

Annexure 5

Biodiversity in Environment Impact Assessment (EIA)

Devaki Panini
Independent Consultant, New Delhi

Background

The relevance of Environment Impact Assessment (EIA) has grown in the present day with rapid industrial growth and the spate of development projects coming up in ecologically fragile areas. Areas that are valuable repositories of biological diversity are fast disappearing with rapid industrialization thus intensifying the conflict between competing interests of development and conserving the environment. As this conflict deepens, it becomes imperative to find appropriate legal mechanisms, instruments and strategies to control and restrict industrial pollution and preserve areas that are the last remaining storehouses of biological diversity. In this context, it is alarming that there are very few legal mechanisms available for restricting environmental degradation and industrial pollution. It is also disconcerting that there are very few legal instruments that actually prescribe undertaking positive measures for conservation of biological diversity.

The Environment Impact Assessment Notification, 1994 (hereinafter the EIA Notification) is one of the few regulatory mechanisms through which environmentally unsustainable development projects can be modified or checked and industries responsible for environmental offences can be brought to book.

The Central Government's Ministry of Environment and Forests passed a notification way back in 1994 making Environment Impact Assessment a mandatory requirement for granting clearance for expansion and modernization of any existing industry and undertaking any new development projects. This notification was passed under clause (a) of sub-rule 3 of Rule 5 of the Environment (Protection) Rules and ensures that clearance would only be given to industries and development projects that undertake environment impact assessment. Further failure to comply with the requirements of an EIA attracts penal measures although non-compliance with the EIA procedure is seldom acted upon. However the procedure for EIA is hardly foolproof and most often industries manage to bypass the requirements of an EIA with impunity. Even where industries have complied with the EIA procedure this is done with as a mere formality. In many cases industries have conducted an EIA as an afterthought, long after they have been established. It is glaring that the Ministry of Environment and Forests has allowed several hastily produced, shoddy and inaccurate EIAs. A recent example of the blatant misuse of an EIA was highlighted when an EIA prepared by a leading consulting firm for a certain project was brazenly used by the Ministry of Environment and Forests to grant clearance for another proposed project. In fact in several cases, the EIA procedure has been cleverly used by industries to actually acquire an environment friendly image despite the fact that they are notorious for large-scale pollution and degradation of the environment. The Executive on its part has been unable to strictly enforce provisions of environmental statutes and has specifically failed to rigorously implement provisions of the EIA notification. Thus in most cases industries and the government agencies pay mere lip service to the provisions of the Environment Impact Assessment Notification of 1994. This can be largely attributed to a lack of political will to enforce strict conservation measures in a developing country such as India as it is felt that strict enforcement of environmental laws and regulations (such as the EIA notification) would stymie economic growth. Additionally, most of our environmental laws are replete with loopholes thus allowing ample room for manipulation to accommodate the vested interests of the private industrialists.

The main objective of this sub-thematic paper would be to examine the inherent flaws in the EIA procedure and specifically highlight the defects in the EIA notification with reference to conservation of biological diversity. While bringing out the apparent shortcomings of the notification, the paper would hope to provide constructive suggestions for making the EIA notification a more effective and legally sound instrument for enabling conservation of biological diversity.

Community Conserved Areas (CCAs) in Gujarat

Srinivas Mudrakartha and Prahlad Chalageri
VIKISAT, Ahmedabad

Gujarat is a state blessed with a variety of Community Conserved Areas (CCA) such as forests, community agriculture, coastlands, grasslands and wastelands and domestic species. The key objective of community resource management has had been to support, manage and sustain its own livelihood systems, at individual, community and society levels. People also attempted to conserve, protect and develop the natural resources for ensuring its continued availability to the posterity too. However, anthropocentric development has led to hastening the process of degradation of the environment. Nevertheless, examples of community participation in natural resource conservation continue to exist. Unlike the current style of policing approach of administration, CCAs do strongly believe and practise the self imposed rules and structures within the framework of sustainability. Strengthening/supporting such community efforts stands a fair chance of bringing about a positive change to meet the growing demands.

The present study is an effort to document examples of CCA across different ecological regions and species covering the changing scenario of administration, economic conditions, competition for natural resources and development and, the legal and political aspects. The following category of CCA is explained below with some prominent/representative case studies from different parts of the state that comprise Sacred groves and species in the tribal belts, Gauchara, Goshaalas, Chabutara and community agriculture by religious communities, vidis of Banni area, and the modern day version of the community management practices like JFM and Wasteland Development Programme.

The case studies are no by means complete or exhaustive, but are only indicative of the efforts of the community. It is also recommended that an in-depth study may be carried out for a holistic and synoptic understanding of the CCAs.

Sacred groves

There has been no systematic study carried out in Gujarat on Sacred Groves. This is an attempt in that direction. On the part of the State Forest Department, there does not seem to be a clear management strategy. Chusan pir from Marine National Park is a unique example of a conservation effort by the Badela, Sanghar and Vadher communities of an entire island of mangrove vegetation which is also a breeding ground for many birds for the past 300 years. Again, studies from N-Gujarat indicate that remoteness plays a key role in preserving species composition, density and natural regeneration, whereby its value and virginity are intact. Socio-cultural benefits and spiritual attachments are factors of prime significance for a community. Intangibles such as social functions, occasional religious ceremonies keep the community's interest alive and faith going.

The sites managed under formal committees have ownership records while the rest not so hence found conflicts. Deforestation, modernization and drought are influencing the traditional practice and respect towards sacred groves.

Finally, proper identification and creation of sacred groves, their ecological role, mass awareness and creating livelihood opportunities to the community and setting priorities for research need to be given a fillip for conservation efforts.

Grassland

Community based experience of Banni is one of Asia's expanses of grasslands shows satisfactory results regarding reclamation, production and equitable use of the common property resources. The cooperative management system resulted not only in robust grass production but also improvement in its quality, in addition to enhancing drought resilience of the community.

Mangroves

The Neja case study is yet another example of community effort in conserving its village mangroves. The community initiated action 20 years ago when conflict arose with nomads who started exploiting the mangroves heavily for fodder.

The community also took up appropriate soil and water conservation measures, cultivation of salt resistant species which has checked ingress of salinity and solved drinking water problem.

Community Agriculture

A leading religious group supports community agriculture activities in Yogeswar Krishi, Sridarshanam and Vriksha Mandir. This is an example of non - conventional modern practice of community initiative for sustained development.

While Yogeswar Krishi is a small-scale community agriculture practice at village level, Sri Darshanam is a similar practice covering 20-25 villages carrying out common farming. In both the cases, the village as a unit takes care of protection. The initiative helps to gather and exchange skills aiming at socio-economic and cultural - spiritual equity.

The farming practice generally includes the use of local and indigenous species thereby ensuring agro biodiversity in balance. There is scope to re-cultivate the abandoned wild crops by interaction with these groups.

The concept of Vriksha Mandir is similar to sacred grooves. It inspires people to cultivate sacred attitude leading to develop and conserve sites.

Matsya Gandha is a similar voluntary practice, where coastal community provides both personal service and their boats for fishing. The activity is restricted to 220 days in a year. Although the activity does not directly aim at biodiversity conservation, it has an indirect impact. The subsistence collections and consumption pattern checks excessive harvest. The practice of the fisherfolk abstaining from fishing activity for 140 days in a year has helped regeneration of aquatic life.

Joint Forest Management (JFM)

Gujarat has been considered a pioneering state in India in the context of JFM. It was among the first few states to have implemented the GOI Resolution of June 1990. It was also among the first few to set up a broad based state level working group with senior forest officers, NGOs representatives, academicians and individuals in NRM as members. Currently people's forum like SAKSHAM (Sanghatana Kshamata Manch) a state level Federations are footing ahead in NRM. Starting with three to four villages and a few hectares, Joint Forest Management (JFM) today encompasses more than 1300 villages and covers over 1,75,000 hectares in Gujarat.

Community Interest in Animal feeding and Care Taking

The following community management practices have religious influences, where an idea emphasizes the sensitivity to have the rights of other non-human living beings to co-exist with us, even in a drought year. The cultural donations from individuals from and outside the village as well as voluntary donations sustain the activities in the above types of conservation efforts. Following are the particulars in brief.

Gauchara

The gauchara institution has played an important role in ensuring maintenance of cows in a harsh environment with low and uncertain rainfall in many parts of Saurashtra. An indigenous institution for community care of cows - the Gauchara system- exists. According to certain elders of the Ahir community, the essentials of the form in which the Gauchara is practised today dates back at least three hundred years. The system is believed to have been created in response to the frequent droughts in the area and the shortages of fodder during the dry season.

Chabutara

Chabutara (a platform) is an institution that focuses on feeding birds particularly during food scarce seasons. The chabutara is a small, 10-12 ft high platform constructed with bricks with an open pan on the top where grains are kept. This practice is managed in some villages by nature loving individuals while in others by the communities.

The frequency of visits of common and rare birds increases during late-summer months and monsoon (May to August) when an alternative source of grains in the fields becomes scarce. One way this helps farmers in controlling pests through their natural predators. Reviving the spirit and norms of one of their oldest institutions and also provide drinking water facility near the chabutara after learning from the experiences of others are required.

Community Conserved Special Species: Mahuda, Guggal and Deva chikaliya.

For the last 35 years, people of Dhandasana and Kanadara village have been traditionally following the practice of collecting the flowers of Mahuda (*Madhuca indica*) on a community basis. The flowers and fruits are assembled at a place. Later, small packs are prepared out of these against the names of the right holders/members that are maintained in a register. This case exemplifies unique contributions of local communities under the able local leadership towards protection of trees and sharing of fruits and flowers, equitably.

Some communities have respect towards the species guggal who have made it obligatory and mandatory to plant its stump during marriage ceremony. Later, during monsoon they plant it in their farms or in open places. This practice facilitated the species to prosper.

It is a general belief among adivasis of Bhiloda taluka that catching and releasing of the bird Deva chikaliya (Indian Robin), particularly on the day of Uttarayana (January 14) is significant in forecasting monsoon. This way the species has more attention and care.

To conclude, it is imperative to encourage the community based initiatives to conserve biodiverse areas, a status on par with other natural heritage sites such as the national parks, reserved forests and water sanctuaries. Precaution should be taken to retain the sites' uniqueness and traditional values for better future. A further detailed, in-depth research study may achieve this objective.

Community Based Monitoring

Kamaljit S. Bawa

Ashoka Trust for Ecology and Environment, Bangalore

Current conservation measures usually focus on the establishment of protected areas, national parks, wildlife sanctuaries, marine sanctuaries, and reserves. These conservation areas are often planned, developed, and implemented by the national or state government. However, in a country like India, millions of people live in or near protected areas and depend upon goods from natural ecosystems to sustain their livelihoods. In many protected areas, people have usufruct rights to collect a wide variety of ecosystem products. In other areas people have customary rights to collect forest produce. Often these rights are not explicitly recognized in the written laws of the country, but are observed habitually, almost without conscious thought, by local people accustomed to exercising such use rights. Authorities who do not recognize or accept these rights frequently come into conflict with local communities, which often have little say in management of natural resources. Thus, an antagonistic relationship often arises between local residents and the state agencies that manage protected areas. Successful conservation strategies in India must include people as the key partners in conservation decisions, thereby turning the current antagonistic relationship between the people and the protected areas to one of mutual support. Thus, a major challenge for conservation professionals in India is to develop strategies that enhance the livelihoods of the millions of people who rely on ecosystems for sustenance while simultaneously conserving biological diversity.

Community based conservation (CBC) is a strategy in which local communities play a key role in the decision-making for conservation and management of biodiversity (Kothari et al., 2000). CBC has had a long, uninterrupted history in many parts of the world. In much of India, however, mechanisms of local resource management were undermined or eliminated when regional or national government expropriated community lands to meet the growing demands of industry and the expanding colonial empire. These lands were later placed under the authority of non-community-based conservation entities, which has led to disenfranchisement of local communities.

The rationale for restoring CBC is quite simple: CBC makes the most effective use of human resources in a given locale while eliminating, or at least reducing, some of the obstacles to successful conservation. The human resources-e.g., local residents, especially the older ones whose memory and experience extends back decades-are invaluable for their tremendous knowledge about the structure and ecological process of the local ecosystems, gleaned from years of continually adjusting and adapting to their surroundings. This knowledge offers them opportunities to play an important role in conservation (Kothari et al., 2000). The role of communities in conservation may range from simple consultation about conservation and management to complete control over formulation and implementation of all conservation decisions.

This document first outlines the requirements and mechanisms for the involvement of local people and organizations in conservation, then describes the processes involved in community based conservation and, finally explores the limitations of this approach to conservation.

Requirements for Success in Community-Based Monitoring

There are many requirements for community-based monitoring to be successful. These include tenure and resource rights, community empowerment, benefit sharing, equity in the distribution of benefits, traditional knowledge, institutions and state policies.

Tenure and Resource Rights

Secure tenure over resources is critical to the success of conservation programs. Uncertain tenure discourages local people from investing in land and promotes exploitation of resources in the surrounding areas; if they are not assured that these resources will be available to them in the future, people are inclined to take as much as they can get in the short term. Therefore, it is necessary to secure tenure and resource rights for those people living in or relying on protected areas. Community-based conservation also requires clear definitions of resource rights (see Stevens, 1998).

Community Empowerment

Local communities have historically managed the resources in their surrounding ecosystems. As the state's power increased, it

gradually took away control over resources, disenfranchising local communities. State agencies not only need to encourage local people to participate in management of local resources, but also need to appropriately equip communities so they can act as stewards of natural ecosystems. Without political and economic power and without acquisition of skills, local communities cannot play an effective role in developing and implementing management plans.

Benefit Sharing

Costs and benefits of conservation vary considerably across spatial scales and are often inequitably distributed among different societies or states. Benefits, in general, may be widely dispersed and costs highly localised. Conservation strategies must reduce the costs for people living inside or around natural ecosystems, and at the same time, spread costs to others that also benefit from ecosystem goods and service but do not pay the real costs. At the same time, communities must share benefits from conservation of ecosystems good and services.

Equity in Distributions of Benefits

Benefits must percolate through the community for community-based conservation to succeed. Communities are not homogeneous, particularly in India, where differences in economic interests due to ethnicity, religion, caste, gender and economic power create unusual heterogeneity, resulting in inequity and conflict. Inequities must be removed within communities and among neighboring communities that access the same resources. Often inter-community inequities may overshadow differences among communities. Therefore, inequities with a community and between communities must be addressed.

Traditional Knowledge

An important factor that can influence the success of community-based management is traditional knowledge. People have managed and conserved ecosystem resources for millennia. Thus, local people have considerable knowledge about their surrounding ecosystem ranging from the distribution and uses of plants and animals and their functional role in ecosystems to ecosystem processes. Local communities use traditional knowledge to manage the surrounding ecosystems and to ensure continuous flow of goods and services.

Institutions

Institutions refer to two main groups of organizations. The first group includes clearly defined organizations such as government agencies, non-government organizations or voluntary organizations and elected or appointed bodies that regulate or govern management and conservation of resources. The second group includes customs, practices, and sets of rules that regulate behavior of individuals within a particular group-some of which may not be apparent to non-community members. Strong, representative institutions with an ability to monitor natural resources and regulate access to resources are critical to the success of CBC.

State Policies

Policies conducive to participation of local communities are necessary to ensure success in community-based conservation. The state policies in India have progressively moved towards an increasing role of local communities in managing forest resources. Recent guidelines on forest management issued by the Government of India seek to further strengthen the role of communities in joint forest management by emphasizing the need a) to accord legal status to village first protection committees, b) to support the participation of women in forest protection committees, c) to extend forest first management to non-degraded areas, and d) to increase the benefits of restoration and conservation to local communities.

Processes Involved in Community Based Conservation

Community based conservation and associated monitoring may be viewed as a process that seeks to change institutional relationships in natural resource management by drawing various stakeholders together to make decisions. CBC can also be viewed as a mechanism for social and economic change in local communities that are dependent upon local resources for their livelihoods. Empowerment of local communities which can only occur through transfer of power and reallocation of resources among existing institutions and groups, mutual respect and recognition of alternate and diverse knowledge systems, and capacity building of local communities are some of the few, but important ingredients of successful community-based conservation efforts. Although various steps involved in community-based monitoring will differ from one situation to another, some common and essential steps may be outlined as follows:

Bringing Stakeholders Together

The first step in community-based conservation is to unite efforts between government organizations, community institutions, leaders, groups and other stakeholders through a forum or meeting. This may be organized by any of the stakeholders, including the non-government organizations. The meeting of the stakeholders should lead to the formation of a governance structure that will have the mandate of identifying drivers of the system, such as grazing, poaching, fire, overharvesting; designing interventions

to confer resilience on the system; and ensuring the implementation and monitoring of management plans. A range of institutions can be involved in community-based management, but the essential executive functions should rest with the representatives of the local communities that often have a good knowledge of the drivers and reasonable perceptions of the needed interventions.

Linkages Among Institutions

A critical aspect to successful community-based management is the establishment of links between the various grass root organizations involved with natural resource management at both local and large scales. Although there are village level institutions that regulate the use of resources by local communities, such as grazing, collection of fuel, wood and other non-timber forest products, such institutions do not have the mandate to regulate mining, water resources, and developmental activities except at the village level. Thus, the existing institutions must be reconfigured to undertake new functions and the linking of appropriate institutions must be explored. Institutions responsible for managing natural resources in turn must be linked with democratically elected political institutions, such as the village level panchayats. Ecological processes occur at a much larger spatial scale than that over which local ecosystems are distributed. Thus, nested structures are required to manage natural resources.

Information and Resources

The transfer of management functions to village level institutions has to be accompanied by provision of information and transfer of resources and skills. Currently, information and resources, skills are largely with state agencies. Without transfer and enhancement of these resources and skills, village level institutions will only have a limited capability to manage resources.

Monitoring and Evaluation

Monitoring and evaluation are critical to the success of community-based conservation programs. Moreover, monitoring provides opportunities for local people to develop skills and helps build social capital in the community. Monitoring can be conducted either exclusively by the community or it can involve other stakeholders. Monitoring should involve not only ecological parameters, but also social and economic parameters. Monitoring protocols must be clearly outlined and flexible as in any adaptive management plan. Data and information gained from monitoring should be clearly documented, shared among all stakeholders, and used for future decisions.

