

A Landscape Approach to Managing *Terai* Ecosystems with Reference to Uttar Pradesh (UP), India

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Abstract

One of the reasons for the rapid loss of grassland habitats and their allocation to disparate landuses during the past several decades has been the popular belief that grasslands, unlike woodlands, are economically unproductive. The *Terai* grasslands were not an exception. Following the emergence of an ecological perspective, however, the managerial approach is changing significantly in favour of maintaining the existing wild grassland habitats. The *Terai* in Uttar Pradesh, India, is located within the biogeographic province 07 A, the upper Gangetic Plains, and is estimated to extend over approximately 11,200 sq.km, 19% of which is included in Protected Areas (PAs). Grasslands account for 16% of the extent of the PAs, the rest is highly fragmented and degraded.

The Dudwa National Park (490 sq.km), the Kishanpur Wildlife Sanctuary (204 sq.km) and the Katerniaghat Wildlife Sanctuary (400 sq.km) constitute one of the significant PA clusters. They represent 12 major vegetation communities and contain at least 24 plant species of conservation importance. The endangered species of animals include at least 12 mammal, 29 bird, and 5 reptile species. The Dudwa National Park has a reintroduced population of *Rhinoceros unicornis* and Katerniaghat is contiguous with the Royal Bardia National Park, Nepal. The PAs are situated within a landscape of *Shorea robusta* dominated forests, sugar cane and paddy fields, scattered hamlets, and small townships and thus have a large interface with a variety of human activities, several of which are significantly dependent on the resources of the *Terai* ecosystem. This inevitably leads to conflicts arising from the seeming contradictions between the ecological and the socioeconomic concerns. While the wildlife management practices within the PAs are a mix of traditional approach and innovative experiments in the abutting managed forest, there is little focus on wildlife habitats and ecosystem functions.

Wildlife management plans typically address the PAs alone, likewise forest working plans address only the managed forest, and there is some mismatch of objectives between these two categories. The influences and issues affecting the PA management in the larger context of the landscape go unanswered by default. To secure the ecological interests in the *Terai* grassland ecosystem, it is necessary to adopt a landscape approach to management planning that incorporates hierarchical spatial scales capable of addressing ecological and biological concerns ranging from those at micro habitat levels to those at the levels at which concerns for habitat corridor connections, metapopulations, ecological processes, functions, and socioeconomic aspects can be addressed and demonstrated. This is discussed from the management standpoint.

Introduction

In India, there are broadly five kinds of grassland ecosystem: the alpine pastures in the Himalayas above the timber line; the montane grasslands in the shola-grassland system of the Western Ghats; the *Terai* grasslands south of the

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Himalayan foothills, together with the Indo-Gangetic and Brahmaputra flood plains; the grasslands in the arid zone of Western India; and the grasslands of anthropogenic origin in peninsular India (Dabadghao and Shankamarayan 1973; Puri *et al.* 1983). Each of these grasslands is represented in the lands controlled by the forest department, which is the custodian of wildlife and natural ecosystems in India. In the popular perception, the importance of grasslands is seen only in their utility for grazing livestock. The foresters till very recently considered them unproductive, and administrative and political decisions in favour of regional development have diverted large tracts of grasslands to other uses. Grasslands are overgrazed, subjected to uncontrolled fires, taken over by an abundance of weeds, and subjected to degradation. They are thus among the most threatened ecosystems. Of the estimated 11,200 sq.km of *Terai* in UP, 19% lies within Protected Areas (PAs). Grasslands constitute 16% of the total area of the PAs; the remainder is highly degraded and fragmented (Qureshi *et al.* 1992). This paper addresses some of the broad issues relating to the management of *Terai* ecosystems using a tract of *Terai* in the Lakhimpur-Kheri district in Uttar Pradesh as an example, and makes suggestions in favour of adopting a landscape approach in management planning.

Grasslands in Managed Forests

The first organised scientific approach to managing forests in India dates back to the year 1861 in Central India, which is now a portion of Madhya Pradesh. The Forest Department was established in 1865 and the years till the turn of the 19th century saw surveys, demarcation, and consolidation of lands being undertaken to bring these under the control and management of the Forest Department (Forest Research Institute 1961).

The first forest policy of 1894 (Government of India 1894) recognised the economic dependence of pastoral communities, and of others who reared cattle, sheep, and goats on grasslands. In view of their scattered nature, and the limited resources of the Forest Department, most such lands were either excluded from government control or were more or less ignored since they were not 'productive' in the sense of producing timber or other economically valuable products. The policy did not have any reference to wildlife or, understandably, to the ecological productivity of grasslands.

