ujla clan in Kadamsul and adjoining villages in the buffer area of Simlipal Tiger Reserve are considered experts in the collection of NTFPs like honey, wax and some medicinal herbs. Throughout the Western Ghats area, ladies of landless households typically constitute

the firewood collector user group.

Lifescape

Different biodiversity elements predominate in different habitats and patches. In other words, distribution of biodiversity across the landscape is not uniform. The most species rich patches are not necessarily the ones with the most utilized species. A rich evergreen forest, for example, may be more species rich than a thorny scrub forest but the latter may possess more utilized species (e.g. firewood). Again, conservation priorities ascribed by different user groups to each patch may differ.

Knowledge of economic uses of biological resources generally follows a skewed distribution. While a few local people possess a wealth of knowledge about a large number of species of plants and animals, those who do not depend upon biodiversity for their sustenance typically show little concern. Moreover, traditional wisdom with regard to resource use seems to be eroding, particularly as people are shifting from herbal medicines to modern allopathic drugs. In most sites in Karnataka, valuable information about medicinal usage could be recorded for twenty to more than one hundred and fifty plants. A knowledgeable individual in one such Karnataka site, Karkala was recently hired by a pharmaceutical company for collecting and describing uses of medicinal plants.

Ecological History

Major trends observed in ecological history of the sites are summarized below:

(a) Cycles of destruction and revival of natural resources have repeatedly occurred in history. But the intensity of such cycles has gone up almost everywhere. For instance, the practice of shifting cultivation and reclamation in the Western Ghats region was a destruction-revival cycle of lower

magnitude than the present day landscape changes due to industrial activities (as in Dariaghat in Himachal Pradesh where mining activity is causing major ecological damage) and corresponding efforts at large scale afforestation, usually of the compensatory kind.

(b) Landscape changes in the past were spatially more diffuse due to absence of a strict property rights regime. Such changes have tended to have more defined boundaries as the property rights system has changed. Thus as the distinction between what constitutes private and public domain becomes clearer (say by creation of a protected area), possibilities of landscape changes (destruction/ revival) are spatially better defined.

(c) There is a marked shift from subsistence to commercial uses of biological resources. Emergence of a secondary user group of bioresources - the local contractors - has been a general phenomenon. The primary users, who in the past had a subsistence dependence type relationship with the forest, are presently labourers employed by some contractors for the job of collection and are paid a subsistence wage. The relationship between the collectors and the contractors is one of dependency since contractors regularly provide advances to the collectors to meet their subsistence requirements.

(d) In the past, the local community generally had greater access to local resources. It has been reported, for example, in Simlipal, that prior to 1947, the access rights to the forest were vested exclusively with the local community even though the property belonged to the king. In the post-independence period, the ownership was passed on to the Forest Department and restrictions were imposed on the collection of different NTFPs giving rise to a feeling of alienation in the tribal community. The utilization policies of the state have tended to favour contractors, who engage local people in collection jobs. Control of the resources has thus passed onto the government and thence to the contractors from the local community.

(e) State policies have gradually evolved from an exploitative kind to one with a protection

orientation. However, both have adverse consequences for the local people in that people's rights over local resources are curtailed either way. In the 30's, a people's conservation movement in the Hazaribag area of Bihar resulted in retention of a patch of land which otherwise would have been exploited for short term revenue generation by the British government. Present day conservation movements (Chipko, for example) are also a protest against an anti-people utilization/ protection regime.

(f) Biodiversity based activities, which are basically primary use activities, earn low returns (equivalent to subsistence incomes) even though the resources are commercially utilized and are of high value. Further, with increasing proximity to the external markets and availability of alternative occupations, dependence on biodiversity elements has gone down, resulting in a concomitant fall in conservation stakes for the local people.

(g) State forest policies which restrict people's access to forests have generally failed to check commercial onslaughts on forest area. The mining activities at Darlaghat in Himachal Pradesh and Kudremukh in Karnataka are prime examples.

Management Options

In this section, we put down the various management options for biodiversity conservation, as voiced by the people who ought to be the prime stakeholders in any conservation strategy.

Conservation cannot be synonymous with protection, but rather should be a balance between protective-regulatory measures and sustainable economic utilization. Prudent use of biological resources must be the primary motivation of any management regime. People in the Dalma area of Bihar, for example, expressed the need for protection with sustainable extraction (for subsistence) of

harre, bamboo, sabai grass etc as they are aware of absence of these species in regenerated forest.

The need for cooperative marketing and biodiversity based enterprises (for local value addition of biological resources) was felt by several local communities. For example, in the Gramon site in Himachal Pradesh, people showed willingness to organize a marketing cooperative to link with the intermediate trader at Tikkan if not with the final market at Amritsar. The final market price for some dominant products, is sometimes thrice the collector level price (e.g. products like Banafsa, Muskwala and Brahmi). Local value addition, although an attractive proposition is generally cost-prohibitive and consequently uncompetitive with commercial alternatives. However, a near perfect example of such value addition - manufacture of pickles and chutney by local women's groups - based on wild mango and amla can be found in the Dhathi-Bairghatta village cluster in Changar valley in Himachal Pradesh.

The need for community based property rights and a mechanism for implementation of the rights was expressed. Rights over a resource necessarily includes the right to exclusion of outsiders. For example, bamboo - the crucial bioresource of the Rani Garbhanga area in Assam is indiscriminately collected by an adjoining paper mill. So villagers are required to go to the centre of the forest to collect bamboo.