Social and Human Capital

Community-based conservation and monitoring in the large context enhances the power of local communities to manage their natural resources. Development of human and social capital results in part from the strengthening of institutions and transfer of power and resources from the state to local communities resulting in improved health, education, gender and social equity. This development is critical to the upgrading of ability and skills of members within the community. Thus, community-based management has to be viewed as an integrated approach towards meeting contemporary environmental and development challenges through human development.

Limitations of Community-Based Approaches

Community-based approaches have several limitations that must be overcome if the communities want to play an effective role in conserving and managing biodiversity.

The first limitation is that communities are interested mainly in resources that sustain their livelihoods. These communities extract and manage species that are of sustenance and commercial value. It is in the interest of the community to manage their surroundings in such a way that it promotes the increased availability of valuable species, which in some cases could help non-commercial species but could also be harmful to them. Thus, community managed ecosystems-like other managed ecosystems-are not likely to have all components of biodiversity. Moreover, such ecosystems occur as relatively small patches and cannot sustain ecological and evolutionary processes essential for long-term maintenance of biodiversity unless the managed ecosystems have a certain degree of connectivity. Ecosystem services in community managed ecosystems can be disrupted. For example, the removal of large amounts of biomass-for example, hunting and killing large numbers of large mammals, or cutting down the biggest trees-can impact animal populations as well as nutrient dynamics in the soil resulting in the loss of resources for village communities. However, communities can also restore damaged ecosystems as in the case of joint forest management areas.

The scale at which local communities manage ecosystems imposes a second limitation. Ecological and evolutionary processes and ecosystem functions, such as pollination and seed dispersal, occur over scales at which local committees manage ecosystems. This is particularly the case in densely populated areas. Relatively small ecosystems are likely to have disrupted food webs. Further, the boundaries of watersheds may not follow the boundaries of areas managed by local groups, leaving local groups with no control over upstream and downstream processes. Such control can be achieved through the establishment of a hierarchical management structure that operates at different scales. The local community institutions must necessarily constitute the basic element of this structure.

Finally, community level institutions lack means to impose their will on or resist pressures from outsiders. With increasing globalization, such pressures are likely to increase. If communities cannot counter pressures from neighboring groups, they are also likely to be subjugated by more powerful global forces.

Conclusions

In a heavily populated country like India where millions of people rely on biological resources for their subsistence, it is imperative that local communities actively participate in conserving, managing and restoring biodiversity. Both the policy framework and institutional mechanisms exist to involve local communities in conservation. Indeed the local communities are active partners in joint forest management programs. The effectiveness of such programs will depend upon the extent to which they meet the conditions and requirements of CBC. Furthermore such programs need to be extended to other areas.

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Ecological Impacts of NTFP Collection in West Bengal

Ghazala Shahbuddin
Independent Consultant, New Delhi

Under the Joint Forest Management (JFM) programme in south-western West Bengal, sal-dominated deciduous forests are being managed for the extraction of numerous plant products, both for commercial benefits and subsistence-level use, on a large scale. Over the last century or more, a majority of the sal forests have been managed as coppice stands, that is, repeatedly cut every few years for their branches and poles which are in demand for scaffolding. The forests of this region also undergo a variety of other extraction and management processes throughout the year. People collect a variety of plant products from the forests under their protection for fuel, timber, fodder, medicine, commercial sales and food. In a study of NTFP utilization across 214 households belonging to 12 different Forest Protection Committees (FPC's) in Midnapore district, nearly 73% of local plant species (155 species in all) were recorded as being used by local people for various purposes throughout the year and included leaves, roots, bark, seeds, fruits, shoots or flowers of various plant species. Commercially and in terms of volume, the important plants being utilised are sal seeds, sal leaves, mahua flowers, mahua fruits, mushrooms, tendu leaves, tendu fruits, honey, kalmegh (*Andrographis paniculata*) and satamuli (*Asparagus racemosus*). The forest floor is swept for dry leaves and twigs for fuelwood in most areas. Additionally, there is disturbance in the understorey in the form of fuelwood extraction, fire and grazing during certain seasons. In the sal coppice forests, the sal trees are managed for subsequent pole harvests by thinning of poles and later, cutting away all of the emerging shoots apart from a central one (referred to as multiple shoot cutting or MSC) during the initial years of growth. In most areas, a rotation cycle of ten years or more for the felling of sal trees for timber and poles has been established from which the monetary benefits will be shared between local forest committees and the Forest Department. Cut-back operations are undertaken to convert the uneven sal coppice growth into an even growth in order to build up a series of age-graded sal stands. In many villages, large tracts of barren and degraded lands have been converted to monocultural plantations of Australian acacia or akashneem (*Acacia auriculiformes*), eucalyptus (*Eucalyptus* spp.) and cashewnut (*Anacardium occidentale*), all of which are non-indigenous (or exotic) species that have been transported to India during the last few hundred years. In some areas, the forests are managed for specialised activities such as tassar cultivation which is reported to have negative impacts upon local biodiversity of flora and fauna. In Purulia district, lac cultivation on palash is widespread as an economic activity. In this context, the regeneration of palash is encouraged to the possible decline of other species including sal. Hunting as a practice is prevalent amongst the tribal community and many species of mammals and reptiles are hunted. The current vegetational status in the sal belt of southern West Bengal can thus be summarized as a patchwork of regenerating sal forest of various ages, semi-natural stands managed for various purposes, degraded land and monocultural plantations of exotic tree species.

In spite of the intensity of forest use in the region, there has been little serious evaluation of the long-term biological sustainability of forest produce extraction or the accompanying ecological impacts. Lack of knowledge in the area of biological sustainability is likely to become a bottleneck in the long-term success of JFM initiatives in the region. Here I comment briefly on the state of our knowledge on the sustainability of the forest management practices currently prevalent in south-western West Bengal and suggest research strategies that can be used to design sustainable management plans for the forests of the region.

It was found that currently there is little or no scientific data on the ecological impacts of forest produce extraction either at the species- or at the ecosystem-level. For example, not even one of 150 or more plant species that are being used for various purposes has been studied for ecology, distribution, productivity or sustainable yield. On the other hand, it is felt by many practitioners that production of several species of useful plants such as kalmegh (*Andrographis paniculata*), sarpagandha (*Rauwolfia serpentina*), *Lygodium japonicum* and mahua (*Bassia latifolia*) is declining over this entire region. Even previously common and widely distributed tree species such as charoli (*Buchanania lanzan*), kusum (*Schleichera oleosa*) and piyasal (*Pterocarpus marsupium*) are reportedly now restricted to a few pockets.

A controversial issue in the arena of forest management in this region is the long-term viability of the felling of sal on a rotation of 10-15 years. Repeated felling of sal at such an early age may be causing nutrient depletion of local soils and may result in declines in the future productivity of sal poles, apart from causing depletion of local flora and fauna dependent on a multi-tiered, tall forest for food and shelter. Preliminary studies indicate that soil fertility and microbial communities are impoverished in many areas of

intensive human use, though comprehensive studies have not been undertaken on a large-scale. However, other practitioners feel that sal trees become prone to fungal disease with age and that it may not be viable to have a longer felling cycle. This contention also remains to be verified in the field.

There may also be numerous ecosystem-level effects of forest product extraction in these forests that are as yet unstudied. From various accounts including those of villagers and researchers, it appears that there has been increasing impoverishment of plant communities since pre-independence days. There is evidence to suggest that biotic pressures over the last century, may have converted originally multi-species sal-dominated forests to almost monocultural stands of sal due to a process of weeding-out of species that regenerate only from seed, are shade-tolerant and cannot tolerate repeated cutting, fire or grazing. Clearfelling for sal poles additionally exposes the soil to the ravages of wind and water erosion, solar drying and invasion by weeds and may also be a contributing factor in gradually reducing the proportion of shade-tolerant tree and shrub species that are important components of peninsular deciduous forest. Similar changes in species composition have been found in the thorn scrub forest of Biligiri Rangan Hills where dry deciduous forest is suspected to have degraded into scrub forest in certain areas due to intensive human use over the years.

A distinct impoverishment of native fauna has also been noticed in the region, possibly due to harvesting of many of the local plant species for leaves, fruits, flowers and bark, plant parts that many animal species depend on. Pollinators and seed dispersers are classes of animals that may be affected due to the absence of flowering trees and shrubs in intensively harvested forest stands. Some groups of birds such as those depending on standing dead trees and those foraging in leaf litter and understorey shrubs also appear to be impoverished. However, to date, there is no systematic data on the animal life of variously managed forest stands in comparison to that of relatively undisturbed forest such as that still found in sacred groves and Forest Preservation Plots.

In the absence of statistically viable or systematically collected data, few concrete strategies can be derived for long-term forest management. In view of the status of current knowledge on the ecological sustainability of JFM in the study area, it is necessary to undertake research on (1) the the distribution, population status and sustainable extraction limits of commercial NTFP species that are considered threatened; (2) effects of forest management practices (both in coppice sal forest and in monocultural plantations) on the diversity of native flora and fauna, especially pollinators and seed dispersers; (3) restoration of native forest in areas currently degraded and under plantations of exotic tree species; (4) control of crop and other damage due to elephant migration through Midnapore district; (5) reasons underlying failure of sal regeneration in the study area; (6) sustainability of the sal felling cycle; (7) effects of various forest management practices on soil properties, microbial ecology and nutrient cycling processes; (8) ecology and control of invasive weeds in forests and plantations; (9) implementation of various participatory monitoring procedures for ecosystem management; and, (10) experimental testing of various forest management strategies for long-term biological sustainability. It is also necessary to expand vegetation monitoring activities at the local level that can holistically address several management questions relating to forest use and that involve the local managers/stakeholders, ie, the local village community.

It should be emphasized however, that no amount of scientific research can be of practical relevance unless a societal consensus on the uses of the forest is first reached amongst various stake-holders such as national and state governments, local people's bodies such as forest committees and industrial corporations, so that the conflicts that inevitably exist across forest user-groups are settled. Biologically, there are trade-offs that exist among various uses of the forests. For example, sal pole production that involves clearfelling, the way it is currently practiced, cannot coexist with the objectives of biodiversity conservation (unless it is scientifically designed at the landscape level). As another example, it may be possible to combine some types of NTFP extraction with the conservation of a subset of local fauna. For this it is recommended that an open and wide-ranging consultative process be initiated amongst the various stakeholders at many different levels-local, landscape and national- before research can be productively initiated.

The results of this study also raises larger questions regarding the long-term viability of managed forest ecosystems in India today. Most of our forests that are outside protected areas today represent "living dead forest" in which the presence of a tree canopy hides the absence of a functioning ecosystem. Many 'forests' now resemble monocultural plantations where a few plant species dominate, where natural regeneration of trees is next to absent, where the normal processes of seed dispersal, pollination, nutrient cycling and herbivory no longer occur and where the understorey is dominated by invasive species such as Eupatorium and Lantana. Many other reserved forest lands are now under use as monocultural plantations of eucalyptus, cashew, coffee or other commercially useful species. At this point it may be necessary to remind ourselves that a stand of trees does not necessarily constitute a 'forest' and to ensure that our future management decisions with respect to landscape-level biodiversity conservation, take this into consideration.

Environmentally Friendly and Alternative Technologies

George Varughese and Lata Raman
Development Alternatives, New Delhi

As modern technology advances, so does our ability to change our surroundings. Changes made on surface of the earth today are more extensive and occur more rapidly than ever before. However, the changes in the environment and consequently on the biodiversity are associated with demographic and economic changes.

While the National Biodiversity Strategy Action Plan (NBSAP) initiative is working at different levels including ecological zones and geographical spread, in this paper we are primarily trying to assess the impact of industrial and technological developments on biodiversity and explore eco-technological options to mitigate the impact on the fragile biological wealth.

Though there have been great advances in all the arenas of development, it has been observed that environment with its resources are still deteriorating. Industrialisation with its thrust on exploiting biological resources as raw material has been destructive to the biological wealth of the nation. Hence it is being realised that one of the focus of biodiversity conservation needs to be through developing environmentally and socially sound technologies to minimise the adverse impact on biodiversity.

In this paper, Industrial and technological development have been viewed primarily from two major aspects :

Biodiversity based industries and large scale industrial and technological developments impacting biodiversity rich areas.

The biodiversity based industries like agriculture, fisheries and forestry have suffered in the last 3-4 decades by introduction of various obsolete technologies like those used in green revolution, super rice which requires large quantity of chemical fertilisers, mechanized fishing, shrimp farms, commercial plantations etc. Also the modernised agriculture has encouraged the monoculture cropping pattern destroying the agri-diversity. Marine and aquatic ecosystems are today under severe threat due to intensified fishing technologies, aquaculture, oil exploration and effluent discharge. The practice of mechanized fishing is adversely impacting the lives and economy of traditional fishermen in the country. Industrial shrimp aquaculture have destroyed a million hectare of critical coastal wetlands including mangrove forests, disrupted and displaced traditional fishing communities and contaminated freshwater supplies. Forestry development schemes introduce monocultures of industrial species which ultimately causes the extinction of local species which fulfil the local needs. The practice of commercial plantation has been successful in meeting the industrial and local requirements, while on the other hand it has reduced the biodiversity due to monoculture. Over-exploitation of medicinal plant species by the pharmaceutical companies for commercial trade has led to the threat or extinction of these wild species.

On one hand the industrialization of the country is linked to the economic and social development which has provided livelihood and material comfort to the people, whereas on the other it has major implications on the natural resources and hence biodiversity. The exploitation of mineral resources has resulted in the deterioration of the ecosystem. The construction of dams and canals to harness water resources have serious implications on fish genetic resources. The contamination of aquatic species with pollutants, primarily with sewage and toxic substances, and the occurrence of toxic algal blooms have also rendered them unfit for human consumption. The construction of roads, hydroelectric dams for the benefit of the people has resulted in large scale deforestation which has a significant impact on the local flora and fauna. Introduction of alien species also poses a serious threat to the native flora.

Ecological and economically inappropriate science and technology, often are the causes of underdevelopment and poverty. They lead to higher withdrawals and consumption of natural resources and higher addition of pollutants than ecological limits permit. Hence, the need for eco-technological solutions has been felt for sometime and a few sporadic and scattered innovations and efforts are being made silently in various sectors (eg. agriculture, mining and fisheries).

The successful adoption of alternative eco-technologies depend upon their integration into the existing livelihood systems. Stakeholders are both the experimenters with and potential beneficiaries of alternative systems. However, given the diverse environmental, economic and social conditions in the areas, not all strategies are applicable universally. Hence, development activities that work with and through indigenous knowledge and organizational structures have advantages.

Eco-technologies like biotechnology and precision farming play important role in major components of integrated natural resource management and integrated gene management; efficient water management; integrated pest management respectively. Remote Sensing and GIS plays an important role in biodiversity conservation. Remote sensing has been used to generate the spatial database on forest cover which along with GIS is used to spatially model the disturbance regimes and to integrate the non-spatial data with the spatial character of the landscape.

Technological and industrial developments are essential and important for the economy as well as livelihoods. However, there is a need for environmental consciousness and responsibility through action. There is a need for spreading awareness, promotion and revival of certain traditional “practices” and promoting measures, which could mitigate the impact of the technological developments. The existing eco-technologies are require to be researched, field-tested, promoted and disseminated on a larger scale.

In order to promote eco technologies there is a need for research and development with greater collaboration of various stakeholders and development agencies with more access to credit. The formation of an Eco-technology Alliance for promoting technological solutions for addressing the Biodiversity Conservation is suggested. Apart from the full scale delivery system, including the functions of promotion, distribution and market surveys, the alliance should address the equity issues in adaptation of eco technologies.

The Alliance is intended to bridge the gap between various levels by bringing together different stakeholders for developing and promoting eco-technologies. The Alliance would strive to meet the following objectives :

- Research and Development
- Building Institutions
- Building Alliances
- Promoting Alliances
- Resouce Mobilisation
- Equity Issues
- Policy Issues

Humanised Natural Landscapes in the Eastern Himalaya

Joy Dasgupta
Independent Consultant, Kolkata

A Case Study of the Eastern Himalayan Region

The story of modern Western conservation efforts probably began in the late 19th century in the American west with an ecosystem or a landscape perspective but the subsequent European obsession with big game meant that the conservation perspectives primarily remained concentrated on the conservation of game species. The birth of Forestry also as a science was essentially very strongly timber oriented and looked at managing the forested Landscapes only through the eyes of timber production. The transition to an eco-system management started to take place much later in the 80s and the 90s and Ideas like Landscape level management and Ecosystem management started getting discussed primarily in the United States. Thus in this paper we have begun with an attempt to trace the evolution to the modern concept of a humanized Landscape. The main focus area is the Indian part of the Eastern Himalayan region. Thus the primary objective was to document the existing knowledge about local management paradigms of Landscapes supplemented with notions and insights from related primary sources of information also to identify the formal notions of landscape management in this region and the probable conflicts that they may have with the more informal notions of landscape management.

The paper follows a case study approach dividing the Landscapes into two broad categories namely formal and non-formal Landscapes, the dividing line being the role of the State in the sense that the State recognizes and preserves the formal Landscapes and in the non-formal ones the community plays a more important role. There are four such case studies explored in this paper and these include both formal and non-formal landscapes. The Paper concludes with a discussion of the complementarity of the different Landscapes and the conflicts that emerge when these Landscapes overlap and the possible changes that need to be brought about in the Legal and Policy framework in order to address these challenges.

Important Bird Areas

Supriya Jhunjhunwala and Zafar-ul-Islam
Bombay Natural History Society, Mumbai

The Indian IBA Inventory is finalized and will be published by July 2004. The IBA Inventory is intended to provide comprehensive information on IBAs and species and to be used as an advocacy tool for site and species conservation to enable informed decisions.

The main aim of the Indian IBA Inventory is to document and protect a network of sites which covers all the habitats and species. Given that birds are good indicators of overall biological diversity, most IBAs will also be important for other animals and plants, particularly those which are under the greatest threat. The following are the key areas where the IBA Inventory would be useful:

- Help identify high biodiversity areas
- To form a sound basis for the development of national conservation strategies, including protected areas programme;
- Contribute in the development of national conservation strategies, highlight sites which are threatened or inadequately protected
- Help build regional and national networks of ornithologists and conservationists.
- Help identify future priorities for birds and biodiversity conservation action
- Provide decision makers with high quality biodiversity information for sustainable land and resource use
- Assist governments in the implementation of international agreements such as the Convention on Biological Diversity
- Provide material for education and training
- To help build national and regional networks of ornithologists and conservationists through Indian Bird Conservation Network;
- To guide the work of national NGOs;
- To influence global conventions, e.g., Biodiversity, Ramsar convention;
- To influence regional migratory bird agreements.
- The National Biodiversity Strategy and Action Plan.