The next National Forest Policy of 1952 (Government of India 1952) included most grasslands under the category of village forests in recognition of their utility as grazing areas for cattle and production of fodder, most of the remainder were included in unclassified or vested forests. The biological values and ecological functions continued to be ignored, and *ipso facto* grasslands were considered unproductive in the foresters' lexicon.

The *Terai* in the Lakhimpur-Kheri district of UP, like the *Terai* elsewhere, was malarious and also inhospitable for other reasons, such as its swampy nature, the extensive tracts of tall wet grasslands, and the abundance of wild animals, several of which were formidable and potentially dangerous to human life. Post independence policy encouraged the refugees from western Pakistan to settle in these areas. These homeless and hardworking people drained swamps, reclaimed grasslands, and set up the origins of an agricultural system of paddy

and sugar cane that now occupies large tracts of *Terai*, causing extensive fragmentation of the *Terai* grasslands.

The *Terai* Grasslands of Lakhimpur-kheri

Although the *Terai* grasslands are unique in their structure, composition, biological and physical attributes, and ecological functions, they cannot be seen in isolation from the matrix of forests (woodlands) and other categories of land uses within which they are located.

During the turn of the 19th century, the interest of the Forest Department in the *Terai* of Kheri district was focused on the great forests of sal (*Shorea robusta*) in the upland areas. In the mid 1800s these forests were regarded as wastelands and covered under the Wasteland Rules of 1860 (Rizvi 1979). Subsequently, the forests produced a major proportion of the railway sleepers derived from sal timber in this region (Sawarkar 1988a). The area was renowned for tigers (*Panthera tigris*) and swamp deer (*Cervus duvauceli duvauceli*). Notwithstanding the richness and diversity of wildlife, no management efforts for wildlife were invested in this area prior to 1958.

The first attempt to establish a protected area (PA) was during 1958 when Sonaripur Wildlife Sanctuary (WLS) was created for conservation of the swamp deer (16 sq.km). A series of enlargements resulted in the establishment of the Dudwa National Park (490 sq.km) in 1977 along the Indo-Nepal border (Singh 1983). The park now has an additional buffer zone of 190 sq.km. Thirty kilometres south of Dudwa and across the Sharda river, the Kishanpur Wildlife Sanctuary had been established in 1972 (201 sq.km). The Dudwa and Kishanpur PAs together with Dudwa's buffer zone were declared the 'Dudwa Tiger Reserve' under PROJECT TIGER during 1987. The Katerniaghat WLS, in Bahiraich district, was declared in 1976 (400 sq.km). The last named is contiguous with the Royal Bardia National Park in Nepal with the river Geruwa being shared. It contains two endangered species, the gharial (*Gavialis gangeticus*) and the Gangetic dolphin *Platanista gangetica*. The Dudwa National Park, Kishanpur WLS, and Katerniaghat WLS, all fall within the Biogeographic Province 07A, the Upper Gangetic Plain, within the Biogeographic Zone 07, the Gangetic plain, as per the biogeographic classification of India. The two PAs in Lakhimpur-Kheri district have abutting managed forests (768 sq.km) in the North and South Kheri forest divisions (WII 1998).

Biological Attributes and Ecological Functions

According to the classification of forests by Champion and Seth (1968), the woodland forests are represented by five sub-groups: Northern Tropical Semi Evergreen, North Indian Moist Deciduous, Tropical Seasonal Swamps, Northern Tropical Dry Deciduous, and Northern Tropical Thorn. These are further divided into 21 forest types (Rizvi 1979; Gaur 1983; Singh 1983), which provide some idea of the diversity of woodland communities. These are mainly upland woodlands.

Grasslands occupy the lowlands amidst interspersed seasonal and perennial swamps. The forests and grasslands (the natural *Terai* ecosystem) are part of a landscape that has rich agriculture, human habitations, cattle, and other

indicators of progress of human society. Therefore there are a wide range of interacting influences, including the powerful socioeconomic interests of humans, that affect the physical and biological attributes and the ecological functions of the *Terai* ecosystems.

The current inventory of the *Terai* PAs records 75 tree species, 37 shrubs, 20 species of climbers, 179 species of aquatic plants, and 77 species of grasses. The animals include 56 species of mammals (12 endangered), 455 species of birds (29 endangered), 16 reptiles (5 endangered), 19 amphibians, and 79 species of fish (Government of India 1972b; Gaur 1983; IUCN 1982; Tikader 1983; Qureshi *et. al* 1992; Sinha and Sawarkar 1992; ZSI 1994; WII 1998).