The issue of economic incentives elicited varying suggestions which are not mutually exclusive like collection fees, cash awards and village level grants etc. People also expressed an appreciation of social recognition. In Karkala, NTFP worth Rs. 5 lakhs is extracted annually from panchayat boundaries which benefits labourers, contractors, the Forest Department and the LAMPS but not the village as a whole, despite some of it being collected from public land. A small tax of 5%, say collected from traders could generate much needed funds for development purposes, which may benefit sections of society who are not direct users of biodiversity. This could greatly enhance general

conservation stakes. Cash awards for conservation efforts - to an individual or even a community - was considered a viable economic incentive although operating such a system may be difficult. Development grants linked to conservation efforts and based on careful scrutiny is a further option. We may note that currently the Forest Department does have an ad hoc cash reward system for control of forest fires.

Panchayat committees representing various user groups - the biodiversity stakeholders in a village - was favoured at many places like Kigga near Sringeri in Karnataka. The committee, rather than just some outsiders or only a few people in power, could then be responsible for planning for management of local biodiversity. NGO interventions in terms of technical and financial inputs were welcomed. However, the issue of the extent of long term continuance of NGO support and its possible ultimate withdrawal did not receive a clear response.

Development Aspirations

We made an attempt to understand the linkages between development needs and biodiversity conservation. To this end, we explored the development aspirations - social and personal - and their positive and negative impacts on biodiversity. Biodiversity use is typically a low economic return activity at the primary user level and hence its conservation is assigned a low priority in the general world-view of villagers. The impact of development interventions on biodiversity was also studied as a related issue.

Everpresent pursuit of personal and social development seems to dominate over a conservation ethos. The developmental activities which the typical villager of Amla (Rajasthan) for example, wants to be undertaken are construction of pucca houses, provision of electricity, establishment of a school and a health centre, construction of a community well and so on.

There is a trade-off between short term benefits out of overuse or neglect of biodiversity and the long term security provided by persistence of biodiversity. The environmental costs of biodiversity loss are largely intangible and do not figure in the agenda of concern of the villagers exposed to multifarious external (market) forces.

The response to resource scarcity due to overexploitation is also varied. Whereas, in the Dhani site in Orissa, people have taken a conservationist stance by protecting the forest through a Forest Protection Committee, the migrant community of Baran in Rajasthan, denied of their firewood needs due to illicit felling, shifted to alternative occupations (usually as labourers) outside the village.

Restraint on development or more careful selection of alternative development paths would be feasible, if conservation generates use and non-use values. These values may be social/ cultural (as with sacred elements) or monetary (as when destroying a forest for road construction leads to fall in water supply from a tank for a nearby agricultural field).

Generally speaking, a development activity which leads to destruction of nature will lead to resource scarcity which in turn may either lead to conservation efforts or to further overuse and depletion.

Conflicts and Consensus

Different user and non-user groups are apt to have different kinds of relationships with elements of biodiversity. This may lead to social conflicts, while at the same time, there may be some prevailing consensus on conservation issues. Indeed, conflicts and consensus are endemic to (relatively) closed social systems where it is difficult for any individual (or group) to migrate.

The options given by different user groups for managing biodiversity highlighted some

disagreement and a few commonalities and so did the development aspirations and their relation with biodiversity. For example, in the Subramanaya site in Karnataka, most sections in the village talked in favour of biodiversity conservation, one reason for this being the awareness built by educationists in the area. The social differences such as those of caste or occupation did not significantly affect this dominant social perception. The situation is quite different in many other study sites. In Kigga near Sringeri, for example, the NTFP collectors who were locals wished to use biodiversity sustainably and wanted to have greater information on the market. They wished to regularize this extraction and trade through a panchayat appointed committee and monitored by a local school or college teacher. The NTFP contractor - an outsider with political linkages was averse to any such plans as it might lessen his control and profits. In Neeralekoppa village near Bhadravathi, many NTFP collectors are migrant labourers but the panchayat Sarpanch - a local - is the contractor. He favours panchayat level empowerment which may increase his personal stake.

Another kind of conflict is that between members of a local community and outsiders. For example, in Amla village in Rajasthan, the farmers feel that illicit felling and unregulated grazing by outsiders is one of the most important reasons for depletion of high value timber species in the area. Further, the villagers feel that forest officials are unresponsive towards the needs of the villagers, alleging that while the forest officials stop them from meeting their genuine requirements, they do not check the outsiders who carry out large scale well organized illicit felling in the forest area. The forest officials, on the other hand, claim that the illicit felling is being carried out with the collusion of local villagers.

It seems that there is a need for the local leadership to bring to the fore various conservation issues and play a role in conflict resolution and building upon consensus. An interesting example would be the offer of the shepherd community in C. K. Pura village in Pavgada taluk of Karnataka to work in agricultural fields for a specific period in return of the right to graze their cattle on the bunds of

agricultural fields. This agreement was actually brought about by BCPP investigators who played the leadership role. It is important that there is an effective dialogue across conflicting user groups and relevant issues are resolved as a part of the local political agenda.

CONCLUSIONS

The attempt to develop the People's Biodiversity REgisters have not met with very positive response from the investigators from the education institutions as well as voluntary sector, and from the members of village communities. They have generated a great deal of useful information and insights which seem relevant to local level adoptive management of natural, especially living resources. There are a number of trends in India, as well as in other parts of the world to institute such systems of local level adaptive management, and the PBRs could be very useful instruments to facilitate them. The other important objective of the PBR exercise pertains to recording knowledge, especially that pertaining to possible commercial uses of living resources to facilitate sharing of benefits with holders of such knowledge. This is more difficult to accomplish, and there has been relatively little progress in developing an appropriate legal and institutional framework for this purpose in India, or any other part of the world. It is to be hoped that development of PBRs would help encourage such developments.

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