The IBA Programme aims to identify, document and advocate the protection and management of a network of sites that are important for the long-term viability of naturally occurring bird populations across the geographic range of those bird species for which a site-based approach is appropriate.

The IBA programme produces inventories of internationally recognized sites vital for the conservation of birds. It identifies, documents and protects a network of sites which covers all habitats and species. Given that birds are good indicators of overall biological diversity, most IBAs are important for other animals and plants. The IBA programme aims to identify and promote the protection of networks of key sites for the conservation of birds and other biodiversity in all regions of India.

Site Based Approach

The IBA programme is a site-based approach, which identifies sites of international importance for the conservation of birds and other biodiversity and collates and disseminates key information. Information availability of the importance and location of such sites is fundamental to the success of a site based conservation strategy.

Birds are one of the best-researched taxa in India and a fairly reliable indicator of biodiversity loss. Given that birds are good indicators of overall biological diversity, most IBAs will also be important for other animals and plants. A significant proportion of bird (and other animal and plant species) can be effectively conserved by the protection of key sites, either as official protected areas (national parks and reserves) with necessary and appropriate management, and or through the promotion of sustainable land-use practices (Mallari et al. 1998).

Scope of the IBA Programme

The IBA Programme incorporates the conservation of species and the sites essential for their conservation it therefore covers the entire country and a wide range of habitats has a very wide scope.

Species

The programme not only covers the 78 Globally Threatened birds in India (comprising of Critical Endangered, Vulnerable and Data Deficient and Conservation Dependent species) but also covers species that are endemic or have restricted ranges, congregatory birds and assemblages of species that are typical to a habitat or biome.

Habitats

As the programme covers a wide array of bird species, it also ranges across various habitats such as wetlands, islands, coastal areas, deserts, forests, grasslands and agricultural ecosystems.

Geographic Range

The BNHS organized 15 regional workshops to identify IBAs for every state and union territory of India. With the exception of Daman and Diu and Chandigarh, IBAs have been identified for all the states and union territories of India.

Limitations of the IBA Approach

- The IBA approach only works for those species for which a site-based approach is appropriate. Bird species with highly dispersed or nomadic distributions may not be protected through this approach. Some bird species are not well protected by the IBA approach (such as large raptors, cranes and bustards, which are dispersed at low densities across wide areas and nomadic species).
- For others, the IBAs might be only appropriate across some of their ranges or for parts of their life cycles, (e.g. colonial nesting species that disperse extensively during the non-breeding season) (Barnes 1998).
- Any strategy for the long-term protection of biotic diversity should encompass evolutionary and biogeographic considerations. The IBA programme attempts to take this into account by selecting a network of sites that were spread through most habitats and in different areas of the species distributions. However sub-specific variation was not taken into account. Any future assessment should attempt to include sites where different morphs and subspecies (particularly endemic and restricted range subspecies) are located (Barnes 1998).
- The IBA programme is just one approach to bird conservation. It is not in the whole and the only answer. The IBA criteria are fairly stringent and many sites that are of undoubted local, provincial and national importance fail to qualify as IBAs. This does not mean that they are not important for conservation; on the contrary these sites often fulfill vital conservation roles at local scales. It must be emphasised that sites not designated as IBAs are not dispensable and their role in a wider land-use conservation strategy may be as vitally important as that of any IBA (Barnes 1998).

IBAs and the National Biodiversity Strategy and Action Plan (NBSAP)

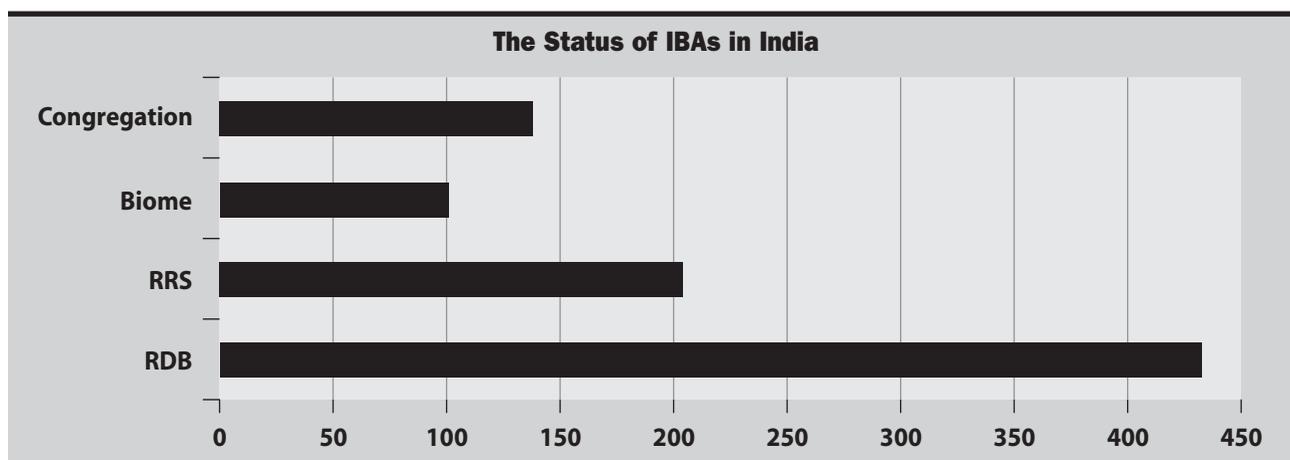
Both the National Biodiversity Strategy and Action Plan and IBA are complementary methods with biodiversity conservation as their common goal. The IBA relates to several aspects and components of the NBSAP and is featuring as a sub thematic review note in the NBSAP.

Status of IBAs

IBAs are the first comprehensive study in which sites have been identified for bird conservation. 464 IBAs have been identified so far. This list however is dynamic and not a fixed list of sites. It is anticipated that several new IBAs will be identified.

Around 90% of IBAs in India are important for one or more of the 78 globally threatened species in India and 47% for the 74 restricted range species found in India. Almost all IBAs fall under at least one biome and hold some of the 374 bird species that fall in the biome criterion.

IBAs are also important for species that congregate in large numbers such as congregatory terrestrial birds, wintering and passage waterbirds and breeding seabirds almost 17% of IBAs have been identified for these species.



International Recognition

IBAs are recognised by inter-governmental bodies and international treaties such as the Biodiversity and Ramsar conventions. The Global Environment Facility recognises IBAs in their own strategies and action plans, while the European Union has used them as a basis for legal judgments (Heath and Evans 2000).

Some International conventions and programmes are particularly relevant to sites and species, these are: The Convention on Wetlands of International Importance, especially as Waterfowl habitat (Ramsar Convention), Convention on the Conservation of Migratory Species of wild animals (Bonn Convention), Convention on Biological Diversity and UNESCO's Man and Biosphere Programme (Evans 1994).

The IBA criteria are compatible with the Ramsar criteria set for wetlands of international importance, yet only 16 IBAs are Ramsar sites. Other IBAs that qualify the Ramsar criteria should be considered for designation as Ramsar sites for the internationally important numbers of waterbirds that they hold.

IBAs Not Covered Under the Protected Area Network

The 92 National Parks and 480 wildlife sanctuaries in India respectively cover 35,357.82 sq. km and 1,15,451 sq. km, which constitutes 4.58% of the country's 32,87,213 sq. km of geographic area (Kutty and Kothari 2001). A high proportion of IBAs in India does not fall within the protected areas system. With 45% of the IBAs still unprotected, IBAs should be designated under national laws where appropriate. While legal measures may not always guarantee protection on the ground, they demonstrate to all sectors of society and branches of government, the official recognition and importance of a site. The IBAs form a network throughout a species' range. As habitats become more threatened, this network will become increasingly important to make sure that these species survive across their ranges. IBAs may include the best examples of the species' natural habitat

The sites are selected using scientific methods, but it is also a very practical approach. The existing protected area network will form the backbone of network of IBAs and new sites will be proposed to fill the gaps. Ideally, each site should be large enough to support self-sustaining populations of as many of the species as possible for which it was identified. The IBA approach is only suitable for those bird species for which a site-based approach is appropriate, this approach however, does not suit all birds. Thus the IBA Programme is only one tool in the armory of conservation and needs to be combined with other conservation strategies in the wider environment.

Points to remember

IBAs:

- are places of international significance for the conservation of birds at the global, regional or sub-regional level,
- are practical tools for conservation,
- are chosen using standardised, agreed criteria applied with common sense,
- must, wherever possible, be large enough to support self-sustaining populations of those species for which they are important,
- are places which can be defined and distinguished from surrounding areas, and which are feasible to conserve,
- where possible preferentially include, where appropriate, existing Protected Areas,
- are not appropriate for all bird species and, for some, are only appropriate in parts of their ranges,
- should form part of a wider, integrated approach to conservation that embraces sites, species and habitat protection.

Establishment of Indian Bird Conservation Network (IBCN)

To conserve the bird species and their habitat, the Bombay Natural History Society (BNHS) started the 'Important Bird Areas Programme (IBA)' with the collaboration of BirdLife International and the Royal Society for the Protection of Birds. In India, lots of studies have been done on birds and their habitat but there was no common platform from where the information could be disseminated and pooled. In 1998, the BNHS organized a Strategy Planning workshop in Mumbai and invited key ornithologists of India to discuss the issue. All of them decided to have a strong network of ornithologists and conservationists, and the Indian Bird Conservation Network (IBCN) came into existence with the following mission:

"To promote conservation of birds and their habitats through development of a national network of individuals, organizations and the government."

The objectives of the IBCN are (a) research and monitoring, (b) conservation action, (c) network development, (d) awareness and education, (e) policy and advocacy, and (f) fund raising.

The IBCN is one of the leading membership networks of Indian organizations and individuals who collaborate to promote the conservation of birds in India and the conservation of biological diversity as a whole through IBCN members. At present the IBCN has

more than 800 individual and 70 organizations partners, supporting the bird conservation movement in India. Some of the partners are not ornithologists but working on different aspects of environment in India, and support the IBCN activities.

The Network brings together diverse strengths and expertise focused on strategic conservation objectives. It provides assistance in such a way that encourages local communities to focus and combine efforts for greater impact. In this way, IBCN acts as a conductor, inspiring and directing a network of partners all helping to implement a larger strategy for concrete conservation outcomes in India.

The IBCN publishes a quarterly newsletter "MISTNET", which contains articles and information on bird species (threatened and common), IBAs along with their conservation issues, interventions and advocacy for the protection of biodiversity and habitats.

The IBCN website: www.ibcnetwork.org

Advocacy, Awareness and Involvement of Local Communities

The IBA process does not stop at identification and documentation of sites - it is continuous process of identification of new sites, monitoring and advocacy for better protection of the existing sites. Many existing and potential sites are data deficient and need proper surveys and documentation of bird life. The IBA process also encourages widespread ownership of the concept, especially at the grass root level. The IBA process actively involves local communities for the protection of IBA sites.

Conservation: It is now well recognized that the existing protected areas are not sufficient to conserve all biodiversity. A large percentage of wildlife, especially birds, live in agricultural and semi-urban areas. Many protected areas (especially reserves) face serious conservation problems despite their status. Also very few of India's protected areas were chosen to conserve birds as such. The IBA approach is the one of the ways to conserve bird species through protection or conservation of important sites.

Unfortunately, assessing biodiversity is difficult, expensive and extremely time-consuming (e.g. Lawton et al. 1998). By the time we obtain adequate information, it will be too late to make use of it.

Most of the Red Data Book species are widespread and distributed across the Indian sub-continent so they pose serious conservation challenge. Many of them are long-distance migrants, traveling across countries, while others move within the country. They cannot be fully protected in few selected sites. Among the 78 threatened species, 17 are migratory and 57 residents. Even among some of these resident species, seasonal and local movement is seen. Migratory species face severe threat of hunting and loss of habitat. To protect these species that cross one or more borders, where conservation deficiencies in one country will affect the measures undertaken by other countries, the Indian IBA programme along with the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) would try to facilitate international agreements between Indian and other countries for the protection and management of migratory species that have an unfavorable conservation status and would benefit from international co-operation.

Monitoring of IBAs: We will select some of the very important sites which are critical for birds will be monitored regularly by IBCN partners with the collaborations of BNHS. Just to start with the monitoring programme, we will select 10 sites out of 464 for monitoring to see whether the populations of birds are stable, increasing or decreasing. We will also focus on conservation issues and the dependency level of human being. We have prepared a Resource Questionnaire to know the dependency level and socio-economic values.

Awareness and Campaign Programmes

The IBCN members have been doing campaigning towards the conservation of IBAs and threatened birds and also started the awareness programme in many areas with the small financial help from the IBCN. In 2004, IBCN started the IBA Day to make general people aware about the bird conservation in India, involving the Forest Department and other Government officials.

Benefits

Local groups, individuals, NGOs and Forest Departments personnel were trained to conduct surveys on IBAs sites and do census in scientific and systematic manner. These local groups were also trained to write their own project proposals and submit to the funding agencies. Awareness towards the conservation of birds and their habitats are implemented to monitor and protect the IBA sites in India.

India has hundreds of small local environmental groups, scattered throughout the country. However there is no way for these groups except possibly through the Indian Bird Conservation Network (IBCN) to coordinate their actions, ideas, discoveries, successes and failures. Without this information sharing, the efforts and resources they put into conservation are often wasted because

mistakes are duplicated, and because actions are not directed towards the most urgent problems. India also faces such great social and economic challenges that there are not enough resources to do all the environmental work that is needed. It is vital that the scarce resources that are available are used as effectively as possible.

Site Support Group (SSG): Around 400 people have participated in Bird Census Training Workshops under the Indian Bird Conservation Network (IBCN). They were given training how to monitor the site and its protection and also to do bird census. IBCN partners would be very helpful for the site protection and species conservation. In each region, the IBCN is planning to form a Site Support Group, which would not only monitor birds but also give efforts to protect the IBAs and minimize the threats.

IBCN is now a well established network in the country and there many areas where the similar kind of training workshops are required to promote conservation of wildlife, especially in the Western Ghats, Western Himalayas, northeast India and also in Terai areas.

More and more people are joining the IBCN to support the bird conservation movement in India and hope to increase its networking in the South Asia and use it as bird information hub to work together with the BirdLife International partners in the Indian-sub Continent.

Integrated Biodiversity Information System

Salim Javed
Aligarh Muslim University, Aligarh

Information on biodiversity is essential to make appropriate decisions leading to better conservation of biological resources. As biodiversity is an all encompassing topic, the task to collect, store and disseminate such information is enormous. Although some information on various aspects of biodiversity exists, but the same is patchy, unorganised and not on a structured database format and in most cases not web-based. Information systems like ENVIS could be better organised and strengthened by establishing an Integrated Biodiversity Information System to cater to the information needs. IBIS should be a web-based system, integrating all existing information systems and database. It is essential that all ENVIS Centres should start appropriate database development on the subject area for which the organisation was identified as an ENVIS centre and these databases are made available on the web through a link with IBIS.

Invasive Alien Species and Biodiversity

R.S. Rana

Independent Consultant, New Delhi

The term 'Invasive Alien Species' (IAS) refers to non-native (exotic) organisms that have been moved outside their natural ranges and dispersal potential, largely with human intervention, and have impacted negatively on the native species and functioning of natural ecosystems in their new homes. Found in all categories of living organisms and all types of ecosystems, IAS are widespread in the world posing the most serious threat to biodiversity next to habitat loss. Many alien species are non-invasive and support our farming systems and other human livelihoods in a big way. In fact, nearly half of our food and other cultivated plants have come from other countries. Only those alien species that cause substantial negative impacts to the environment, ecosystems, habitats, native biodiversity, economies, and human health are considered the "Alien Invasive Species."

Every IAS that becomes established in a new environment alters the composition of native biological communities in some way. These alterations may disturb the structure and functioning of the invaded ecosystems with profound socio-economic impacts. The scope and cost of biological alien invasions by microorganisms, aquatic plants, land plants, aquatic invertebrates, land invertebrates, fishes, reptiles and mammals are global and enormous, in both ecological and economic term. This paper discusses some aspects of invasive non-native species and considers broadly, in the Indian context, the ways and means of preventing their entry into this country, their early detection and eradication/control, limiting their further spread and mitigating their negative impacts. Overall focus is on regulating and managing the intentional and unintentional introductions that may constitute biosecurity threats, posing biological risks to natural ecological systems or to the well-being of humans, animals or plants inhabiting the affected areas.

Intentional and Accidental Introductions

Introduced or the alien species are usually grouped in two broad categories as follows:

- Deliberate Introduction of species for commercial or recreational purposes (e.g., fish for aquaculture; pasture species for rangelands; ornamental or other horticultural species);
Also, Deliberate Introductions for bio-control purposes;
- Unintentional Introductions of pests and diseases, and other species, through traded commodities, especially of agricultural produce, timber, livestock etc;
Also, Unintentional Introductions of organisms through transport vectors such as shipping and aviation.

The deliberate and purposeful introductions are well cared for but the species imported for a limited purpose may escape on being neglected later on.

Most of the deliberate introductions have proved to be of immense value in serving human needs, more so for agricultural and forestry purposes. The great bulk of human dietary needs in most parts of the world are currently met by species that have been introduced from elsewhere (Hoyt, 1992). More than half of the plants now commercially grown in India, for example, are introductions from other lands in recent or remote past. Many among them got so naturalized and diversified here that local people find it difficult to believe that they have traveled here from far away places. A case in point is the sorghum and pearl millet crops that have their origin in Africa. Likewise, it is difficult to imagine an Africa without cattle, goats, maize, and cassava, or a North America without wheat, soybeans, cattle and pigs, or a Europe without tomatoes, potatoes, and maize — all introduced species. Species introductions, therefore, are an integral part of agricultural biodiversity in virtually all parts of the world. Increasing concerns for maintaining the health of these introduced species also led to the introduction of additional alien species for use in biological control programmes based on the import of natural enemies of pests and pathogens from the areas of their origin.

