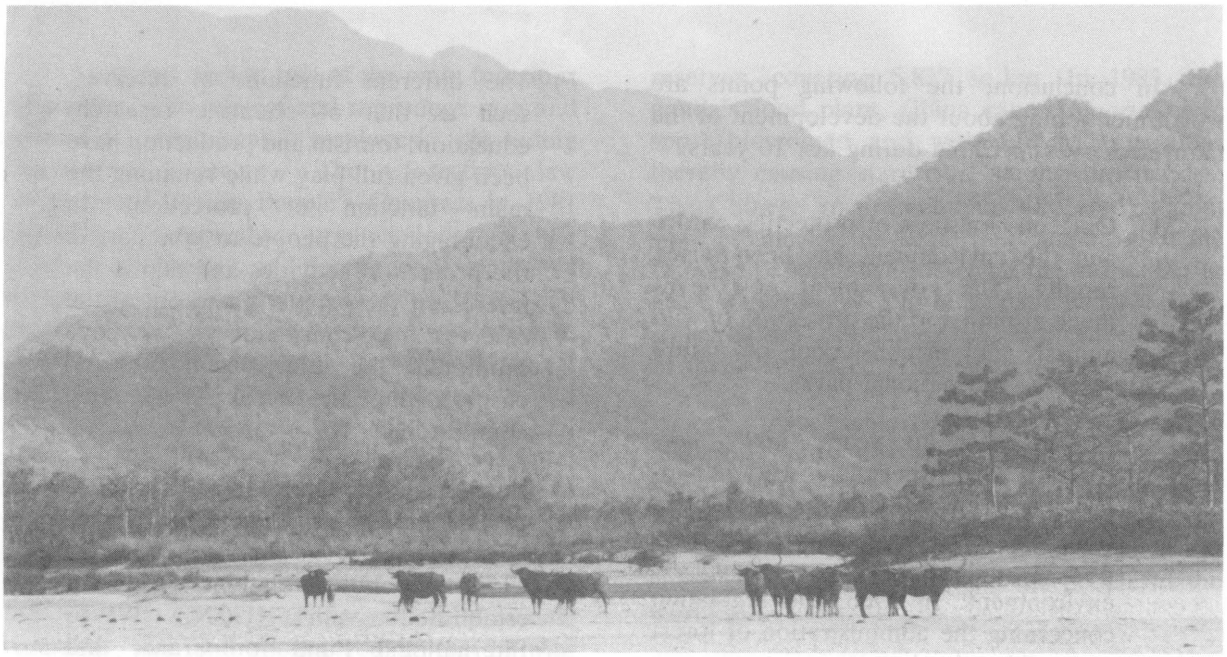

(Photo: Joanna Van Gruisen)

MANAS – A MONOGRAPH

by S. DebRoy
Additional Inspector-General of Forests
Ministry of Environment & Forests, India

Introduction

Manas Wildlife Sanctuary, with an area of 391 sq. km., is located in the foothills of the Himalayas, straddling the Bhutan–India (Assam State) border. The sanctuary has astounding scenic beauty and is the home of some 22 endangered species of mammals, a few of which are endemic such as pygmy hog *(Sus salvanius)* and golden langur *(Presbytis geei)*. Manas contains elements of both the Indo–Gangetic and Indo-Malayan realms, which probably is the reason it offers such a wide spectrum of diversity in flora and fauna.

The magnitude of this unique species diversity, confined to such a small area, reflects a similar diversity of habitats or ecosystems. The importance of this area in the preservation of biodiversity makes it a global asset, which is why the sanctuary was designated as a World Heritage site in 1984.

The sanctuary consists of bhabar and terai areas, typical formations of the Himalayan foothills formed by the great Himalayan wash. There are few perennial streams (except the big rivers, which may shrink to 25% of their monsoon size), and water becomes scarce during the winter except for a small number of water holes which provide respite to animal life.

Fine or small stones, sand, soil and other lighter debris swept down by the monsoon torrent form the ground cover in this region and is called "terai". Usually this terai contains tall grass and reeds and may ultimately turn into marshy woodlands. Such terai regions are important to wildlife preservation because they complement the bhabar areas and form the overall habitat for many animal species. Thus, the combination of these two types of areas will determine the biomass production, or carrying capacity, of the whole area. Therefore, holding sufficient terai area under this situation is vital.