Among the megaherbivores, the elephant (*Elephas maximus*) appears seasonally in Dudwa National Park and Kishanpur WLS. The numbers fluctuate. The maximum tally in Dudwa so far has been over 70 (Sawarkar 1988a). A few straggler males are seen in both these areas the year round. Rhino (*Rhinoceros unicornis*) was reintroduced in Dudwa National Park during 1984 (5 animals) and 1985 (4 animals), translocated from Assam and Nepal respectively (Sale and Singh 1987; Singh and Rao 1984; Singh 1985; Sinha and Sawarkar 1991, 1992). Currently, the population stands at 14. Other species of conservation importance among the mammals are the tiger (*Panthera tigris*), leopard (*Panthera pardus*), sloth bear (*Melursus ursinus*), fishing cat (*Felis viverrina*), leopard cat (*Felis bengalensis*), smooth Indian otter (*Lutra perspicillata*), swamp deer (*Cervus duvauceli duvauceli*), hog deer (*Axis porcinus*), Gangetic dolphin (*Platanista gangetica*) (in Katerniaghat WLS), and hispid hare (*Caprolagus hispidus*). Among the birds the Bengal florican (*Houbaropsis bengalensis*) and the swamp partridge (*Francolinus gularis*) are of special interest as they, like the rhinoceros, hog deer, swamp deer, and hispid hare are obligates of the *Terai* grasslands. Dudwa is probably the last area in UP where the summer immigrant Bengal florican (population approximately 40 birds) is regularly seen (Shankaran and Rahmani 1988). The status of such species is dependent upon the status of the *Terai* grasslands.

The Dudwa National Park is the largest intact area in UP that represents all the characteristics of the *Terai*. Even areas of nearly 500 sq.km, such as the Dudwa, must be regarded as a fragmented habitat within a landscape when the range of the large bodied and wide ranging species and the communities and the populations of wild animals it is required to support are considered. Fragmented habitats have serious implications for population viability of most wild animals, especially for large mammals; wide ranging species; and rare, endangered and habitat obligate species, all of which are represented in the *Terai* (Harris 1984; Oliver 1985; Soule 1986; 1987; Decker *et. al* 1991; Qureshi and Sawarkar 1991; Morrison *et al.* 1998).

Management Strategies in Practice

It is necessary to review the past and current management practices as they bear direct relevance to the habitat quality. These practices also establish managerial traditions, and create a mindset that offers resistance to new ideas. Local dependence on a variety of forest resources once established tends to persist, and the activities diversify further. These forests have been managed under

working plans on a regular basis since the 1920s, with the principal interest in sal timber, and other timber species of economic interest such as khair (*Acacia catechu*), shisham (*Dalbergia sissoo*), and jaman (*Syzygium cumini*). The silvicultural practices varied from selection, to conversion to uniform, to improvement fellings, and a series of plantations were raised, mainly in the upland grasslands, of species such as teak (*Tectona grandis*) (40 sq.km), and eucalyptus (14.5 sq.km). Both are introductions in the Terai. There are also plantations of native species such as shisham and khair. There have been repeated attempts to regenerate tree species in the upland grassland patches (located within the forests) through a combination of silvicultural practices. When these failed to provide the desired results, plantations were resorted to (Rizvi 1979; Gaur 1983; Singh 1985). Between 1969 and 1979, an average of 30,458 cu.m fuelwood and 50,268 cu.m timber was produced annually in the south Kheri forest division (426 sq.km), in which the Kishanpur WLS (201 sq.km) is located. The minor forest products collected included thatch grass, (seven species of tall grasses from grasslands), honey and wax, approximately 80 tonnes/year of a grass species, *Eulaliopsis binata*, for making paper and rope, flowers of *Madhuca latifolia*, at least nine known species of medicinal plants, leaves of *Dyospyros melanoxylon*, fruits of *Mallotus philippensis*, seeds of *Shorea robusta* (average 1,500 tonnes/year), and hides and shed antlers (6 to 8 tonnes/year). Rhesus monkeys (*Macaca mulatta*) were sold for medical research (no figures available) up to 1977-78; fish in the swamps and rivers were auctioned annually (yield not known). Cattle grazing was allowed throughout the tract except areas under regeneration. Although there were adequate rules to regulate grazing, the overwhelming numbers of cattle made it impossible to enforce them.