The Indian Perspective

India is highly vulnerable to the invasions of aggressive alien species in view of its vast ('porous') borders, wide spectrum of climatic and soil conditions, rich native biological wealth, endemic repository of wild relatives of cultivated plants, weak enforcement of biodiversity and environmental protection laws, ineffective implementation of regulatory measures for import of living organisms (plants, livestock, fishes and other aquatic species, insects and accidental introduction of virulent pathogens), expanding tourism and liberalization of trade. While taking due note of the scientific strength of India's national to deal with these challenges, this

overview has pointed out several shortcomings and critical gaps in respect of policy support, priority setting, national database, the line of operational command, legal protection, structural framework, quarantine effectiveness and awareness at various levels.

Some Notable Examples

Lantana (*Lantana camara*), a prickly perennial shrub of tropical American origin, now occurs throughout India. Exotic tropical weedy species, in general, have proved to be more aggressively invasive in nature endangering the native flora. Of these, the recently introduced *Parthenium hysterophorus* (commonly referred to as the 'Carrot weed' or 'White top') has become the greatest menace to natural flora in the plains. Similarly two species of *Eupatorium* namely *E. odoratum* (now named *Chromolaena odorata*) and *E. adenophorum* have become quite adventive in comparatively open forests, fallows and roadsides on hills of Himalayan region as well as in parts of Western Ghats. At lower elevations, *Mikania micrantha* has become a great problem in forests of northeast India where this weedy species climbs over forest trees masking the photosynthetic surface of host plants, suppressing forest undergrowth as well as tree seedlings. Water Hyacinth (*Eichhornia crassipes*), a native of tropical South America, has become a serious threat to wetlands biodiversity, particularly in West Bengal. Likewise, the African honeybee, Thai magur (African catfish) and microbes, like the Banana Bunchy Top Virus and Golden Nematode of Potato, have attracted much attention. Introduction of elephants, the spotted deer and many other species from the Indian mainland to the Andaman Islands have also caused similar problems.

The Stakeholders

A large number of primary and secondary stakeholders are concerned with the impact of invasive alien species that threaten ecosystems, habitats, species and natural base resources. Regeneration of renewable natural biological wealth, the pace of area development programmes and livelihood security are of immense interest in this context. The Ministry of Agriculture of Government of India is the nodal governmental agency for dealing with this subject in the country and also for liaising with the FAO and other international/regional organizations on relevant programmes and activities. The Ministry of Environment and Forests reports on this subject to CBD under Article 8h. There are several other union ministries/departments that have jurisdiction over different components of this complex and cross-cutting thematic area. This issue is also of great concern to the state governments since agriculture and forestry are on the concurrent list of items. In addition, there are numerous other stakeholders including research organizations, developmental agencies and civil society organizations besides the farming and local communities.

Multilateral Environment Agreements and the International Legal System

Key international legal instruments, that address the threat of IAS, include the Convention on Biological Diversity (CBD), the Ramsar Convention on Wetlands, the United Nations Convention on the Law of the Sea, and other multilateral environmental agreements such as the International Plant Protection Convention (IPPC) and instruments developed under the Office International des Epizooties (OIE), the Food and Agriculture Organization (FAO), the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO) and the World Health Organisation (WHO). Prevention of the entry of IAS has somehow been treated inconsistently across the existing multilateral environment agreements (MEA), varying from strong to weak protection. Lack of reliable, consistent and comprehensive data is possibly the biggest challenge in the successful application of risk assessment to invasive alien species.

The Convention on Biological Diversity

Article 8(h) of the Convention on Biological Diversity requires Parties "as far as possible and as appropriate, [to] prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". At its fourth meeting, the Conference of the Parties, recognizing the problems alien species may cause to indigenous and local communities and negative effects on local and national economies, designated alien species to be a cross-cutting issue to be taken into account in each thematic work programme under the Convention, and decided that invasive alien species would be a matter for in-depth discussion of the sixth meeting of the Conference of the Parties. Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) to CBD has developed Interim Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species ("Interim Guiding Principles") at the request of the Conference of the Parties.

CBD is addressing the impact of alien invasive species in many ways including eradication, control, mitigation of their impacts combined with legislation and guidelines at national, regional and international levels. It is recognized as a cross-cutting issue within the Convention and priority attention is being given to geographically and evolutionarily isolated ecosystems as represented by small islands. The Conference of Parties (COP) to CBD has referred to alien species in a number of its decisions while recognizing the importance of the Global Invasive Species Programme (GISP) calling on it to develop a second phase of its activities and requested the GEF and other bodies to provide financial support for this purpose. The Invasive Species Specialist Group (ISSG), a global group of 146 scientific and policy experts on invasive species from 41 countries and a part of the Species Survival Commission (SSC) of the World Conservation Union (IUCN), also provides advice on threats from invasives and control or eradication methods.

The COP has invited Parties to develop country-driven projects at both national and supra-national levels to address alien species and to incorporate the issue into their biodiversity strategies and action plans. Parties have been urged to carry out a number of actions regarding alien species, including application of the interim guiding principles, undertaking of case studies, development of mechanisms for transboundary, regional and multilateral cooperation, and development of education, training and public-awareness measures. The COP has also resolved that the GEF should provide adequate and timely support for country-driven projects at national, regional and subregional levels addressing the issue of alien species.

While reaffirming the priority to full and effective implementation of Article 8(h), COP-6 (held in The Hague in April 2002) urged the Contracting Parties, other Governments and relevant organizations to promote and implement the 15 Guiding Principles. It has also urged the Parties, Governments and relevant organizations to promote and carry out research and assessments on:

- The impact of alien invasive species on biological diversity;
- The socio-economic implications of invasive alien species particularly the implications for indigenous and local communities;
- The development of environmentally benign methods to control and eradicate invasive alien species, including measures for use in quarantine.
- The costs and benefits of the use of biocontrol agents to control and eradicate invasive alien species;
- Means to enhance the capacity of ecosystems to resist or recover from alien species invasions;
- Priorities for taxonomic work through the Global Taxonomy Initiative; and
- Criteria for assessing risks from introduction of alien species to biological diversity at the genetic, species and ecosystem levels.

Current Assessment

Challenges posed by invasive alien species in India are enormous, both in dimensions and intensity. In marked contrast to this alarming situation, level of preparedness and response of the Central and State Governments appears to be inadequate. There is no unified national system geared to address the problems created by biological invasives and the authority/responsibilities dealing with plants, animals, fishes and other aquatic species are rigidly compartmentalized. Participation of key players and major stakeholders in decision-making and problem solving is either lacking or ineffective. There are some examples of good work done in some areas but they do not seem to be part of a planned national effort.

Role of the Central Government

- Overall authority regarding regulation of imports (of plants and livestock) and quarantine;
- Leadership, perspective planning, coordination and monitoring;
- National system development, infrastructure, database, institutional support, linkages;
- Early Warning and Watch: Detection, containment, quick response and monitoring;
- Legislation enactment and enforcement;
- Capacity building and research support (Developing technologies to manage IAS);
- Education and public awareness;
- Fund mobilization; and
- Regional and international cooperation (also inter-governmental negotiations/national reporting)

Role of State Governments

- Assert partnership rights in preparation of the National Strategy and Action Plan on IAS;
- Play the Area Commander's role in all Central Government's field programmes;
- Establish Surveillance, Early Warning and Quick Response System dealing with IAS;
- Strengthen plant quarantine capacity and assist the Central Government in enforcing regulations of domestic quarantine;
- Enlist greater involvement of Panchayati Raj institutions in decision-making;
- Mobilize funds for field programmes and preparation of Case Studies;
- Involve local institutions in demonstrative restoration of the ecosystems;
- Support socio-economic studies in partnership with civil society organizations.

Role of the Institutions

National and local institutions are required to provide technical expertise, research backup, technological support and policy inputs. They should lead the effort on socio-economic studies and restoration of ecosystems with active participation of local communities and civil society organizations. It is also obvious that India cannot succeed in facing its invasive species problems unless it plays a leadership and proactive role in regional and international cooperation, and also in intergovernmental negotiations on this subject under different biodiversity related conventions and international agreements.

Need for a 'National Invasive Species Advisory Committee' and a 'Unified Command for Plant and Animal Quarantine' at the nation-

al level

Considering that the scope of dealing with invasive alien species is multi-dimensional and requires multi-disciplinary inputs, there is an urgent need for establishing a broad-based National Invasive Species Advisory Committee to advise the Government on this subject, prepare the National Invasive Species Management Plan and to provide national leadership. The plant quarantine activities in the country are presently regulated through implementation of Plants, Fruits, Seeds (Regulation of Import into India) Order, 1989 notified under the DIP Act, 1914 while the animal quarantine is regulated through implementation of the provisions under the Livestock Importation Act 1898 (as amended upto 2001). Authority for import and quarantine of plants and seed materials is presently with the Plant Protection Advisor to the Govt. of India, Department of Agriculture and Cooperation, who heads the Directorate of Plant Protection, Quarantine and Storage. Director, National Bureau of Plant Genetic Resources, working under ICAR, shares the delegated responsibility for import of germplasm of agri-horticultural crops. Authority for import and quarantine of livestock (including fishes and aquatic species) rests with the Department of Animal Husbandry and Dairying with technical advice of the Animal Husbandry Commissioner and Fisheries Commissioner. There is an urgent need to establish an autonomous authority under the Government of India to conduct pest risk analysis and develop national standards for domestic and national quarantine besides enforcing the quarantine regulations. Hence, a recommendation has been made to enact legislation for establishing an autonomous Quarantine Authority of India ensuring a Unified Command for Plant and Animal Quarantine in the country.

Conclusions

Four aspects of the exotic invasives are noteworthy. Firstly, people are largely responsible for moving organisms or their reproductive/vegetative parts from one place to another, especially through modern global transport and travel. Secondly, while some species are capable of invading well-protected/"intact" ecosystems, IAS more often seem to invade habitats that have been already altered by humans, such as the agricultural fields, grazing lands, abandoned mining areas, human settlements, and roadways. The degradation of natural habitats, ecosystems and agricultural lands (e.g. loss of cover and soil, pollution of land and waterways) that has occurred throughout the world has made it easier for some alien species to establish and become invasive since they are "colonising" species that benefit from the reduced competition that follows habitat degradation. Thirdly, alien species are often intentionally introduced for direct or indirect economic benefits without proper risk assessment regarding their becoming invasive later on in situations favourable to them. Fourthly, the negative consequences of IAS affect various strata of communities quite differently, the deprived sections bearing the burden more than others.

The national system for responding to the prevalent and impending threats of AIS is still weak with notable shortcomings and gaps. It has, however, the scientific strength and capability to face these challenges provided that the priorities are set rightly at various levels, required funds are mobilised and the actions are taken without further delay with full administrative support and political will. The Central and State Governments must work together for this purpose in active partnership with lead research institutions and civil society organizations and with effective involvement of Panchayati Raj institutions and local people. It is also desirable that campaigns for clearance of already heavily infested areas and restoration of invaded ecosystems be linked to Government's 'Food For Work' Programme in case a real headway is to be made in this direction.

Living Marine Resources Drugs and Biodiversity¹

Chandrika Sharma

International Collective in Support of Fishworkers, Chennai

Traditional ecological knowledge (TEK) systems are highly evolved within local and indigenous coastal communities in India, as elsewhere, based on generations of close interaction with the coastal ecosystem. Coastal and marine resources such as fish, coral and seaweed have been used for various purposes, including as food, housing, health supplements and as medicine. The livelihood of coastal communities continues to depend on coastal biodiversity and access to it.

Coastal resources and traditional populations are under pressure from, among other things, destructive fishing practices, habitat degradation, pollution, urbanization and industrialization. These apart, the various emerging uses of marine biodiversity and their potential impact on biodiversity and coastal peoples, need to be closely monitored.

The tremendous genetic, biochemical and physiological animal diversity in the oceanic ecosystem and its potential, is only now being better understood. This note will concentrate mainly on the growing use of marine biodiversity for pharmaceutical purposes.

Marine Bioprospecting and the Pharmaceutical Industry

Marine bioprospecting is the collection and testing of marine living organisms for the purpose of developing new products with pharmaceutical, agricultural and/or industrial applications. In the developed world research has been underway since the 1960s. In India the National Project on Development of Potential Drugs from the Sea was initiated much later, in November 1990 and research is since being coordinated by the Central Drug Research Institute (CDRI), Lucknow. Several organisms are being taken up for product development.

In general, however, it is countries of the North who have the knowhow, capital, human resources and technology on these aspects, while it is countries of the South who have the genetic resources. Patents of all antitumour drugs of marine origin, for example, are held by companies or institutions in the North, primarily from the US, Japan and Europe. The North, therefore, asks for stricter Intellectual Property Rights (IPR) regimes, while the South, in contrast, is more concerned about compensation for use of resources and equitable benefit sharing arrangements.

Given the circumstances it is in the interests of Southern countries to be proactive in putting together appropriate policy and regulatory frameworks that are effective in:

- protecting the interests of local communities traditionally using, and knowledgeable about, these resources;
- ensuring a fair deal to States;
- protecting marine biodiversity from damage as a result of bioprospecting and other research activities; and
- preventing biopiracy.

The International Legal Framework of Control Over Marine Biodiversity

National legislation and frameworks for use of marine diversity will need to be in accordance with international law. The international community deals with control over marine biodiversity mainly through the following conventions and agreements: The 1994 United Nations Convention on the Law of the Sea (UNCLOS), the Convention on Biological Diversity (CBD) and the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement of the World Trade Organisation (WTO).

There is an ongoing debate about the coherence between TRIPS and the CBD. This debate has, among other things, focused on the following aspects: (i) according to the principle of national sovereignty enshrined in the CBD, countries have the right to regulate access of foreigners to biological resources and knowledge, and to determine benefit-sharing arrangements. TRIPS, on the other hand, enables persons or institutions to patent a country's biological resources (or knowledge relating to such resources) in countries outside the country of origin of the resources or knowledge. (ii) Article 15.4 of the CBD states that "access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party." In TRIPS, there is no provision that applicants for patents or other IPRs over biological resources have to obtain prior informed consent. There is thus no recognition in TRIPS of the rights of the country in which the biological resource or knowledge of its use is located. (iii) While a key emphasis in CBD is on benefit sharing arrangements, under TRIPS there is no provision for the

patent holder on claims involving biological resources or related knowledge to share benefits with the state or communities in countries of origin.

Fishing communities: Areas of Concern

From the perspective of fishing communities developments related to the use of marine biodiversity for pharmaceutical purposes need to be carefully monitored in terms of the following aspects:

- a. Given that areas rich in biodiversity are also likely to be areas that fishermen have traditionally fished, it is possible that access to fishing grounds and to coastal spaces traditionally inhabited and used by fishing communities, could be affected by activities related to marine bioprospecting.
- b. Bioprospecting and bioharvesting activities may have negative impacts on coastal and marine ecosystems and thereby on fisheries-based livelihoods, given that collection is an extractive process, and even mariculture of required species can have negative impact.
- c. Bioprospecting activities may make use of, and appropriate, the traditional knowledge base of coastal fishing communities, either in locating biodiversity or in identifying species and their useful features that have traditionally been used by them for medicinal or other purposes.

Agenda for Action

1. Sustainable use and management of marine resources

Given that the oceans still keep many secrets and continue to yield new surprises, the quest must be to protect and manage the coastal and marine biodiversity using an ecosystem approach, in ways that also sustain local livelihoods. By the same logic there is a strong case for adopting a precautionary approach to oceans use, in keeping with Principle 15 of the Rio Declaration.

2. Sustaining livelihoods of fishing communities

In keeping with spirit of Agenda 21, the following actions would be relevant:

- a. Document the traditional knowledge of coastal communities, including fishing communities, about marine and coastal resources in ways that protect the interests of these communities, rather than make available their knowledge to prospectors. It is also in the interests of States to grant a priori and inalienable rights over these TEK systems, as this would prevent their misappropriation through IPRs.
- b. In keeping with CBD Article 10 (c), to go beyond mere documenting to providing active support to the further development of TEK systems, towards better management of coastal and marine resources and towards strengthening traditional medicinal systems.
- c. In coherence with CBD Article 8(j), ensure that the rights of local fishing communities to both land and marine resources traditionally accessed by them, is protected by national legislation.
- d. Ensure that fishing communities are recognized as decisive stakeholders, where bioprospecting activities make use either of resources that they have traditionally enjoyed access to, or of their knowledge of coastal and marine resources.
- e. Make it obligatory for Indian or foreign agencies engaging in bioprospecting activities in India to make available information on existing/ongoing bioprospecting activities, especially to fisherfolk in locally understandable terminology and language.

There also needs to be some debate on benefit sharing arrangements as this is undoubtedly a complex issue.

3. Retaining control over biodiversity

It would appear that if countries and communities of the South are to retain control over their biodiversity, they must oppose, or radically limit, the patenting of all life forms during the review of Article 27 (3)(b) of the TRIPS Agreement and in other relevant international fora.

Mining

Highlights

A new nation-wide report by the NGO Kalpavriksh, *Undermining India*, exposes the increasing threat that mining activities pose to India's present and future security. Some highlights of the report:

- Mining activities are destroying some of India's most ecologically sensitive areas, including catchments that provide water security to millions of people;
- At least 90 wildlife sanctuaries and national parks, and 100s of other ecologically sensitive areas with unique biodiversity and wildlife, are threatened;
- Culturally and economically fragile communities residing in these areas, including many adivasi/tribal groups, are seriously affected by mining;

- Since the economic liberalisation phase in the 1990s, the mining sector has opened up thousands of sq. kms. of the country for reconnaissance and prospecting activities, many of which are taking place in some of our most ecologically fragile areas;
- Many mining activities are in gross violation of environmental policies and laws, of the constitutional guarantees to adivasis and other communities, and of the National Mineral Policy's own assurance that "ecologically fragile and biologically rich areas" would be avoided;
- Government of India and state governments need to take urgent steps to declare ecologically and culturally sensitive areas as being off-limits to mining, to commission an independent assessment of the impacts of the mining sector, to make necessary changes in the mining policies and laws, to ensure ecological restoration of already mined areas, to provide alternative employment to workers before closing down mines in ecologically sensitive areas, and to set up an expert group to explore ways of sustainable material and energy use, including the reduction of luxury and wasteful consumption of minerals;
- Communities, people's groups, and NGOs, need to unite and network more strongly, to resist the increasing take-over of sensitive areas for mining.