Unfortunately this aspect was overlooked when the area was declared a Wildlife Sanctuary in 1928. Colonisation of this zone in the Brahmaputra valley by an expanding population, plus large-scale immigration from East Bengal (which is now Bangladesh) brought a large chunk of this highly productive terai area under the plough, for it contained a perennial water source which is essential to wet cultivation, the mainstay of agriculture in Assam. By the time the authorities had gazetted the Manas Sanctuary in 1928, most of the available area in the terai belt was settled by farmers and the remaining areas were grossly unproductive compared with the bhabar area in the sanctuary.

Since the early 1950s, local people have tried to encroach on more terai areas to convert them to agriculture. The pressure was so great that the Government set up a seed farm in the southeastern corner of the sanctuary, which had already been encroached upon. Strong objections by the forest authorities persuaded the Government to relocate the farm, but this has yet to be done. The farm had appropriated about 2,200 acres of terai area, which was considered to be a serious ecological setback to the potential of the sanctuary.

The River Manas originates from the snowline of Tibet, crosses Bhutan and gushes from the mountains into the plains of Assam, entering the sanctuary from the North. Here, the flow is considerably reduced and it starts depositing stones, sand and soil in generous measures. The river then divides and subdivides into numerous channels within the sanctuary, eventually reforming into the two major rivers (Beki and Bholkaduba) of the district of Barputa.

Because of the unstable nature of the parent rocks in the Himalayas which are of tertiary origin, the river sweeps along an enormous quantity of stone, sand, silt and debris. The catchment area of this river and its tributaries are situated in a high rainfall monsoon zone and in most parts of the catchment area the average annual rainfall is well over 3,000 mm, which accelerates bank cutting and soil run-off. Landslides in the hills of this region are common, even though nearly 70% of the catchment area is reported to be adequately covered. These areas mostly consist of steep hill slopes and are deemed inaccessible and unsuitable for settlement or other forms of land use.

The heavy deposits of mountain wash make the course of the river very unstable from its entrance into the sanctuary from the gorges of the mountain. New channels are formed during every monsoon and existing channels are silted up. These silted areas experience vegetative succession, starting with the initial colonisation by various grasses and shrubs, followed by *Dalbergia sisso* and *Acacia catechu* and their associates. There is, however, one 8 km wide belt where the river course changes so frequently and regularly that the process of succession can never progress far before giving way to new channel formations and siltation.

This process of forming and reforming river channels sustains much of the land in this belt, known as the Manas basin, which is perpetually in the riparian stage of primary succession. This area of more than 100 sq.km. is the best tiger habitat in India and its biomass productivity is one of the highest in the country. Census figures put the tiger population at about 30, an incredibly high number, although some of these tigers also utilise adjoining areas. The other species of interest of this area is the wild Asiatic buffalo *(Bubalus bubalis),* whose numbers probably exceed 1,000. The buffaloes of Manas remain genetically pure as they do not come in contact with the degenerated domesticated specimens which are abundant in the nearby villages.

Water in this area is plentiful owing to the high water table. The tall grasslands and deciduous forests that cover the high banks above the general high flood level harbour a large number of animal species, including a good population of elephants *(Elephas maximus)*. The river basin is also the wintering ground for a host of migratory birds (ducks, waders, divers, etc.) Many avifauna species also utilise the extensive sandy islands and grasses for breeding. Pallas' or ringtailed fishing eagle *(Haliaeetus leucoryphus)*, osprey *(Pandion haliaetus)*, grey-headed fishing eagle *(Icthyophaga ichthyaetus),* marsh harrier *(Circus aeruginosus),* Bonelli's hawk eagle *(Hieraaetus fasciatus),* Montagu's harrier *(Circus pygargus),* and crested serpent eagle *(Spilornis cheela),* among others, are common raptors in

the area.

The aquatic life is also rich and the river is one of the few retreats of the mighty golden mahseers. The river once had good numbers of gharials *(Gavialis gangeticus)* but these huge reptiles have not been sighted since 1975. Some gharials have been released by the Bhutan authorities within their territory and a few of the young animals were seen in the river as recently as 1984. But since the high flood during that year, none of these reptiles have been observed. There are at least three species of monitor lizards in the area and many varities of snakes, including Indian rock python and hamadryad.