Hunting in the forests outside the PAs was regulated under the provisions of three Acts and Rules until the Wildlife (Protection) Act 1972 superceded these. A moratorium was placed on hunting tigers all over India in 1970. Following that, several species were taken off the hunting list. By 1978-79, all licensed hunting came to an end. Between 1962-63 and 1968-69, 66 tigers, 6 leopards, and 5 sloth bears were killed in the south Kheri division alone. Four of the five deer species in the Terai (not the swamp deer), the antelope (*Antelope cervicarpa*), nilgai (*Boselaphus tragocamelus*), and for some reason ten hyenas (*Hyaena hyaena*) were also hunted under license (Rizvi 1979; Singh 1983).

Current Wildlife Management Planning Issues and Needs

Management of forests in India has been driven by the institutionalised process of working plans since the 1870s (FRI 1961). The first attempt to bring wildlife management under a specific wildlife or Protected Area Plan came about in 1972 when this was made mandatory for the tiger reserves established under PROJECT TIGER (Government of India 1972b). Unlike the working plans (Mathur 1982), there was no code that enabled wildlife planners to follow a systematised process until the Wildlife Institute of India published a Manual for the purpose in 1995 to address the management of wildlife in PAs and in managed forests (MF) outside the PAs (Sawarkar 1995).

Working plans and wildlife management plans traditionally only addressed a specific notified area, a forest division or a PA. The concept of buffer zones

outside the PAs has enabled wildlife planners to extend management outside PA boundaries, and strategies are normally covered by ecodevelopment plans (WII 1995). Buffer zone management has still not been extended to PAs, beyond some selected range of areas, for various reasons. Now, in view of the fact that PAs cannot be seen in isolation from the interacting influences of other land uses in their surrounding tract, the planning needs to be based on the concept of a landscape in which the current buffer zone management strategies are integrated and planning is reordered taking the PA values and related issues in the particular landscape into consideration.

The current strategies to manage buffer zones, at least in practice, chiefly address the management and reduction of social and economic pressures on PAs and forest resources. This indeed is acknowledged as a primary function (Government of India, 1983), but there does not seem to be any serious attempt at maintaining habitats for wildlife in buffer zones, especially those which have natural ecosystems extending into them (Berkmuller and Mukherjee 1987; McNeely and MacKinnon 1989; Groenfeldt *et al.* 1990; Sayer 1991).

There is a clear need for the negative influences of habitat isolation to be countered. The conflicting land uses result in dramatic changes in environmental features along the PA interface (Carbyn 1979; Miller and Harris 1979). If the range of habitats outside PAs is not maintained, there is likely to be an increase in man-wild animal conflicts, a reduction in the ecological productivity of the natural systems, and further alienation of the human cultures that have evolved in forested/wilderness environments. Ecological surveys should thus be considered an integral part of socioeconomic surveys in such areas to enable balanced strategies to be developed. This applies especially to ecodevelopment planning outside a PA.

The principles of landscape ecology constitute an intersection between all the disciplines of 'wildlife science', viz. ecology, geography, forestry, wildlife biology, landscape design, sociology, and economics. In other words, they are integrative and interdisciplinary (Forman and Gordon 1986; Risser 1987). Landscape is a heterogeneous land area composed of a cluster of interacting ecosystems, i.e., ecosystems that are spatially related (Forman 1987). Landscapes do not have a specific size and may operate on a variety of scales depending upon a recognisable array of ecological processes working in harness over an area. None of the ecological processes act independently, rather they are mutually determining (Morrison *et al.* 1998). For example, agricultural practices combined with flooding patterns and fire escapes are suspected of encouraging exotic plants to invade favourable sites in tall wet grasslands, like *Cymbopogon martinii* and *Sesbania aculeata* in Dudwa.

Several hierarchical scales could be considered to simplify the concept for managerial application. Micro habitats, which are unique, could be addressed at site level; in grasslands especially, the next level could be vegetation and habitat characterisation in which few to several species might be present. This might also apply to upland forests. Similarly, the level of watershed/s in which populations of several species may be encountered can also be considered. The habitat corridors; the zones of influence (wildlife on people and people on the PA); the areas of administrative decisions relating to landuse or specific

resources that are likely to affect the PA values; and the level of biological organisation, i.e., distribution and abundance of individual species, populations, and communities, can also be considered. The best example is the concern for metapopulations and the relationships between 'sources' and 'sinks' (Gavin 1991).