Mining activities are impacting some of the most ecologically sensitive areas of the country, many of which form crucial water catchments, besides supporting rich biodiversity and providing secure livelihoods to tribal and other communities. While one or the other individual instances of mining threats to ecologically sensitive areas has been in focus until now, its time to take stock of the national picture. A new report by Kalpavriksh, titled 'Undermining India - impacts of mining on ecologically sensitive areas' states that at least 90 sanctuaries and national parks and hundreds of other ecologically sensitive areas across the country - in the Western Ghats, Eastern Ghats, Aravallis, Coasts, Central forest belt, North East Hills, Western Himalaya, and natural desert areas - are threatened by existing or proposed mining activities. A few examples of mining threats to ecologically sensitive areas which are water catchments are: proposed bauxite mining in the Eastern Ghats in Andhra Pradesh which will impact the catchment of the Machkund, Sileru, Gosthani and Sharada rivers; mining in Bailadila in Chhatisgarh which has made the Sankhini river into 'lal pani'; iron ore mining in the Western Ghats impacting the rivers in Karnataka and Goa such as the Bhadra and Zuari; iron ore mining in the Saranda forests of Jharkhand impacting the Koina river; limestone mining in the Hemwalghati in Uttaranchal. Many of these areas are crucial to our long-term water security, thus it is vital for the country to safeguard these areas through appropriate land use planning, including comprehensive designation of 'off-limit' areas where no mining can be permitted. This also requires a critical examination of current development policies, including those in the mining sector, to see how they are impacting our ecological as well as livelihood security, especially of the most under-privileged sections of society who are dependent on natural resources. Finally, it requires introspection on the very many wasteful ways in which we use minerals, including luxury minerals like diamonds, marble, granite, and gold.

While a substantial number of the mining threats listed in the report are from ongoing mining (both large and small), a major threat to many ecologically fragile areas is from new mining as the liberalisation of the mining sector in the past few years has 'opened up' access to more areas. Since 1996, 65 large prospecting licenses covering over 90,000 sq. kms. of area have been granted and since 2000, 119 reconnaissance permits covering over 1,55,000 sq. kms. have been given. A closer look shows that many of these overlap with some of the most ecologically rich and culturally sensitive areas in Rajasthan, Chhatisgarh, Maharashtra, Orissa and Jharkhand, and more are to come. For example prospecting licenses over large areas and now reconnaissance permits swamp the area around Udanti sanctuary in Chhatisgarh, one of the last homes of a viable wild buffalo population and a tribal area. In January 2001 it had been reported that a company granted a prospecting license here had illegally removed soil from the Udanti sanctuary and that government of India had ordered an enquiry. But what is more of concern is the legal destruction which is taking place and is likely to further place in the coming days. While reconnaissance and prospecting does not amount to mining, the writing is clear on the wall. A reconnaissance permit holder or prospecting licensee has been given preferential rights for obtaining a prospecting license or mining license in these areas. Therefore provisions in the National Mineral Policy, 1993, such as: "Mining operations shall not ordinarily be taken up in identified ecologically fragile and biologically rich areas" are regularly violated by other rapid changes taking place in the sector to facilitate mining in ecologically fragile areas.

India's environmental and forest policies and laws have some provisions to counter this trend, but in a climate where the general development policy itself is in contradiction, their implementation is poor. Moreover, dilutions have taken place over the last few years. The Coastal Regulation Zone notification has been amended repeatedly to permit mining in sensitive coastal areas, while environmental public hearings were done away with for mining leases of major minerals upto 25 ha. It is important to note that 50% of India's mining leases for major minerals and a much greater percentage of leases for minor mining leases are less than 25 ha in size! The status of ecological restoration of mines in the country also remains poor, contributed by a lack of a clear statutory framework and apathy from the miners.

The fact that there is a great overlap between our forest resources, tribal areas and minerals, compounds the situation. The last few years has seen several struggles by tribals and other local communities against mining which threatens ecosystems and liveli-

hoods, as also the emergence of the Mines, Minerals and People network to respond to the rapid changes in the mining sector from a people's perspective. Examples of peoples struggles include those of tribal communities in Kashipur, Orissa, against bauxite mining in the Eastern Ghats, tribals in Andhra Pradesh against proposed calcite mining around the famous Borra Caves, and villagers in Hemwalghati in Uttaranchal against limestone mining. There have also been recent attempts to amend constitutional provisions protecting tribal rights and preventing land transfer in notified tribal areas called scheduled areas, to allow access to private companies to mine in scheduled areas. Although this move has for the moment been thwarted by tribal activists, the threat is far from over; indeed the 10th 5-Year Plan Approach Paper recommends action to remove impediments in the way of such 'development' projects in scheduled areas.

Given this background, Kalpavriksh feels that development activities like mining can be sustainable and sensitive only if the overall planning and decision-making in India themselves are oriented towards the twin objectives of ecological security (including conservation of ecosystems and species) and livelihood security (especially of the most under-privileged sections of society who are dependent on natural resources).

Some of the key actions recommended by the report 'Undermining India' are:

- Government of India to urgently take stock of ecologically sensitive areas in the country impacted by existing mining activities or likely to be impacted by future mining.
- Ecologically sensitive areas and biodiversity, especially water catchments, to be safeguarded through appropriate land/water use planning and clear, long-term designation of areas where no mining should be permitted. This includes phasing out of existing mining in ecologically sensitive areas.
- More stringent, participatory, and transparent Environmental Impact Assessment procedures, to be applicable to all sizes and categories of mining under the environmental laws.
- Identification and prioritisation of mine-affected areas in ecologically sensitive areas for ecological restoration and evolving a clear framework for the purpose.
- A comprehensive review of ecological and social impacts of economic and mining sector reforms, including the impacts on biodiversity, on water resources, on local residents or nomadic communities traditionally using the areas affected by mining, and so on.
- The rights of tribals and other communities, and the letter and spirit of constitutional provisions in place in specially notified tribal areas such as 'scheduled areas', to be respected.
- Comprehensive action plans to be framed for 'just-transition' to safe and sustainable livelihoods for labour impacted by stoppage of mining activities in ecologically sensitive areas. Sudden blanket bans without provisions for alternative livelihoods for labour involved in ongoing legal mining in ecologically sensitive areas is unacceptable.
- Government of India to setup a taskforce with experts from within and outside the government to evolve a strategy and action for appropriate material and energy use, especially to reduce and eliminate luxury and wasteful use of minerals, and to meet our legitimate material and energy needs sustainably.
- Communities, people's groups, and NGOs, to unite and network more strongly, to resist the increasing take-over of sensitive areas for mining.

Natural Dyes and Biodiversity

Uzramma

Dastkar Andhra, Hyderabad

The paper examines past and present practices of natural dyeing in India, as reference points for future interventions by catalyst agencies, State, international, and local.

With the invention of chemical colours in Europe in the 19th century, a sustained process that took 20 years and a substantial investment, the practice of natural dyeing in India, and the cultivation of dye-bearing plants, once significant parts of India's economic activity, died out. The history of indigo, the most important of Indian natural dyes, illustrates how a traditional dyeing practice thriving over millennia, was destroyed by commercial interests through their use of science for profit.

Natural dyeing was related not only to cultivated plants such as indigo and aal [*Morinda Tinctoria*], but was intricately linked with forest plants and the lives and occupations of forest-based communities, such as the Bhutias. The crucial point is that the continued survival and well-being of the forest as a resource for natural dyeing is dependent on the close integration of local user communities with the forest.

Indigo dyeing was practiced as part of the production process of the Ilkal saree in Karnataka, worn by literally hundreds of thousands of women in Kanataka and Maharashtra. The dyeing, weaving and marketing of the Ilkal saree, an activity practiced on a huge scale, involving thousands of producers and crores of rupees has never been given its due recognition. The only economic occupation of a forest based community in Orissa is to dye with one plant, aal [*Morinda Tinctoria*].

The artisanal practices of printing using natural dyes in Gujarat, Rajasthan, and Andhra continue to produce a variety of beautiful and highly desirable fabrics with no environmental pollution.

The paper examines the role of the State, past and present, and other governmental and non-governmental agencies, in their relation to natural dyeing practices. Though NGOs have played an important role in the revival of natural dyeing practices, there are limitations to what they can accomplish: ultimately natural dyeing practices must establish their own contemporary market linkages.

Natural dyeing is a double-edged sword. Linked to its local users it can be a powerful tool to regenerate local flora. But if it is separated from user communities through commercial intermediaries it can be an equally powerful force in the depredation of the resource base.

The paper finally suggests policy and methodology for future interventions.

Nomadic Pastoralism and Biodiversity

P. Vivekanandan
SEVA, Madurai

1. Introduction

Pastoral communities depend upon rearing of domestic animals for their livelihood and survival. There are roughly 40 million pastoralists in our country. Due to their higher dependence on animals, pastoralists are successful in developing breeding practices that help to protect and enhance animal resources. Their breeds are often considered superior by farmers. Pastoralists raise animals under conditions close to those obtaining in the wild therefore the breeds kept by them are most likely to retain those traits that are of greatest interest from the genetic resource angle (Ilse, 2000). Therefore, due to being directly responsible for the well-being of their animals, pastoralists seem to be predisposed for a crucial role in the conservation of domestic animal biodiversity.

The Union Ministry of Environment and Forests has initiated the process of formulating a National Biodiversity Strategy and Action Plan in collaboration with Kalpavriksh and for which one of the sub thematic review papers commissioned is on "Pastoral Nomads and Biodiversity". SEVA (Sustainable-agriculture and Environmental Voluntary Action), a member of LIFE (Local Livestock For Empowerment of Rural Poor) network has conducted case studies based on field level group discussions or workshops with the pastoral communities, NGOs, - Govt. officials and academics during May 2001- December 2001 for the purpose of preparing an action plan under the sub theme ' Pastoral nomads and Biodiversity'.

This paper is based mostly on actual field information recorded rather than collection of secondary information or data.

2. Pastoral Communities and Biodiversity Conservation

Pastoralists are devoting their life in the upkeep and maintenance of native breeds of animals. These animals adapt to the region or environmental situation and provide livelihood support to the local communities. Such local breeds are the result of many hundreds of years of natural selection and selective breeding practices followed by the traditional pastoral communities. The breeding goal was not primarily to increase the productivity in terms of meat and milk but according to the local requirements viz., survival under high environmental risks, draftability, good mothering instincts, herd ability, loyalty to the owner, ability to walk long distances or climb steep slopes, aesthetic or cultural preferences etc.

Some examples of pastoral groups responsible for conservation of breeds or species are listed below:

Todas of Nilgiris	:	Toda buffalo
Irulas of Thalavadis	:	Toda buffalo
Van Gujars of Himalayas	:	Local buffalo
Raikas in Rajasthan	:	Naricattle, Marwadi camel , Merwadi camel (one humped) Bagalisheep, Sonadi sheep, Boti sheep, Tepli sheep, Kali goat, Majjetti goat
Rabaris in Gujarat	:	Gir and Kankrej cattle
Rath Muslims in Rajasthan	:	Rathi cattle, Sahiwal cattle

Ehtnic Communities of Tamil Nadu

(Naicker, Udayar Pallar, Konar,	:	Malaimadu cattle breed
Moopar, Reddiyar, Thevar,	:	Umblacherry cattle breed
Pallar)	:	Vembur sheep, Meicherry sheep, Sandynella sheep, Kachakatty Karuppu sheep
Dhangar Gowli in Maharastra	:	Deccani sheep
Dhangar Gowli in Karnataka	:	Dhangar cattle breed
Gaddis in Shiwalik Hills	:	Gaddi sheep/goat breed
Kurma/Golla of Andhra	:	Deccani Sheep/Osmanabadi goat breed

3. Methodology

SEVA has conducted workshops and discussion meetings with traditional communities, pastoral nomads, tribals and farmers who are directly responsible for conserving native animal breeds.

The Details of Workshops/Meetings Held	
Place where meetings organized	Date
1. Brain storming session with representatives of herders groups and scientists – Madurai	23.5.2001
2. Workshop with herders, tribals and village forest committee representatives – Pilavukkal Dam, Srivilliputhur	12.7.2001 and 13.7.2001
3. Discussion meeting with herders groups Vembur village, Thoothukudi District	14.7.2001
4. Workshop with cattle herders, University Scientists and Govt officials at Umbalacherry village, Nagapattinam District	18.7.2001
6. Discussion with pastoralists in Gholiya village Banaskantha District, Gujarat	28.8.2001
4. Discussion meetings with representatives of tribals, Forest officials and NGOs at Thalavadi	7.9.2001
5. Workshop with Toda tribals and Scientists at Sandynella, The Nilgiris	10.9.2001
7. Discussion meeting with LIFE Network Members, Pune (LPPS, ANTHRA, SEVA)	15.10.2001
8. Documentation of Indigenous knowledge Practiced by Raika Pastoralists, Sadri, Rajasthan	26.2.02 and 27.2.02
9. All India Pastoralists and Herders meet, Sadri, Rajasthan	23.03.2002

4. Pastoralism and Holistic Resource Management

Pastoralists are living under different environmental conditions and often migrate from place to place. They usually follow rotational grazing system that is congenial to the local situation. (examples : after the harvest of wetland paddy when the season is dry i.e. Jan 15 - July 30, Umbalacherry herders in Tamil Nadu promote "Kedai" (temporary herd pooling from farmers) for community grazing for a period of 6 months; when the south west monsoon begins coinciding the cropping season the Raikas in Rajasthan migrate along with their animal herds for distant pasture land.)

The majority of the pasture lands which have been existing for many centuries were very recently converted into lands planted with introduced plant species (Eucalyptus in Nilgiris, Pines in Siwalik Hills and Prosopis in Kutch region are typical examples), thereby threatening pastoralism. Pastoralists contribute to grazing which is important tool to manage ecosystem viz. watershed, cropland and forests. In some forest zones, too much growth of grass leads to wildfire or pasturelands without animals are poorly maintained ecologically compared to those with animals. Dunging, urinating, salivating and trampling of animals play a complimentary role in managing the ecosystem (Allan Savory 1990). The interaction between domestic animals versus wild animals, domestic animals versus forests, domestic animals versus cropping lands, domestic animals versus local cultural richness are reviewed based on ground realities:

4.1. Domestic Animals Versus Wildlife

Local breeds often have a history of interaction with wildlife and habitats have evolved through grazing pressure from both wild life and livestock. Local breeds and species may therefore even be necessary to maintain an ecological balance and to conserve the specific ecosystem (Ilse 2000). In the Bharatpur bird sanctuary in Rajasthan, buffaloes were initially evicted from the park area. However without their grazing pressure, certain types of vegetation started to over grow bird-nesting habitats. This led to readmission of buffaloes (Ilse 2000). With regard to Kumbalgarh sanctuary (Rajasthan) pastoralists maintain that browsing by camels actually increases the tree growth rates (Ilse 2000). Forest fires caused greater damage in ungrazed areas covered with tall grasses in giant squirrel sanctuary areas from where 'Malaimadu' cattle is being evicted from forests. (Benitto Paulraj 2000)

The increase in population of wild animals occasionally make use of domestic animals (calves of Malaimadu cattle preyed upon by panthers) in their wild habitat for their survival. In Nilgiris annually 100-150 Toda buffaloes are preyed upon by wild animals like tigers.

In Kutch area pasture land and nomadic Rabaris are responsible for conservation of carnivore biodiversity (Indian wolf, striped hyena, caracals, desert cats, jungle cats and leopards) which survives basically the traditional land use practices and sheep herding evolved and preserved by cultures and traditions over thousand of years (Yadvendradev V. Jhala - 2002). By proper understanding the survival pressure the need for keeping a balance rather than exclusion of domestic animals from forest grazing is to be relooked and co-existence policy experimented. Joint conservation of both wild life, local breeds through people participation is need to be promoted.

4.2 Pastoralism and Agro Ecosystem.

Pastoralists follow rotational grazing system which is congenial to the local ecosystem. For example ' Malaimadu ' cattle sent for forest grazing when crop is cultivated in the plain lands by farmers. After the harvest of crops cattle are allowed to graze the left over stubbles on the harvested field. During that time cattle are used for penning which in turn increases the fertility of the soil. In Cumbum valley without the large quantity of dung supplied by ' Malaimadu ' cattle, the land may not sustain its productivity which produces cash crops such as paddy, grapes and banana. The sustainability is a matter of land and cattle existing together and depend upon each other for their mutual up keep. Herders derive income through sale of dung and it sustains their activities in the long run. There is a symbiotic relationship between sedentary farmers and transhumant pastoralists which promote ecological agriculture and survival securities.

4.3. Pastoralism and Joint Forest Management

Joint Forest Management, which is supposed to be participatory resource management, is actually threatening the conservation tradition of the pastoralists. For example all places where village forest committees (VFCs) have been promoted in Tamil Nadu, watershed work is carried out by planting of saplings without any consultation with the local pastoralists/herders and sudden closing of traditional grazing area as well as pathways for passing over the planted site is totally blocked. All of a sudden grazing permit is stopped and herders are fined if their animals enter the traditional pasture land (new converted into planted area). In all the VFCs the forest range officer and District Forest officer carry out the watershed work directly without channelising the funds through VFC account. Therefore in the large scale afforestation work local people especially pastoralists and herders are alienated, neglected and threatened. A population of 12,000 cattle of ' Malaimadu ' breed is on the verge of extinction mainly due to this type of attitude and conflict in Srivilliputhur, Rajapalayam Taluks of Virudhunagar District and Peraiyur Taluk of Madurai District. Similarly ' Dhangar Gowlis ' tribals in north Karnataka are considered as enemies of forest due to their local cattle owned by them. Raika pastoralists owning camels are facing problems in Kumbhalgarh Reserve Forests in Rajasthan. Since 1993 Gaddi shepherds and Van Gujars got excluded by the Governments of Punjab and Himachal Pradesh when they set up Joint Forest Management; their traditional role as partners in participatory use in grazing has been nullified and as a consequence their commitment to managing biodiversity and sustaining tree and grass cover has eroded (Minoti Chakravarty- Kaul 2002).

4.4. Pastoralism and Common Property Resource Management.

Poor management of common property resources affects the access to grassing and quality drinking water. It is due to encroachment, less attention and market economy.

(Examples: In Kutch area of Gujarat introduction of *Prosopis juliflora* spread the entire area about 20 years back which affected the banni grazing lands. In addition entry of pastoral groups from other region increased competition and put pressure on the already reduced pastureland and water. In Rajasthan, the allotment of gochar land for private use at the discretion of District Collectors is undercutting their resource base of grazing land.