An example of the potential of this area, which is still not fully explored, concerns the turtle *Kachuga syehetensis*. In 1988, this species, which was assumed to be extinct and had not been seen during this century, was found to exist in the sanctuary area. It was subsequently identified as *Kachunga syehetensis,* and had hitherto been repesented only by some shells preserved in the British Museum and Calcutta Museum.

The remaining sanctuary area is under grassland and tree cover in almost equal proportions. The woodlands spread along the foothills and generally follow the streams down south. They contain some pockets of evergreen, semi-evergreen, moist deciduous and low alluvial savannah woodland forest types as per broad forest classifications. The grasslands may be broadly classified into two categories: i) wet alluvial grasslands having a lot of reeds; and ii) high alluvial grasslands, often having scattered tree growth.

The combination of woodland and grassland with some swampy areas provides ideal habitats for many species of animals, with the tiger at the top of the biological pyramid. There are several other predators present such as leopard *(Panthera pardus)* and dhole *(Cuon alpinus),* plus a number of lesser cats such as golden cat *(Felis temminckii),* fishing cat *(F. viverrina),* marbled cat *(F. marmorata),* clouded leopard *(Neofelis nebulosa),* etc. Dholes inhabit the lower hills of Bhutan and the foothills areas and are generally confined to the woodlands.

Amongst the larger herbivores there is a sizeable population of elephants. More than 1,200 animals, including nearly 30 herds and some lone bulls, can be found in this area. These elephants are not permanent residents of the sanctuary and range over large areas, including Bhutan. The forest belt in this sub-Himalayan region stretches more than 200 km. from east to west along the India–Bhutan boundary with an almost uninterrupted contiguous forest cover of more than 2,840 sq.km. The entire belt is a composite habitat on the Indian side which merges with Bhutan. According to census figures, the total number of elephants in this area is estimated to be about 2,500 to 3,000. The sub-adult population (below 12 years) constitutes more than 56% of the total population with a sex ratio of about 2.5:1 in favour of the females, which characterizes it as a healthy population.

The sanctuary has a small population of Indian rhinoceros *(Rhinoceros unicornis),* probably more than 80, which is slowly building up. About two–thirds of the sanctuary is ideal habitat for this species.

A good number of gaurs *(Bos gaurus)* also utilise this area, mainly during the dry months when most of them come down from the lower hills of Bhutan. Their number is estimated at around 1,200 to 1,500 and at least two large herds of more than 100 animals have been repeatedly sighted. A group of around 200 gaurs seems to permanently reside near the base of the hills.

By far, the most numerous species (about 12,000) is the hog deer *(Axis porcinus),* which is found virtually all over the sanctuary. There are also sambar *(Cervus unicolor), barking deer (Muntiacus muntjac), swamp deer (Cervus duvauceli)* and a small number of chital *(Axis axis).* For chital, Manas is the eastern–most range of their distribution.

A host of other species is harboured by this sanctuary, including sloth bear *(Melursus ursinus),* binturong *(Arctictis binturong),* scaly ant-eater, porcupine, giant squirrel *(Ratufa indica),* some species of flying squirrels, mongoose, and slow loris *(Nycticebus coucang).*

Special mention should be made about the existence of the elusive and tiny pygmy hogs *(Sus salvanius).* This is the smallest member of the

Sus group and is primarily a grassland dweller. The **IUCN Red Data Book** lists its status as "indeterminate". The mature individual stands no more than 25 cm. at the shoulder and was reported as being extinct by the noted naturalist, E.P. Gee. In 1964, however, this animal was sighted by the author. Since then, the pygmy hog population has increased noticeably and it is no longer "extremely scarce or rare" in Manas. The hispid hare *(Caprolagus hispides)* which shares the same grassland habitat with the pygmy hog is another rare species whose status has improved considerably during the last 15 years.

More than 450 species of birds have been identified but many more species remain to be catalogued. The presence of good populations of the Bengal florican *(Euphodotis bengalensis)*, great Indian hornbill *(Buceros bicornis)*, wreathed hornbill *(Rhyticeros undulatus)* and lesser hornbill deserves mention.