Application of the Landscape Approach

Certain issues in this part of the UP *Terai* which attract the landscape approach to management planning will be discussed here to illustrate the idea.

The tiger (*Panthera tigris*) is one of the world's critically endangered species. The *Terai* has long since been known for the abundance of tigers. The hunting record statistics for one division cited earlier provide some indication. Current estimates suggest that there are 65-80 tigers in Dudwa tiger reserve. This is a very low number compared with the past. The decline in both population and range of distribution has occurred within the short span of a decade and a half. In the seventies and early eighties, tigers were distributed south of the national park through the sugar cane fields. There were several intact swamps within the stretch of agricultural lands. The surrounding tall grasses merged with the cane. Tigresses bred on several such sites (Sawarkar 1988a, b). Man eating tigers are not unknown in the *Terai*, but there was a sudden spurt of man eating between March 1978 and December 1981 during which 90 human kills were recorded, of which 12 were inside the park. A special committee was appointed by the Government of India to determine the causal factors and make recommendations. Forty one percent of the kills took place in the sugar cane fields when people unwittingly, mostly in the early mornings and evenings, came across a tiger in thick cover; 21% of the kills were thatch grass cutters, many illegally cutting inside the park; 12% of the kills were those of cattle grazers; and 28% for other assorted reasons. In all, seven identified man eaters accounted for 67 kills. All were proscribed and six were shot (Government of India 1982). The pattern of kills conformed to the intensity of spatio-temporal activity of people and the increasing presence of immigrant labour in an unfamiliar environment. To reduce the propensity of encounters, the committee, among several other measures, suggested strong anti-poaching strategies and the maintenance of thatch grass patches outside the park. These were fast disappearing and their decline had prompted people to enter the park illegally to collect thatch. Other suggestions included maintenance of corridor links with the south Kheri forests and shifting of a few villages for this purpose; maintenance of fuelwood reserves by regulating activities; and management of fish resources in swamps and rivers outside the PAs. In the mid 1980s the illegal trade in tiger bones and products picked up sharply (WWF 1998) and many tigers outside the PAs were poached. Sugar cane cultivation was intensified as sugar mills and their capacities went up. As a result, the large remnants of tall wet grasslands of Gholia and Gajraula outside the park were heavily encroached. The prey species were decimated. The north and south Kheri forests became progressively isolated and opportunities to reduce the interface problems rapidly declined. Later, tigers and people continue to be in trouble.

It needs to be appreciated that the opportunities to resolve the issues surrounding a single wide-ranging species and the interest of the people mainly lay in planning land use over a large tract outside the park.

The northern swamp deer (*Cervus duvauceli duvauceli*) is an obligate of the Terai grasslands and is one of the most endangered deer species in the world (Holloway 1973 and 1975; Schaaf and Singh 1976; Martin 1977; Schaaf 1978; Singh 1982; Sawarkar 1988a). In 1980 its population in Dudwa was estimated at nearly 2,100 individuals, in 1988 it was about 1,000, and by 1998 it was estimated to lie between 700 and 750 (WII 1998). In earlier times the major population, approximately 60% of the total, was in the north west section of the park, Sathiana. Just prior to the monsoonal flooding, this section of the swamp deer population disperses and goes south across the Suheli river into the upland grasslands of Ghola and Gajraula and the swampy grassland patches interspersed within the sugar cane. This coincides with the peak fawning during June and July. The deer remain outside the park till late January/early February. The rutting is completed outside the park in November/December.

What affected the tiger has affected the swamp deer. The fawning habitat and rutting areas were rapidly lost to encroachment. The deer were also exposed to increased poaching. When George Schaller visited Ghola and Gajraula in October 1963, he encountered a herd of 800 swamp deer (Schaller 1984). This approximately 52 sq.km of Terai grassland is estimated to be some 70% smaller now. There are no more than 150 swamp deer in Sathiana, compared with more than 900 in 1980. The swamp deer population of Kishanpur WLS has fortunately remained stable at around approximately 400-500, mainly around one large swampy grassland, Jhadital. But the flood plain grassland habitat of Ull river, extending well beyond the WLS, needs planned attention to secure the future of this species.