In Toda tribal settlement areas viz. Mandus of Nilgiris the drinking water reservoirs are polluted by Industries (Rallis India, Hindustan photo chemicals).

The Savanna grazing land which occupied an area of rolling down 60 k.m.length and 40 k.m.wide in Nilgiris is on the verge of disappearance due to the wrong afforestation policy of the Forest Department of introducing species like eucalyptus, pine tree and wattles. About 85 percent of the original pasture ecosystem has been converted into planted area (the current area of grassland is reduced from 29,875 ha to 4700 ha) depriving the traditional grassing rights enjoyed by the Toda tribe over centuries (The Toda lands covering an area of 2948.67 acres is almost encroached by Forest Dept. through eucalyptus plantation). Very recently a dialogue initiated with the District Forest Officer Ooty -North, the Forest Dept.is likely to consider to cut down eucalyptus plantation and return the Toda lands for reverting to original pastureland (Keya Acharya 2002). In Umbalacherry village pasture land over an area of 105 acres is encroached upon by local vested interests which is crucial in the breeding tract of Umbalachery breed in Nagapatinam District of Tamil Nadu.

Construction of dams affects the pasture land and a typical example is construction of Ranjit Sagar reservoir across the river Ravi inundated large part of Shamilat van which excluded the Gaddi shepherds and graziers who had used these forest pastures as

common property resources since time immemorial (Minoti Chakravarty - 2002).

4.5 Pastoralism and Cultural Links

Pastoralism, culture and biodiversity are closely linked. Therefore conservation of biodiversity needs to recognize traditional style of life, their values, attitudes and social institutions imbibed in the life of ethnic communities. Many pastoral societies have instituted restrictions, even taboos on selling female breeding stock to somebody outside the community because they consider it their capital (Male breeding bulls are maintained at Village level by the community in many villages of Rajasthan or maintained as temple bull in some villages of Tamil Nadu ; Toda buffalo bulls are considered as sacred and freely let in the forest. Male camels are gifted as dowry among Raika pastoralists; when somebody loose their animals due to out break of disease or any other reason other members of the community contribute female animals as free donation or at very reduced price). Herders owning small number of animals are pooled together for the purpose of sharing a common bull and 'Kedai' (bigger size of migratory herd ranging from 200-500 animals) is promoted as breeding institution. Buffalo cult is prevalent among toda tribes who consider their buffalo as sacred creature more valuable than gold ; buffaloes are given as gift during the time of marriage, child birth or during funeral (1 buffalo is sacrificed during the death of the tribal members) etc.

Documentation of indigenous knowledge, social institution and cultural affairs of pastoralists and by recognising and incorporating them in development work will strengthen conservation tradition. Undermining these aspects lead to hollowness of our approach without rooting in the very base of development.

5. Factors threatening Pastoralism and Biodiversity

Pastoral nomads or animal stock herders who depend upon animal rearing as their traditional life style are facing problems. Such problems if unresolved will certainly lead to erosion of their culture and loss of biodiversity. The factors responsible for causing erosion of their culture and biodiversity can be examined under the following heads:

- i. Official perceptions of Common Property Resources as 'wasteland'.
- ii. Existing Breeding Policy.
- iii. Role of Government actors and Policy.
- iv. Bilateral Funding Programme
- v. Present Education System.

5.1. Official Perception of Common Property Resources

Pasturelands have officially been viewed as either degraded lands or wastelands. Therefore Forest Department has introduced new exotic species under the false perception of greening the 'wasteland'. Instead of conserving the local grass species of that ecosystem, totally different species have been introduced leading to loss of valuable silvipastoral systems prevalent in that locality. Before undertaking such conversions local people were not consulted. Lack of proper land use planning both at state level and national level poses a serious threat to the traditional resource rights of indigenous communities and livestock keepers as well as to conservation of local biodiversity. There is no understanding of the use of grazing by animals as a tool for ecosystem management.

5.2. Existing Breeding Policy

Existing breeding policies of many states are only designed for maximising milk and meat production. Indiscriminate cross breeding with exotic breeds is destroying our gene pool of local breeds preserved by pastoralists. Government subsidies and soft loans are directed at improving crossbred animals while neglecting local breeds. Conservation of indigenous breeds was not at all reflected in the policy for many decades. While evolving such policy all stakeholders were not involved due to which some of the indigenous breeds have already disappeared. (Example: under the subsidized "Calf rearing Scheme" of Tamil Nadu Animal Husbandry programme only exotic breeds are included).

5.3. Role of Actors of Conservation- Government Functionaries

Herders and pastoralists have always been viewed as enemies of forests by forest officials at field level. The role played by pastoralists and herders are not properly understood by many functionaries of Government Department. In order to protect the forest ecosystem there is always a tendency to exclude the animal conservers by threatening, implicating and penalizing them instead of initiating a process of dialogue and resolution of conflicts. The Animal Husbandry Department, which is supposed to address the problems or difficulties faced by conservers, confines its activities only to the provision of veterinary and insemination services. When real problems faced by pastoralists are not addressed the secondary services extended by Government Department become unwanted and superficial.

The role of facilitator in encouraging co-existence, holistic resource management is not at all understood by the hierarchy orient-

ed Govt. functionaries. They lack participatory skills. The existing social institutions and knowledge of local breeding practices were not documented by the Govt. actors. This has led to the implementation of a blue print model perceived to be superior instead of facilitating a process approach in all developmental work.

5.4. Bilateral Funding Programmes

Conservation Projects or Joint Forest Management projects attract a lot of donor funding. When the work is implemented by the existing Govt. structure, which is not, transformed from its conventional attitude this is dangerous. Govt bureaucracy is resistant to involving actors like NGOs and self initiated community organisations. Lack of training and orientation of forest officials lead to professional ego, selfishness, red tapism and corruption. For example in the Rs.500 crore JFM project of Tamil Nadu even 1 percent money has not been given to expert NGOs for facilitating participatory approaches; external evaluators have not been included for evaluation of this programme over the last 5 years of implementation (1997 - 2002); youth are officially designated as NGOs for monitoring Village Forest Committees instead of NGOs.

In each VFC village Govt. is spending Rs. 30 lakhs for watershed development directly by forest range officer and District Forest Officer without channelising through VFC account. Massive funding programme without any human face only alienate local people and the very survival of their local breeds instead of integrating them for holistic approach.

5.5. Failure of Education System

Govt's policy of bringing literacy at grassroots is laudable. However because of good education all educated youth are consciously or unconsciously oriented towards seeking jobs outside or even prefer to work as unskilled labour in cities. The educated youth are not interested in continuing with the traditional style of life and only interested in migrating to cities. The labour is therefore becoming costly and pastoral families are finding it difficult to maintain their stocks economically. Globalisation of market is also affecting educational policy and leading to faster deterioration of trends.

In the educational system the curriculum (both at school level as well as in the syllabus of agriculture/veterinary/forestry colleges) does not have content on biodiversity and conservation of indigenous animal breeds.

6. The Proposed Action

The Proposed action plan for preserving pastoralism, holistic resource management and biodiversity conservation is summarised below:

Goal: To recognise and enhance the role of pastoralists, tribals and livestock keepers for sustainable management of natural resources, grazing lands and conserving local livestock breeds of animals.

Strategies and Activities Proposed

i. Providing Access to resources (pasture land and drinking water)

- Restoring traditional resource rights of communities (gochar lands in Rajasthan, 'Meichal' purambokku land in Tamil Nadu, British/Jameen recognised pasture lands allotted for traditional pastoralists such as Raikas, Toda tribals, etc.,) Natural ecosystem restoration programme by removing some of the exotic tree species and returning the land for original pasture land with local species of grasses will help pastoralists in restoring their traditional rights. (In Nilgiris Tamil Nadu Forest Dept. should expedite removal of eucalyptus and return the Toda land for their using as original pasture land ensuring social and livelihood securities for Toda pastoralists ; removal of Prosopis sp. from the bunny grass lands of Kutch area).
- Participatory management of common property resources, ensuring that nomadic pastoralists and users are also involved. For this mapping of existing rights and use patterns must precede the development of any new plan for an area.
- Joint conservation management emphasizing co-existence of wildlife, domestic animals, herders and local people through process approach rather than top down approach.
- Conflict management between nomadic pastoral groups and local people through networking.

ii. Reviewing existing breeding policy through consultative process involving all stake holders

- Bench mark survey of pastoral communities conserving indigenous animal breeds for different regions (tasks for Animal Husbandry Department, NGOs).
- Promotion and development of local institutions and breeders associations (Tasks for the NGOs, Animal Husbandry Dept., National Bureau of Animal Genetic Resources, Karnal, NDDB, Anand).
- Undertaking impact study of breeding policy implemented for the last 5 decades. (Tasks for NGOs, State Level Biodiversity Forum).
- Documenting local institutions conserving livestock breeds (Tasks for NGOs/volunteers of communities, ICAR and Agricultural Universities)

- Recognizing livestock keepers conserving local breeds and involving them in future plans.(Ministry of Agriculture,Central Herd Registration Scheme)

iii. **Role model facilitation for Govt. Functionaries**

- Training orientation and exposure visit for Govt. functionaries for purpose of initiating participatory approaches in development work. (For officials of Forest Dept. and Animal Husbandry Dept.)
- Implementation of watershed or conservation work through CBOs and peoples organisations instead of direct implementation by Forest Department (linking PRIs, SHGs and CBOs)
- Involving NGOs for social mobilisation and training.
- Documentation of indigenous knowledge and grass roots innovations in the field of sustainable animal production. This will ensure delearning and shedding of professional ego (Tasks for Faculties of University and Research Scholars and Junior officers of DRDA)
- Enhancing and strengthening the capacity of local institutions and herders/pastoralists groups in addressing their problems (Tasks for NGOs and DRDA).

iv. **Providing Intellectual Property Rights and Rewards for Conservers of local breeds**

- Recognition and rewards for individuals or groups conserving outstanding local breeds.
- Documentation of case studies on improvement of local animals by using local breed bulls over decades
- Revitalizing social institutions responsible for conservation
- Improving economic situation of local livestock conservers (this could be done through developing niche markets for the special products of pastoral communities - someone would need to do market surveys for the same)
- Awareness and support for marketing the products of indigenous animal breeds.
- Recognizing customary rights of pastoralists for access to grazing lands/forests

v. **Bringing Changes in the Educational system**

- Incorporating indigenous knowledge and biodiversity conservation in the curriculum of agricultural universities and veterinary educational institutions.
- Promotion of value based education instead job oriented at school level. School education should impart right motivation so that educated youth will return to their villages and contribute towards holistic development.
- Mobile schools/flexible curriculum for children of pastoral communities.
- Providing fellowship for students returning to rural life for undertaking traditional herding and rearing of local animals for conservation of domesticated biodiversity.

vi. **Networking, Documentation and Dissemination**

- Networking with NGOs, CBOs, and Scientific Institutions for awareness raising and documentation and dissemination of information (including description and characterization of local breeds) about preservation of local livestock breeds maintained by herders.
- Economic empowerment of poor livestock keepers/herders through linkage with various actors and identified niche markets. To facilitate the conservers to develop their own self-governing associations which add value to their produce prior to marketing.

Summary

Pastoralism is the traditional life style still existing among many communities. Pastoral communities are preserving domestic animal biodiversity through their way of life in tune with local ecological situations. In marginal environments local livestock breeds are crucial for sustaining rural livelihoods. These breeds provide a wide range of products or value to local people. These animals require relatively low inputs in terms of fodder, management and health care compared to cross bred animals. However wrong perception of resources, political backing for cross breeding with exotic breeds for the wide diversity of ecosystems, lack of awareness on domestic animal biodiversity have already resulted in the disappearance of some of these breeds and many more are threatened.

Understanding holistic resource management will require learning from indigenous knowledge and social institutions responsible for conservation of local livestock breeds. Grazing, herding and impact of domestic animals is one of the tools of ecosystem management and domestic animals contribute to the well being of human, wildlife and forests.

A viable action plan for revitalization of pastoralism and biodiversity conservation shall take into account providing access to pasture land and water, restoring traditional resource rights, joint conservation management, participatory planning, involving local stake holders while framing location specific breeding policies, recognition and rewards for conservers, local animal breeders and networking for documentation and dissemination of indigenous knowledge based development.

Ultimately there is a need for integrating the customary rights and needs of pastoral communities in JFM/CFM/State biodiversity planning. This will ensure treating the natural grass lands as components of ecosystem. Therefore the natural ecosystem restoration programme undoing some of the past insensitive policies should be given attention and on priority basis (such as deforestation of exotics in the Nilgiris, Siwaliks, Kutch bunny lands should be considered for conservation of traditional land use practices).

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Non-Pastoral Nomads

P.K. Misra and N. Prabhakar
Independent Consultants, Mysore

Non-pastoral nomads have been referred to by a variety of names such as gypsies, travellers, peripatetic, service nomads, commercial nomads, non-food producing nomads, symbiotic nomads etc.

Their presence has been noted all over the world. They are found in almost all parts of India but their presence is noted more in southern, central and western India. They are extremely flexible and adapt different strategies to provide goods and services that are normally not available to local populations. Their multi-resources economic activities compliment rather than compete with trader, pastoral, peasant or even industrial production. Traveling is a condition of their livelihood but its duration, frequency and mode has a lot of variety. They tend to exploit socio-cultural-economic niche and may also combine it with the exploitation of natural niche. They develop appropriate skills to gain acceptance to the settled population. They are generally multi-lingual. The movements of the peripatetic are not haphazard. They are well directed. They maintain their identity.

No reliable estimate of their population is available. Generally non-pastoral nomads were one of the links in maintaining the decentralized and diversified framework of the Indian society.

However, on account of the various factor the diversified pattern of living in modern India is changing very fast. The process of homogenization and standardization is sweeping through the country. This is not only devastating bio-diversity of the country but also the existence of non-pastoral nomads. Their situation is grim. Their goods and services are no more wanted by the settled populations. Their indigenous knowledge is also not required. From being skilled population they have been turned in to unskilled. They are found selling plastic goods, decorative objects and have joined unskilled labour market. For want of survival their hunting, trapping and foraging may have also increased which again may have serious consequences on wild life and pn bio diversity

It is simply not possible to revive their traditional skills or traditional life-styles. The only way is to educate them and train them into new skills. It is absolutely necessary that specific plans for their rehabilitation; education and care have to be developed. To rehabilitate the non-pastoral nomads would require a lot of commitment and patience. Traditionally the non-pastoral nomads have been playing the role of communicants and also imparting popular religious instructions through their trades like displaying deities, relating mythological stories, puppetry and so on. Their these skills and ability to move on from place to place can be imaginatively utilized for communicating modern ideas of conservation and maintenance of bio-diversity.

Paper Industry and Biodiversity

Binode K. Baruah
Independent Consultant, Guwahati

Paper mills have direct influence on ecology and biodiversity due to their consumption of large amount of forest products and simultaneous release of huge quantity of toxic liquid, solid and gaseous waste into the environment. The ecological implications lead to rapid loss of forest cover and pollution in environmental components influencing diversity of plants and animals in the affected areas.

In medium and large size Paper mills the raw materials mostly comprise of bamboo and forest wood for production of good quality of paper. These Paper mills, to produce one ton of paper, consume about 2-3 metric ton of bamboo along with 7000 gallons of water and other chemicals like resin, dye, talcum powder, chlorine, caustic soda, sodium sulphate etc. It has been estimated that one hectare of bamboo plantation provides about 15 - 20 metric tons of bamboo, so, in terms of requirement of bamboo by the large Paper mills with production capacity of 300 tons per day, forest cover of about 60 hectares are being exploited for the purpose of extraction of raw materials. This not only reduces the forest cover but also destroy the habitat of large number of plants and animal species. This is a common scenario of bamboo grown areas of hills and plains in the country including the North Eastern states.

The contribution of bamboo plants towards the conservation of ecology, biodiversity, pollution free environment, prevention of soil erosion and other socio economic values are well established. Forest being a State subject, the policy on bamboo extraction from forest is generally controlled by State Forest Department and concerned Paper mills. The Paper mills are required to pay royalty depending upon the quantum of raw materials permitted for extraction. The extraction is carried out by private parties or contractors with the help of unskilled workers. Technically, bamboo felling is selective and measured cutting and should be under joint supervision of Forest Department and Mill authority. Moreover, there are several schemes for the management of forest resources to maintain the resource supply on sustained basis. In spite of these, indifferent management and overexploitation have led to rapid resource depletion in alarming proportion resulting adverse affect on the biodiversity components of the forest areas.

With reference to pollution, the mills use about 7000 gallons of water to produce one ton of paper, and in turn generate harmful liquid effluent which pollutes the receiving wetlands and soil. It has been estimated that a Paper mill with a capacity of producing 300 TPD paper releases about 2100 M³ effluent alone per hour. The released effluent contain numerous organic and inorganic chemicals and is extremely harmful to aquatic biota and affect the biodiversity of receiving wetlands. The effluent also pollute the soil altering the physicochemical and nutrient status affecting the agricultural yield. Paper mills release gaseous pollutants like dust, sulphides, sulphates, mercaptan etc. from its digesters and boilers and cause air pollution detrimental to man and wildlife. Besides, the solid waste generated by the Paper mills destroy the productivity of large fertile land areas.

In recent years, the demand for paper is increasing in developing country like India. Therefore, to keep a balance between demand of paper and resource exhaustion, it is necessary to minimize the use of forest based resources and maximize the utilization of agro based raw materials as alternative to bamboo and forest wood for the purpose of paper production. Simultaneously, in respect of pollution abatement, use of sophisticated pollution control technology is essential; if it is economically not viable, and the industry has to persist to cater the requirement of the population, more emphasize should be given to develop indigenous pollution control measures to make the Paper mills more eco friendly.

Issues Concerning Paper Industry

1. Management of forest for resource sustenance:- A greater and serious involvement by Forest Department, Paper mills, NGO or environmental activists to suitably design and execute the appropriate management of forest resources including regeneration, prevention of over exploitation, look over the resource development, educating the extracting personnel etc.
2. Monitoring of resource extraction and mill operation:- It is imperative to strictly follow the extracting guidelines under joint supervision of Forest Department and Paper mill personnel. With reference to operational status, the mills should take maximum precautions for efficient functioning of the effluent treatment plants to optimize the reduction of the toxicity of the released effluent and waste water.
3. Promotion of agro based resource/waste utilization as alternative:- Agro based resources like rice straw, wheat straw, jute cut-

tings, bagasse, different types of grasses, waste paper etc. can be used as raw materials for manufacture of normal grade of paper and paper boards. Establishment of such mills should be encouraged by providing support by Government and other organizations.