History of Management

As noted earlier, Manas was gazetted as a wildlife sanctuary in 1928. Unfortunately, hardly any useful conservation–oriented work could be initiated due to the lack of funds and also because of the prevailing complacent attitude towards what was considered a low-priority activity at that time. However, hunting and trapping of all wild animals was prohibited. The Elephant Preservation Act and some other State and local protection acts were already in force to ensure legal protection of the rare animals even during those early days when wildlife was abundant, but enforcement of the laws, especially in the inaccessible areas, was virtually non-existent, mainly because of shortage of manpower. For example, the 391 sq.km. tiger reserve core area (with an additional 125 sq.km. of three reserve forests) is now controlled by a Conservator of Forests, whereas before Independence the same area had been supervised by a Deputy Ranger.

Because of the inadequate staffing, few conservation measures were effected. Nearby villagers were allowed to graze their livestock and to extract fuelwood, small timber and minor forest products.

In the early 1960s things began to happen. Steps were taken to stop all extraction of forest products. Grazing by domestic animals was phased out. These measures caused public resentment, but by 1965 the sanctuary was comparatively free of these forms of biotic interference. Villagers were consulted in an effort to gain their understanding and cooperation, but this met with only limited success. Meanwhile, improvements were slowly being made in management methods, which were becoming more intensive.

Manas was next designated a Range, which improved its status and importance. In the meantime, the tiger, the supreme predator of the forest, had sunk to a precarious state. This prompted the launching of the prestigious Project Tiger in April 1973, thanks to the commitments by IUCN and the Government of India to the conservation of wildlife. Manas was one of the seven initial sites seleted on the basis of their different ecosystems, which constituted tiger habitat in the country. Manas became not only a Divisional Unit, but was placed under the exclusive charge of a Conservator of Forests, who is a State-level officer in Assam.

Project Tiger's purpose was to redress the resource shortages that had led to the depletion of wildlife in protected areas. The Central Government had heretofore provided limited support and the State governments had inadequate resources and little incentive to support wildlife areas, which produced little or no revenue to the State exchequer. Project Tiger changed this attitude quickly, which improved the situation. At present, more than 20% of the personnel are engaged in the management of the core zone of the Manas Tiger Reserve, which is about to be declared a national park, the highest category of a protected area.

Principles of Management

"Total ecosystem preservation" is the principle of management in Project Tiger. Although the name of the project is suggestive of a species–oriented programme, in reality it involves balancing the total ecosystem. This requires elimination of all biotic interferences from the area, which is essential to the success of the project.

As the supreme predator in the forest, the tiger is the indicator species. In order for the tiger to survive, its habitat must be preserved in its natural state. Like any other species, the tiger is dependent on its food and habitat being maintained at the optimum level. This also applies to its prey species. Since these are mostly herbivores, the condition of the ground cover must be kept in natural or nearly natural conditions. This requires soil and water regimes appropriate to the climatic and geographic location.

The Tiger Reserves are large enough to support viable populations of tigers for all time to come. Each has a central core zone designated for national park status which has a legal protection that is not easily assailable. The object is to keep conditions in this core zone as natural as possible.

The area adjoining the core zone is to be maintained as a "buffer zone", where normal forestry practices are allowed but the emphasis is on preservation of wildlife. Usually the core zone is to be declared as a national park and the buffer zone as a sanctuary. There should be no human settlements in the core zone and any existing ones should be moved. The people should be provided all necessary assistance for their relocation.

Manas Tiger Reserve covers an area of 2,840 sq.km., of which 391 sq.km. have been designated as the core zone. A proposal is now in the final stage to add another 254 sq.km. to this core. The rest of the area forms the buffer zone. In most Project Tiger areas both the core zone and the buffer zone are normally under the administrative control of the Field Director for all management purposes. But Manas is unusual in that the Field Director is in charge of about 520 sq.km., which includes the core zone and three other small reserve forests nearby which are a small part of the buffer zone. The remaining area is administered by four territorial divisions under the control of two Conservators of Forests.

This is probably a better arrangement, since the Field Director is already encumbered by normal forestry operations in the buffer zone and would not be able to fulfill all his responsibilities in the core as a wildlife manager. On the other hand, if the Field Director gets deeply involved in wildlife management, forestry activities in the buffer zone may be neglected. Therefore, it is better to have separate supervisors for core zone and buffer zone, but with close cooperation and understanding. This is especially so in tiger reserves covering large areas.