The elephant did not find any specific mention in this region during the 1970s. Since then the forests along the northern boundary of the park in Nepal have been cut for settlement and presumably important habitats and links across the Kheri, Bahiraich, and Pilibhit districts in India have also been lost. It is suspected that the elephant herds now range over much larger tracts. They are regularly seen in Kishanpur WLS and Dudwa National Park, more often than ever before. Crop raiding at these times has become serious. Elephants are reported seasonally in Royal Shukla Phanta Wildlife Reserve in Nepal (T. Maskey personal communication). Presumably they belong to one such disoriented metapopulation. This has increased the problem of ensuring conservation of elephants while maintaining the economic security of people across the range of elephant movement. This underpins the need for landscape/regional planning. Now that there is a better understanding of species-habitat relationships, and some bitter experience to go with it, the planning perspective can be reset and not just in consideration of long-ranging species. Depending on the issues, different spatial scales come into play and they are often all connected.

The forests outside the PAs are managed traditionally. Wildlife habitat management is not on their agenda, although legal protection of wildlife is. However, forest managers have a wide range of tools to manage habitat structure, composition, and conditions without prejudice to the production functions which managed forests need to serve. Working plan surveys and inventories are flexible enough to identify, locate, describe, and map micro habitat elements such as snags, den trees, down wood, breeding and fawning

areas, cubbing sites, heronries, other key and sensitive sites, sites of unique botanical interest, riparian forests, corridor connections (woodlands and grasslands), waterholes, swamps, groves, old growth forest patches, grasslands, and grassy openings. Silvicultural systems and tending operations can be built around these (Thomas 1979; Hoover and Wills 1984; Kelly and Braasch 1988; Hunter (Jr.) 1990, 1995; Sawarkar 1995; Morrison *et al.* 1998). The predation pressure of the tiger can be dispersed across the prey species to reduce the impact on the small population of swamp deer dwelling in the *Terai* grassland by managing the woodland habitat, with its interspersed grassy patches and edges, to manage, restore, or enhance the populations of species such as sambar (*Cervus unicolor*), spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*) and wild pig (*Sus scrofa*). Woodlands offer thermal cover to rhinos in winter and in the peak of summer (Sinha and Sawarkar 1992). Most species use more than one habitat (Morrison *et al.* 1998). Upland woodlands have a role to play in controlling the flooding pattern in the *Terai* grasslands. Interactions between ecosystems are often reflected in simple connections, and these present a good place to begin planning, which can then progress towards more complex interactions at different spatial scales. Most would be difficult to discern precisely.

There are 139 villages and hamlets in a belt of 5 km width surrounding the Dudwa National Park. In 1992, the fuelwood requirement per annum was estimated to be 22,800 tonnes; the annual requirement of thatch grass 64,700 tonnes; the human density was 129 per sq.km, and the cattle density 300 animals per sq.km (Qureshi *et al.* 1992). At the time there were opportunities to manage and harness substantial resources outside the government forests with the adoption of sensible land use practices. These, although now much reduced, still offer some chance.

Conclusion

The forest or wildlife departments may not have jurisdiction over the areas abounding PAs but they can identify opportunities. The only way to accomplish the desired set of practices is through building partnerships with other agencies such as the revenue, agriculture, animal husbandry, human health, tribal welfare, education, and fisheries agencies, who have programmes in and around the forested rural sector, and potentially have the capability of putting together programme packages that benefit people and natural ecosystems alike. This is easier said than done. However, a beginning has to be made to influence policies that might arbitrate the development of a synergy between land uses. Ecodevelopment or buffer zone management cannot succeed without partnerships and motivated and willing stakeholders, among whom the local communities are the most important. The local communities need to be enabled to make the connection between the proactive role of the managers of the natural ecosystems, and the increased benefits flowing to them.

Landuse management implications may transcend the state boundaries in a country, e.g., Pench National Parks across Maharashtra and Madhya Pradesh in India, or an international boundary, e.g., Manas World Heritage Site in Assam in India and Manas in Bhutan; Sunderbans Tiger Reserve, India, and Sunderbans World Heritage Site, Bangladesh; the Royal Bardia National Park,

Nepal, and the Katarniaghat WLS, India; the Valmiki Tiger Reserve, India, and the Chitwan National Park, Nepal; the Shukla Phanta WLS, Nepal, and the Lagga Bagga Reserve, UP, India. Notwithstanding the procedures needed to set the terms of bilateral cooperation between countries, there is no ambiguity in the planning principles that need to be followed to secure the mutual interest in ecosystem management.

Such needs and implications were discussed in the Millenium Tiger Conference, held from March 3-5, 1999, in New Delhi, in the session on Transboundary Cooperation. The landscape planning approach admittedly has many miles to go. The important need is that wildlife managers, planners, and decision makers are walking on that road.

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