4. Monitoring of waste receiving ecosystems and environmental impact:- Periodic evaluation of quality of effluent is necessary to assess the pollution load. This will help to take preventive and corrective measures at appropriate time. Overall environmental study covering biodiversity and other ecosystem components is needed to assess the environment impact.
5. Community participation:- Local communities should be involved in growth and conservation of different bamboo species in both plain and hill areas for the purpose of forest resource generation and biodiversity conservation.

Recommendations

1. To follow strictly the extraction guidelines for extraction of bamboo.
2. To involve local people and NGO's to create awareness about extraction, bamboo species conservation and biodiversity conservation.
3. Encourage bamboo plantation, mixed bamboo plantation among the people.
4. Establish bamboo germplasm bank and preservation of seed and seedlings.
5. Application of appropriate technology in the Paper mills for effective reduction of pollution load in the effluent, gases and solids for biodiversity conservation.
6. Regular and effective monitoring of pollution scenario by local people, Government agencies, NGO's etc. for the protection of environment and biodiversity

Pesticides/Toxics and Biodiversity

Bharati Chaturvedi and P.K. Misra
Chintan Environmental Research and Action Group, New Delhi

Introduction

The review-study is based on the premise that since, internationally, there is ample scientific evidence of various chemicals severely impacting wildlife, this linkage would be valid for India as well. This was seen as plausible because of the high levels of various chemicals known to be detrimental to the health of wildlife, found in the natural environment.

The objective of the review-study was to critically assess the extent of the work undertaken in the area and offer suggestions about further work in research and policy-action. It was particularly focused on wildlife. Over 200 articles were studied using the above-described methods. Of these, only 47 were found to be of direct relevance to the issue of toxics and bio-diversity in India. The toxics examined in particular were pesticides, heavy metals, organochlorines not including pesticides and miscellaneous effluents. Expertise from a variety of fields was harnessed to review the found materials and the study was finalized after extensive peer reviews.

Observations

The following observations were made:

- It was seen that there are many studies that have shown links between the health of an organism and the presence of various chemicals. However, many of these studies were laboratory studies, thereby not reflective of the complex synergetic effects in a natural habitat. Out of 47 case studies, only (7) 15% were found to be field studies and the rest, i.e., 85% (40) were are laboratory studies.
- There is a very small body of literature available on the impacts of various toxics on bio-diversity.
- The little information available indicates that many chemicals have been seen to adversely impact bio-diversity health. However, these have been studied only in the context of larger doses, not smaller doses of chemicals that can cause irreversible damage.
- Most studies do not indicate an understanding of the possible impact of toxics on a species. Hence, their own aim is to demonstrate effects rather than address the broader issue of species health or its possible endangerment. There are large gaps in the scientific data on levels of toxic chemicals in wildlife and aquatics and their impact on wildlife of the country in general. As this survey has pointed out, of the available data, most are restricted to investigating the levels of only a few individual organochlorines and organophosphates
- The studies usually do not examine the source of the toxin. They also do not place the results they find in the wider context of impacts on bio-diversity and bio-diversity conservation.
- However, both lab studies and field studies are able to provide us with a fair picture of the possible hazards that various toxins are likely to be creating for bio-diversity. The use of studies done abroad is also useful here.
- A few of the studies also demonstrate that pesticides in India are actually being exported globally as through migratory birds, as these birds were found to have an increased level of pesticide upon leaving India.

In this context, the following recommendations have been made :

I. Recommendations for Research

- a. There is a need for increased field studies taking into consideration a wide variety of known toxics as laboratory studies are unable to take into account the exposure to realistic environmental regimens, movement and quantum of toxics. Cross basin studies must also be undertaken. As toxics also have a global impact, a coordinated effort between known toxic chemicals widely used in India and their impacts on bio-diversity must be undertaken.
- b. Species specific studies, including top of food chain species must be undertaken. Studies on species-specific chronic effects of environmental exposures to individual toxic chemicals are limited and should be further explored. This includes the tiger, elephant, rhino and other big mammals for which there is no data available. Links between disappearing or endangered species and toxics, if any, must be determined.
- c. Study the impact of toxics on biodiversity in highly polluted zones: There is a need to identify and study the impact of toxics on biodiversity in highly polluted zones. For this, collaboration with people's organizations, which are able to identify

polluting establishments or estates, is essential. These toxic hotspots could include tea gardens, areas with a rich bio-diversity where there is agricultural run-off, factories generating organochlorines, such as pulp and paper mills (through their effluents) or chlor alkali plants, pesticide manufacturing units, other cash crop cultivating areas with intensive use of pesticides, specific highly polluted spots, Mining Areas, dumps of fly ash. Investigations must be conducted where cases of drop in the number of species or other abnormalities are reported, verbally, anecdotally or otherwise.

- d. Building Capacity :It is important to improve monitoring facilities to monitor the effect of toxics on wildlife population. The capacity of existing monitoring stations should also be built up to this end.
- i. Bio-Monitoring should be undertaken at the community level as an important tool, because it assists communities to assess the health of their own eco-systems.
- j. Apart from simulated exercises there should be intense dialogue between laboratory researchers and field researchers.

II. Building Networks

In order to be able to work more effectively, it is critical to build up networks of various kinds, which can receive and send information as well as be a part of the monitoring and surveillance exercise. This may be done as follows:

- a. A small clearinghouse of information must be immediately set up in this context.
- b. An exercise to make linkages between toxics and bio-diversity clearer to faculty and researchers, NGOs and communities as well as link with them.
- c. A reporting mechanism must be set up in responsive laboratories and also enable a reporting and feed back mechanism for physiological or other changes in species.
- d. All information gathered about a specific species in an area must be transmitted back to the local population and to the officials and discussed with them.
- e. It is critical to educate the public and build up public understanding, through schools and otherwise, about the impact of toxic chemicals on their natural systems.. Specific campaigns should be funded and undertaken to target adults.

III. Policy Recommendations

- a. A Policy of Chemicals Production and Handling

India at present follows toxics related policies that have neither forward linkages nor backward linkages. In the case of pesticides, there is only no policy being followed at all, but only the Insecticides Act, 1968.

While India is a signatory to the POPs convention, which requires it to phase out 12 of the most deadly POPs, the means by which this can be done is not in place. Many of the pesticides listed here as well those being reviewed are easily available across the counter, despite being banned. There is also no inventory on stockpiles, which accumulate and add to the environmental burden. There is also no move to encourage any biological means of controlling malaria, integrated pest management or improving sanitation and water channeling. DDT continues to be used for malaria control, despite its ineffectual results. Meanwhile, several more pesticides are available for use in household applications, making them even more readily dispersed in the air, water and soil. As there is no extended producer responsibility, their containers, often with residual amounts of pesticide, are left to further contaminate.

Similarly, dioxins and furans, listed under the POPs Treaty, are created through processes like incineration and open burning of wastes. Yet, there has been a spurt in the number of burn technologies (those using incineration, gasification and other thermal means of waste handling, including waste to energy projects.) being approved all over the country. The Ministry of Non-Conventional Energy Sources has a scheme that greatly encourages such technologies and offers both subsidies and loans to entrepreneurs setting them up. No comparable encouragement is given to waste reduction, composting or improved packaging.

It is crucial that zero waste creation, waste minimization and better materials use is also incentivized through institutional support.

Dioxins are also created during various industrial processes, such as PVC manufacturing and recycling, bleaching of paper production, making household cleaners, cement kilns, copper smelting and medical waste incineration. Increasingly, leaching from landfills is also posing a big threat for this reason. While PVC can be phased out in India, as it is being in several uses in other parts of the world, other operations will require cleaner production or substitute technologies.

PCBs are still around in vast quantities. However, there is a need to inventorize these, contain them, completely ban the further use of these and enforce regulations.

Many manufacturing activities intended for export result in creation of chemical pollution in India. A firm re-visit is required for these. Export Promotion Zones should also be re-examined in this light.

Here, while there is no policy framework to phase out toxics, including heavy metals, it is possible to create a framework for their phase out in various applications and create incentives to promote alternatives, as well as minimize their production, apart from handling stock-piles. Both the Basel Convention and the Stockholm Treaty must be adhered to in action and in spirit.

- b. Transparency and Mandatory Sharing of Information : It must be mandatory to make available a detailed database of the components all materials and formulations , as well as their known effects on animals or human beings, entering the market. Similarly, Toxics Release Inventories and the Community Right to Know must be made mandatory.
- c. Extended Producer Responsibility : Some of the existing contamination problems are also due to poor disposal of various goods, such as Ni-cad batteries and computers, after their active use. It must be mandatory for the manufacturer to take them back for proper disposal, failing which manufacturing itself cannot take place.

IV. Protecting Bio-Diversity through Policy

Knowledge about the impact of toxic chemicals on wildlife needs to be incorporated both into the policy framework for wildlife protection as well as regulation and control of hazardous chemicals.

- a. Ring of Fire : Since pesticides and other toxics travel far and wide, regardless of their point of use, a toxics regime must be established around and within buffer zones around Protected Areas and other bio-diversity hot spots. This should examine the use of the organic farming and alternative/less harmful ways of malaria control, as well as best practices for waste handling as all these activities cause toxicity in the environment. However, it is important to note that this is no substitute for actually phasing out toxics in toto, on a global scale.
- b. Curtailing industrial processes that can be potentially hazardous through their emissions or products, situated near or in a Protected Area, must be considered in the light of their impact on bio-diversity and manufacturers should be encouraged to shift to cleaner production
- c. Organic Farming : The Union Ministry of Agriculture is currently considering a policy of encouraging organic farming. However, it is imperative to advocate for greater incentives for organic farming, especially during the crossing over period. It is also advisable to enforce higher pricing and stricter availability of many pesticide formulations. Are there any changes needed in the distribution system which presently advocates pesticides/fertilizers.
- d. Local Involvement : The issue must be placed for discussion and action at the level of Panchayats, which now enjoy more decision-making powers and autonomy after the 73rd Amendment. In this case, it must be linked up clearly with the impact toxics have on human health, including reproductive health.

If bio-diversity is to be protected against a toxics onslaught, it is critical to build up a strong public voice to advocate against the creation of a toxics regime. Being a part of the anti-toxics movement must appear to be an attractive proposition to political leaders and must be made a part of their agenda. A broader coalition of civil society is essential to deal with the problem, even if bio-diversity is not their chief area of concern.

Remote Sensing

N.N. Prasad, S. Narendra Prasad, Pallavi Yadav and Bilal Habib
Salim Ali Centre for Ornithology and Natural History, Coimbatore

The Review Process

The review process consisted of extensive consultations with major National and State level agencies and institutions. These institutions are National Remote Sensing Agency, Space Application Centre Ahmedabad, Indian Institute of Remote Sensing, Regional Remote Sensing Centres, Maharashtra Remote Sensing Application Centre, Andhrapradesh State Remote Sensing Centre, Bihar Remote Sensing Centre, Rajasthan Remote Sensing Application Centre, Karnataka Remote Sensing Application and Utilization Centre, National Atlas and Thematic Map Organization, Forest Survey of India. The consultation process included eliciting information from Envis Centres. ENVIS (Environmental Information System) is a network of subject specific nodes located in various institutions throughout the country. The Focal Point of the present 25 ENVIS centers and over 80 nodes, in India is at the Ministry of Environment and Forests, New Delhi, which further serves as the Regional Service Centre (RCS) for INFOTERRA, the global information network of the United Nations Environment Programme (UNEP) The primary objective of all ENVIS centers is to collect, collate, store and disseminate environmental related information to various user groups, including researchers, policy planners and decision makers. The National Institutes of relevance for biodiversity conservation such as Zoological Survey of India, Calcutta, Botanical Survey of India, Calcutta, Wildlife Institute of India, Dehradun, Indian Institute of Science, Bangalore. Forest Research Institute Dehradun, Bombay Natural History Society Mumbai and various Universities. Very extensive collection of scientific papers, reports and few unpublished Ph. D. thesis and articles published in various scientific journals was done to assess the countrywide experience on use of Remote Sensing and GIS for biodiversity conservation. The themes of relevance are landuse/landcover, wildlife, wetlands, ecosystem processes, GIS application, change analysis and urban application. Nevertheless we still expect vast amount of unpublished reports, maps dispersed through out the country which where not consulted due to lack of resources and time for the present review. We choose to represent this information according to the most recent biogeographic classification consisting of 27 biotic provinces. Obviously, the chief merit of such linking lies in the ready accessibility of information pertaining to the use of Remote Sensing and GIS to a wide range of user groups. The NBSAP process, by itself ,can benefit by accessing this information in the unfolding era of digital domain and knowledge enterprises. Among the variety of datasets that would be involved, spatial (or map) information system will be a major "content". These spatial information sets are vital to make sound decisions at the local, regional, state and central level planning, implementation of action plans, infrastructure development, and disaster management support vis-à-vis biodiversity conservation and management.

Biodiversity Spatial Data Infrastructure (BSDI)

In the above context, particularly, for biodiversity issues, the planned National Spatial Data Infrastructure (NSDI) imitative should be modified to form a Biodiversity Spatial Data Infrastructure (BSDI) either as a separate or part of the larger NSDI initiative. The BSDI should aim to provide and establish an infrastructure, at the National, Regional, State and local levels to make available organized spatial and non-spatial data at multiple hierarchical levels. The BSDI in addition, should contribute to local, National and Global information needs for sustainable economic growth, environmental quality and stability and social progress to ensure overall priority for biodiversity conservation. The proximate goal for such a system is to create databases covering physical, geographical, biological and socioeconomic attributes for storage, retrieval, analysis and dissemination.

Recommendations

We recommend following actions:

1. Establishment of Biodiversity Spatial Data Infrastructure (BSDI).
2. The Proposed National Data Infrastructure should be modified to incorporate the action points for current NBSAP and improved NBSAP processes. We suggest a modified NSDI action plan to work in Collaboration with ENVIS centers.
3. Proposed BSDI should make use of current and historical, spatial and non-spatial data.

Use of Historical Data

- a. Aerial Imagery
 - Establish a task force to prepare a catalogue of aerial photographs (Scale, vintage, stereo capability, nodal agency to work stream procedures to obtain the imagery). This includes data from declassified CIA, Russian source. The Task force will be

multidisciplinary in nature. This will be the main umbrella under which small groups could work.

- b. Past series (editions) of SOI maps at 1:50,000 and 1:250,000 scale should be acquired, digitized- themes related to forests, water body and road, railways and irrigation canal networks.
 - c. Thematic maps based on aerial photographs, FSI maps (Total Number 2200) on 1:50,000.
 - d. Thematic maps
 - Vegetation (NRSA, Hyderabad; FSI, Dehradun)
 - Wastelands (NRSA, Hyderabad)
 - Wetlands (SAC, Ahmedabad)
 - Grasslands (SAC, Ahmedabad)
 - Integrated Mission for sustainable development (NRSA, Hyderabad)
 - Rajiv Gandhi Drinking Water Mission.
 - e. Data Standards/Methodology/Procedures/Monitoring Protocols/NSDI/NRIS
4. Establishment of Web Based Biodiversity Information System at a Hierarchical Level.
This web based information system should include National, State and sub state level hierarchical system. This Web Based Biodiversity Information system should also include Watershed as well as Administrative boundaries and
 5. A reporting and monitoring system.
This may be instituted under the proposed National Biodiversity Authority (NBA) consisting of various ministries, Institutes under well Constituted thematic groups

Research on Agricultural Biodiversity

Sunil Archak and Tejaswani
Agricultural Researcher, New Delhi and Hittalagida Network

Part I. Existing Research Setup on Domesticated Biodiversity

Research and Development activities related to agrodiversity is carried out by National Agricultural Research System (NARS). NARS comprises of Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs). ICAR is a body which controls and directs major part of research work on domesticated biodiversity in the country. ICAR is a vast network of Institutes and Bureaus, National Research Centers (NRC) and Project Directorates (PR). Each one of these Institutes, Bureaus, NRC, PR and SAUs have regional substations located in various agroecological zones in turn covering almost all parts of the country. To avoid duplication and to have proper linkage among researchers working in particular research aspects, and crop across the country, All India Co-ordinated Research Projects have been formulated. In addition, some research activities related to domesticated diversity is also going on at several institutes under Council of Scientific and Industrial Research (CSIR), Research centres and colleges of traditional universities. Research activity in agrodiversity can be mainly classified into i) Exploration and collection ii) Characterisation and evaluation iii) Conservation and iv) Utilisation of germplasm

There are three National Bureaus in the country taking care of domesticated biodiversity. 1. National Bureau of Plant Genetic Resources (NBPGR), New Delhi. 2. National Bureau of Animal Genetic Resources (NBAGR), Karnal, Haryana 3. National Bureau of Fish Genetic Resources (NBFGR), Lucknow, Uttar Pradesh. These Bureaus act as nodal organizations in India to carry out planning, conducting, promoting, coordinating and leading all activities related to domesticated diversity.

Part II. Gaps, Strategy and Action Plan

Major gaps in research associated with domesticated diversity are

1. The need of *in situ* conservation to continue the evolution process has been neglected. It is important to realise that *ex situ* conservation where in evolution process is stagnated, can not substitute *in situ* conservation.
2. Exploration and collection activity can never represent all the gene pool available. Most of the important land races may remain unavailable due to lack of proper information of existence.
3. Along with evolution of local races, information associated with its cultivation, conservation, cooking, and palatability of these diversity have evolved over generations. Hence, collection and recording of knowledge associated with diversity is equally essential along with collection of physical unit of diversity.
4. Hitherto evaluation always aimed at those characters, which can be brought for mass production. However, it is important to realise that need of farmer varies with ecological location, cultural habits and socio-economical conditions.
5. There is an overestimation of importance of High yielding varieties (HYV) against landraces. The thrust to develop HYV for mass production and consumption has neglected the need of sustainability for farmer in producing them.