Though Project Tiger was launched in April 1973, serious work began only at the end of 1974, when encroachments were gradually eliminated to repair the damaged habitat.

Management Practice

To allow the restoration process to proceed, the manager's main job is to ensure the complete or nearly complete elimination of human interference from the area. This is extremely difficult in a developing country such as India where there has been enormous pressure on the natural resources, particularly during the last five decades. It is also very difficult to restrict the use of natural resources by local people. Such sudden restrictions render living conditions difficult and people naturally become resentful.

The manager is thus in a difficult position, standing between the demands of the people and the resources which are necessary to their survival and economy.

To restore the natural conditions of the habitat in the core zone, it is sometimes necessary to help the wildlife through such methods as canopy manipulation, creation of water sources, and elimination of biotic interference. This may accelerate the ecological recovery.

Fortunately, the degradation of the habitat in Manas was not so great. Some areas had been degraded by over-grazing and collection of minor forest products, but the major damage was caused by intensive poaching of all species, with the exception of elephants. Because of the poaching, the potential of the population dynamics was never realised. Anti-poaching measures had to be initiated immediately and given top priority.

Anti-poaching arrangements had been far from satisfactory before the early 1960s. Up until then, the entire area was looked after by one ranger with only 30 to 40 guards, two elephants used for anti-poaching patrolling, and about half a dozen 12-bore shotguns. Today, more than 225 people with more than 100 weapons (both rifles and shotguns) guard the area.

Before 1973, no vehicles were available to field staff. Now there are more than a dozen 4–wheel drive vehicles, mini trucks and others at the command of field staff. There are 14 permanent wireless stations and walkie-talkie sets for fast communication, which are indispensable to anti-poaching activities.The riverine tract contains a large number of animals of various species and naturally attracts the attention of poachers. This area is also one of the most difficult to negotiate, throughout the year. Fast water transport and two mobile river patrolling camps have also been set up, which have proved their worth.

Forty-three guard posts and three range headquarters have been set up at strategic points for round-the-clock vigil. These measures have proved invaluable and the results are manifest in the rise in population levels of virtually all species, many of which are threatened species listed in Schedule I. Examples include swamp deer *(Cervus duvauceli)* and pygmy hog *(Sus salvanius)*. In 1973, the sanctuary had fewer than 150 swamp deer; by 1987 their number had passed 500. Though the status of the pygmy hog is not clear, they have been observed much more frequently in the past six or seven years and in new areas.

Many poachers have been arrested and prosecuted – an effective deterrent to others. Thus, much of the poaching can be curtailed, but the main problem that persists is the poaching of rhinos. Because the price of rhino born in the illegal wildlife trade has soared, professional poachers find it highly lucrative. About three rhinos a year are being poached despite tight security, but that is not enough to threaten the species in Manas.

Violent encounters with poachers occur frequently and many poachers, and a few wildlife staff, have been killed. These poachers are professionals who do not hesitate to open fire when confronted, often with sophisticated automatic weapons.

Unlike animals poaching, illegal tree felling and timber smuggling is not a major problem. One reason could be that a large number of trees are carried down by the floods which can be collected by the villagers and used for domestic purposes or sold legally.

Illegal grazing also does not pose a major threat, although stray cattle in small numbers sometimes trespass. Similarly, surreptitious collection of reeds and grass for building house structures is not a serious problem.

Thus, undesirable biotic influences in the core area have been eliminated or severely restricted in the last 20 years. Meanwhile, tourism has expanded considerably, causing management to contemplete a drastic reduction in this activity. So far it has not been observed to cause too much disturbance except during the three-month peak season when the animals seem to move away from the tourists' zone (about 3.6% of the core area).

Fire as a Management Tool

By far the most important management practice in Manas is the annual controlled burning, deliberately induced with specific objectives.

Maintaining the composition of the different habitat types deserves top priority in the management of Manas. Under the existing climatic conditions, geographical location and the basic soil qualities, the climatic climax of the area will lead the vegetative cover to semi-evergreen or evergreen successions if left to nature and all biotic influences are eliminated. The grasslands that exist today will gradually be converted into woodlands of various successive stages of progression until the climax is achieved. Although alluvial grasslands in Manas are only a temporary phase of succession, many species of wildlife are dependent for their existence on this.