Action Plan

1. Building of detailed database at each village level indicating existing varieties, available location and knowledge associated with it.
2. Establishing conservation centers at village level as an economically viable activity. These centers should produce and market the local races as a commercial activity. These centers can act as buffering place for *in situ* conservation.
3. Physical handling of the material and handling of all information associated with it should be effectively linked by networking of these centers along with all research centres. There is a need to build up information network between research organisations and *in situ* conservation centers.
4. Major portion of physical handling of landraces can be left with local areas with the local people. However, all the detailed information regarding the characters along with available quantity can be linked across the country with the central linking point lying with National gene banks.
5. The process of germplasm evaluation at research centers should be evolved in to interactive process where in representatives from all strata of the region like marginal/small farmers, women, and tribal community have to involved.
6. Biochemical and phyto chemical evaluation has to be taken up for value addition to land races such as curcumin content in

turmeric; papine in papaya, aroma concentrate in flowers to add commercial value for local varieties. Involvement of private sector in all such activities can be encouraged to give economically sustainable remunerative activity in village.

7. Evaluation of diverse land races should consider nutrition estimation, keeping quality and suitability of the local races for producing processed food items, as a value addition exercise.
8. Considering PGR as national resource, it is important to identify the beneficiaries for hither to existing landraces. There is a need to evolve a fool proof system for assigning rights to individual farmers, villages, communities, or regions.
9. Support price mechanism does not assign any special weightage to land races. There is need to validate the need of it.
10. Henceforth seed with the farmer and knowledge associated with it are made available to public free of cost. With the development in PBR and patents it is important to safeguard this information.
11. There is a need to organize debates and workshops involving all the stakeholders to generate views on various key issues including, a) Supply of germplasm to private sector with appropriate IP attached b) Generation of funds to support future PGR programmes.
12. Complementary comprehensive conservation approach is the order of the day. Any decision-making in this regard requires comparison of the costs, advantages and drawbacks of each method case by case. It is important to make a comparative socio-economical studies as a support for policy decisions.
13. Germplasm registration offers a form of soft IP. There is a need to build registers. Few attempts which have been made to develop biodiversity registers have concentrated on diversity at species level. It is important to realise the intraspecific diversity existing in domesticated plant and animal species. The problems of rewarding farmers rights lies in the basic fact of non availability of authority and authenticated information on the source of these land races. Development of local data banks and registers in local regions inturn would facilitate this.
14. Additions such as multimedia documentations on importance of every step of conservation activities would be beneficial for the whole process. Educational programmes such as UGC telecasts need to be prepared since next step is to inspire the future generations.
15. There is a need to create skilled and committed work force with sound knowledge of legal issues along with background of genetic diversity.
16. NBPGR has a mountain of information for already collected seed material. In addition to documentation of the information, dissemination is also very important. Ways and means should be worked out to provide people these information.
17. There is a need to build a give and take policy between farmers and research institutes in terms of genetic resources.
18. There is a need to initiate studies on impact of multiple cropping, varietal mixtures, fallowing and rotation, organic amendments, flooding, burning, mulching, raised beds, site selection, manipulating shade etc vis-à-vis PGR conservation and management.
19. Productivity of land races have to be assessed over years under farm condition to assign it proper weightage unlike those studies taken up in research stations with optimum condition. Accordingly definite and different needs of resource poor farmers and regions can be addressed with the exchange of material suitable for them.

Thermal Power and Biodiversity

Sagar Dhara
Cerana Foundation, Hyderabad

India's 100,000 MW commercial power generating capacity, 65% by coal-burning plants, is the second largest in Asia. India's plans to increase this capacity, largely by thermal power, is one of the world's largest power augmentation programmes.

Thermal power generation in India will impact biodiversity in this country and the neighbouring ones—particularly, Nepal, Bhutan and Bangladesh—more than any other anthropogenic activity will. This problem has remained unrecognized.

Thermal power impacts biodiversity at the: a) local (<10 km) and regional scales (<50 km), and b) meso (<500 km) and macro scales (>500 km). Local and regional impacts are due to air, water and possible soil pollution as well as disturbance to forests due to downstream industry, services and population expansion around power plants. These impacts are limited in extent and scope. Meso and macro scale impacts occur because of acidic gas (oxides of sulphur and nitrogen) deposition over large areas downwind of thermal power plants. These effects, which manifest slowly, are more injurious to the environment than the regional scale ones.

Thermal power plants emit large quantities of air pollutants—oxides of sulphur, nitrogen and carbon and particulate matter. Air pollutants, except carbon dioxide, are phyto-toxic and cause visible (necrotic foliar symptoms) and subtle (lower plant quality and decreased yields) effects. These effects are particularly pronounced at a local scale.

Thermal power plants also require large quantities of water for cooling systems, which is discharged at elevated temperatures (5-12 degrees Celsius above ambient) into water bodies—streams, rivers, canals, marine waters. In the hotter parts of the country, many aquatic organisms live close to their critical thermal limits. While a 5 degree rise in water body temperature may not impact them significantly, a larger temperature change may alter the ecobalance amongst species—predators, competitors, prey animals and plant foods. These effects, though not well understood, will be confined to the receiving water body and within a local scale.

Coal-based power plants generate large quantities of ash, which are sluiced with water and put into unlined ash ponds. If the soils are porous, as they are in many parts of the country, toxic heavy metals may leach from the ash and contaminate the top level aquifers and the root zone soil layers, which would be inimical to plant and animal life. The effects of such episodes, if they occur, would be confined to the regional scale.

To minimize coal transport, thermal power plants that use Indian coal, are usually located at coal pitheads, which lie in or close to forests in North-central and East India. After a power plant becomes operational, it attracts downstream industries and services, consequently creating a growth pole in its vicinity. Forests close to such growth poles shrink, and that impacts the biodiversity.

Large parts of India, eg, the Deccan Plateau, do not have the requisite surface water resources to support thermal power plants. These water resources are available close to rivers sources, which usually are in forested hills. There is a logic, then, for thermal power plants to move closer to forests. Such a move will impact forests in much the same way as pithead plants. These impacts will be felt at the regional level.

Though a few studies of the impact of air and thermal pollution on individual plant species exist, techniques such as ecosystem analysis have not yet been used extensively to understand regional biodiversity changes in a holistic manner.

For most of the year, upper atmospheric (>1000 m) winds move from the Middle East and over Afghanistan and Pakistan into the Indo-Gangetic plain and take a broad U-turn swing over North-Eastern India before moving into East and South India from over the Bay of Bengal. Indian thermal power plants have very tall stacks (275 m) which push air pollutants into the upper atmosphere. Acid gas emissions from Indian power plants located in the path of these winds in North-Central and East India are picked up by the westerly winds, transported over meso and macro distances, and deposited back to the earth's surface as dry and wet depositions.

Wet deposition data for the last 30 years indicates that rain water has gradually become more acidic in several parts of India. Wet

and dry deposition of acid gases impact terrestrial and aquatic ecologies directly by reducing species density and diversity and altering their mix, and indirectly by impacting their environments by acidifying soils and water bodies and causing forest diebacks.

Studies indicate that soils in the Himalayas (including Nepal and Bhutan), North-East India and in the Western and Eastern Ghats (extending into the Sundarbans in Bangladesh), which have low buffering capacity for absorbing acid gases, may in the coming decades, acidify. Consequently, they may lose their capacity to host the very rich biodiversity they have today. The extent of the impact on these regions is still to be assessed.

India's current emissions of acid gases, currently 5 and 10 million tonnes of oxides of sulphur and nitrogen, respectively, are expected to treble over the next two decades, and may accelerate the acidification process significantly. There is, therefore, an urgent need to formulate and debate the policy measures required to mitigate this problem.

Tourism and Biodiversity

Hari Babu and Syed Liyakhat Parveez
Equations, Bangalore

Policy and Theoretical Framework of the Paper

Tourism has made roadways into numerous spaces on the surface of the earth, encroaching into all types of ecosystems. It has been given a variety of forms and hence due specialisations.

The current trends displayed by tourism raise serious concerns about the way in which it is practiced today. Tourism in ecologically sensitive regions is antithetical to the primary goal of biodiversity conservation. This is especially when experiencing nature is redefined as tourism - an industry that is recognised as capital intensive. The recent tendency to qualify tourism in natural and undisturbed areas, like forests and coasts, as 'ecotourism' or 'nature tourism' is too vague a terminology. The very reason why the tourism industry opted for this terminology was because wherever tourism is practiced, it has proven detrimental to the environment and the social fabric, promoted dehumanising situations like displacement, marginalisation, siphoning off of natural resources and violation of basic human rights of indigenous peoples and local communities.

Indigenous peoples and local communities, who have otherwise been left untouched by traditional tourism activities, are now being targeted for tourism ventures; their homelands and cultures are now the prime target globally for rapid commercialisation and exploitation by the tourism industry. Indigenous peoples and local communities are paying a high price for tourism. To start with, governments, especially of the developing and underdeveloped countries, and multinational corporations have disregarded the interests of indigenous peoples and local communities in their desire to cash in on the billion-dollar profits from this industry.

The effects of these policies are that indigenous peoples and local communities have been evicted from their traditional lands. Their control and access to their traditional homelands has been compromised. They have suffered social degradation brought about by foreign influences and the commercialisation of their culture. The rich biodiversity of their natural resources has suffered from pollution and environmental damage, unable to support the growing number of tourist arrivals.

The few benefits that the indigenous peoples and local communities derive from tourism are far outweighed by the damage it has caused them. They have been made to bear the brunt of an industry over which they have neither say nor control. With globalisation, these threats have been exacerbated. International agreements that open up access to the local tourism industry by multinational tourism corporations will only hasten the exploitation of the natural resources, culture and way of life of indigenous peoples and local communities. Ecotourism, which has been touted as the fastest growing form of tourism in the developing world, has not proven to be sustainable at all. Rather, it has targeted indigenous communities as areas of destination and exploitation in the guise of being environment-friendly.

The Paper deals primarily with gross impacts of tourism activities in major ecosystems identified in India. It also focuses on principles in relation to tourism and biodiversity, and not detailed aspects like ecotourism initiatives in a particular. The section on ecotourism has been included because of the fact that tourism in/around PAs and in eco-sensitive areas is being promoted as ecotourism by many agencies; governments, tourism industry and communities themselves. The rationale of the aforementioned activities is discussed on the basis of existing legal frameworks; the inadequacy of the laws in relation to tourism and biodiversity is highlighted. Wherever laws exist, as in the CRZ Notification, the violations have been pointed out and so are positive developments like Courts ruling against tourism development in certain cases. The developments regarding Convention on Biological Diversity and Commission on Sustainable Development are mentioned in relation to tourism and examined against contradicting process like the GATS; tourism occurs in all these processes significantly. The International Year of Ecotourism is included as a parallel process. Finally, we have suggested a multi-stakeholder process as means to revalorise the role of indigenous/local communities to mitigate the negative impacts of tourism.

Six very important Action Points have been chalked out which deal with the following:

1. The constitutional validity to institutionalise grassroots democracy by the 73rd and 74th amendment

2. The Department of Tourism needs to recognise right of the Panchayats and the need to consult them in tourism development.
3. To make amendments in the clause and bring out elaborate set of guidelines that defines tourism in the Wild Life (Protection) Act 1972
4. The state governments should bring out guidelines for tourism that are site-specific
5. The CRZ Notification to be implemented with more strict measures.
6. Indian commitments in the GATS needs to reflect a bottom up consultative process with state governments and the three concerned central ministries.

Tree Plantations and Biodiversity

A. Damodaran

Indian Institute of Plantation Management, Bangalore

Tree or forestry plantations have been eulogized by corporate and industrial stakeholders for being predictable, reliable, malleable and flexible (Anon., 1998). These virtues speak very little when it comes to their role in biodiversity conservation. Plantations have impacted on biodiversity in complex ways. While, in some cases, plantations have undermined biodiversity wealth, in certain cases, they have facilitated conservation of biodiversity. While the need for conserving biodiversity in India is central, a national programme for development of natural resources is necessary for its success. Accordingly Chapter 11 of the Agenda 21, calls for national forestry action programmes, that promote, amongst other activities, revegetation of degraded areas. Tree plantations, particularly those that are multi-specific in nature could minimize pressures on the India's biodiversity wealth if well designed, structured and managed.

The pattern of relationships between plantations and biodiversity conservation would depend upon the ownership structure of plantations and the target groups to which they cater in terms of their end-products. The view that man-made plantations with their monoculture bias and orientation towards production of industrial raw material orientation constitute a direct threat to biodiversity has been well harped upon particularly in the context of the Eucalyptus debate in India during the 1980s and 1990s. On the other hand the role of man made plantations in improving the biomass base of rural economies and in reducing biotic pressures on protected areas and reserved natural forests has been highlighted by the forest establishment (Lal, 1989).

The impact of farm forests and other public owned forest plantations on agro-biodiversity including livestock and agrogenetic resources has been a much debated issue. The positive impact of multi specific tree-plantations and polyculture agro-forestry systems in increasing the diversity of consumptive and non-consumptive biomass relevant to local communities is a point that is accepted by different interest groups.

The paper has been structured against the backdrop of these issues. This paper examines the typology, evolution and rationale for tree/forest plantations in India from a historical perspective. After taking note of the fact that plantations evolved on account of the limits reached with regard to exploitation of natural forests for supply of industrial raw materials, the paper proceeds to critically survey the principal sustainability issues concerning tree plantations in India.

The paper attributes the failure of forest plantations in India to their harmful ecological and social effects. This in turn can be attributed to many reasons including inappropriate and improper choice of plantations sites. The paper argues that apart from being ecologically unsustainable in a large number of cases, plantations have not been successful even in the narrow economic sense. In other words tree plantations in India have, notwithstanding a few exceptions, been neither conducive to biodiversity conservation nor to economic success. However these facts do not take away the intrinsic strength of plantations as a reliever of biotic pressures on natural forests and agroecosystems.

The paper argues that plantations have to be multi - specific if they are to properly serve their mission of saving the biodiversity of natural forests. Therefore the solution to the present problems associated with India's tree/forestry plantations lies in adoption of a slew of measures to improve their sustainability. The paper suggests a matrix of sustainable plantation activities for biodiversity conservation in India.

Urban Biodiversity

Ulhas Rane
Bombay Natural History Society, Bangalore

Some 10000 years ago, development of agriculture on one hand and domestication of animals on the other hand made a significant impact on human evolution. Fertile land and water attracted human settlements. Villages grew into towns - cities - metropoli - megalopoli. In 1900, less than 10% of the world's population lived in cities. In 1920, it increased to about 14%. Then there was a sudden ascent, climbing to 40% by 1980 (Sadik, UNPF, 1988). In the third millennium it is likely to be over 50%. The destruction of urban biodiversity is going to have adverse impacts not only on urban areas, but also on surrounding rural areas.

It is obvious that this issue has to be tackled with a rational, objective and a broad based approach. The democratic country of India has a structure for policy decisions at various levels. Elected representatives of people take policy decisions, which are then implemented by the bureaucracy. A broad base and long term visualisation for policy planning requires inputs from a multi-disciplinary team, consisting of technical experts, sociologists, academicians, economists, planners, politicians and representatives of research institutions, universities and also voluntary organisations.

All policy norms should become a part of the design, approval and implementation process. This will encourage planners to work out design solutions for possible environmental problems. This whole exercise can be efficient and successful if everyone involved open up their minds and started looking at the broader issues of planning. To begin with, therefore, it may be necessary for Town Planners to become Regional Planners, Architects to become Planners and Landscape Architects to become Landscape Ecologists. Similarly a close coordination amongst planning authorities at the national, state, district, city and village level becomes essential. The planning policy considerations from the angle of Urban Biodiversity will have to be at National, Regional and Local levels. Similarly, biodiversity considerations should be two-fold: natural ecosystems and man-made ecosystems.

After carefully looking at the global and national scenario in the field of development and environment and the prescribed traditional and modern town planning norms or standards and balancing them with the environmental and ecological needs, some realistic norms could be worked out:

A. National Level

Natural Ecosystems (forests etc):	33.33%
Green and Open areas (fields etc):	33.33%
Human settlements (villages etc):	33.33%

B. Regional Level (for Urban Centres)

Natural Ecosystem (forests etc., very minimum human intervention):	33.33%
Green areas (man-made greens i.e. fields, parks, gardens etc):	33.33%
Intensive urban area:	22.22%
Area with potential of urbanisation:	11.11%

C. Local i.e. City Level

Natural Ecosystem (forests etc., minimum human intervention):	10%
Green areas (parks, gardens etc.):	15%

The above strategy, a combination of development norms and guidelines for conservation and rejuvenation of biodiversity, is broad based and could be detailed out by the local planning authorities considering the local conditions and parameters. It may be noted that it takes care of balanced development at the national, regional and local level, without compromising on natural environment. It has been an accepted norm for the sustainable land use of the country to maintain an equal ratio for forests (1/3), agriculture etc. (1/3) and human development i.e. cities, villages, infrastructure etc. (1/3). The existing forest cover in India is about 19% and the new act proposes to bring it up to 33.33%. This will be of great benefit for the country's natural biodiversity. In turn, this strategy will also help urban biodiversity. Presently, there are no strict norms for the development of cities and villages (i.e. the

remaining 1/3). The strategy adopted here for urban planning would ensure an additional 45% (10% forests + 15% gardens + 5% roadside plants + 15% greenery in the side open spaces of buildings) of this 1/3 area, thus making it an additional 15% of the urban green area.

At the city level, the proportion for development (residential/commercial/industrial) is maintained at 50%, considering the intensive needs. This is above the existing norms (approx. 40%) of the most metro cities. This intense development at the city level will be mitigated because of the increased greenery at the regional level. Similarly, the proportions of open spaces are allocated in appropriate proportions as natural forest and man-made parks and gardens giving reasonable allowance for the indigenous biodiversity. This proportion is also retained at 25%, which is above the existing norms (10% to 15%). Over and above this, additional provision for urban biodiversity is allocated within the built environment by using the infrastructure of roads and railway as green corridors.

This combination will take the proportion of green spaces much above the normal existing town planning standards, thus giving a chance for rejuvenation of urban biodiversity even in the existing expanded towns. This involves neither a compromise for development nor for the well being of the natural environment. This will provide a balanced strategy for sustainable urban growth.

¹ This note is largely based on the ICSF Working Paper titled 'The Impact of TRIPS and the CBD on Coastal Communities', by Anna-Rosa Martinez Prat (2002, to be published), International Collective in Support of Fishworkers.