It appears that for the last several centuries, the open sub-Himalayan flats have been used by the local people for grazing

livestock. To this end they have been setting fire to these areas during the dry periods, which produced new and vigorous flushes of grass and deterred the regeneration of trees.

When the sanctuary was set up, the grazing and burning both continued. No action was taken against this since in the Sal areas controlled burning was being used routinely to prevent accidental fires which could be devastating. Thus, the grasslands in Manas flourished because of this biotic influence.

This annual burning used to be carried out from January to March, when the tall grass was dry and highly inflammable and produced "hot burning". Large patches of dried grassland were burnt in single sweeps and such fires were cut off only by streams and the woodlands. Such burnings were harmful to wildlife as hardly any food or cover was left unburnt and the animals faced serious problems until the grass sprouted back.

The burnt areas were so completely denuded that neither the predators nor their prey species could find suitable cover. The burning also affected the insect life and microoganisms and dessicated the soil below the top layer. Although this stopped colonisation by trees and preserved grassland, it seriously disturbed the animal life.

In 1976, this pattern of burning was modified and brought under strict control. Burning was started much earlier, immediately after the monsoon receded, usually by mid-October, though in some years this occurred at the end of the month. Within two weeks of the withdrawal of monsoon, the patches of drier areas were fired. High areas and grassy areas, which had been intensively utilised by herds of the larger herbivores (mainly elephants and buffaloes) usually dried up immediately after the monsoon. Such areas in small patches can be burned. These fires cannot spread, as the grass in the surrounding areas is still green and the soil is still moist. In fact, it is essential that efforts be made to keep the fire going. The area thus burnt could form an area measuring from a few square meters to half a hectare.

During their routine patrolling, the anti-poaching staff burn whatever suitable patches they find. The fire, therefore, cannot be really hot and a lot of unburnt vegetation is left back even within such burnt areas. Often some areas within these patches are not dry enough. The sanctuary staff continues this operation in all the grassland areas until the end of the dry season (April).

After burning, grass sprouts within two weeks, even during the driest period, and animals can graze in such areas within three weeks after burning. Because grassland is burned continuously in small patches of irregular patterns, fodder is never in short supply. In fact, if the entire grassland is allowed to dry up without being burnt, the fodder may become unpalatable. And because considerable unburnt and half-burnt stems are scattered over the burnt patches, cover conditions both for the prey and the predator exist at a compatible level. Thus, the area keeps a high level of productivity (and palatability) even during the lean period for the animal community.

For quite a number of species this period coincides with their breeding season. Natural, hard-burning fires sweeping over large tracts probably caused considerable disturbance earlier, which can now be avoided completely or at least drastically minimised through controlled burns.

The burning has prompted much speculation about loss of animal life, especially the slower-moving ones. Though there are no records of loss of life even during the earlier days of hot burning, the probability cannot be ruled out. With the present patch burning, fatalities can be eliminated. These fires are started during late afternoon when there is no wind and the grass is moist from dew. The fire spreads slowly providing an opportunity for even the slow moving animals to escape. Some insect life and microorganisms are lost but this is unavoidable. The ground below a depth of 7-8 mm is not affected by such fires, which are also unlikely to affect reptilian life below ground level. The author has repeatedly scrutinised patches but could detect no evidence of loss of life (microorganisms excluded).

The fire certainly causes some degree of dessication, but this is negligible in an area like Manas where the water table is high and the

ground contains moisture even during the driest spell, generally from mid-March to the beginning of April.

The Controversy

The management concept in Project Tiger, as mentioned earlier, is the elimination of the biotic influences. Fire was one factor which was strictly forbidden in any project area. A lot of planning was done and a lot of money was spent on fire prevention in the project areas. To use fire as a management tool to benefit the wildlife provoked much criticism and controversy before the measure was accepted by wildlife managers. While I myself supervised all the details of the operation, I had to defend the merits of fire as a management tool against the bitter critics who tended to overlook some ecological aspects of the area.

First, we had no choice but to maintain the composition of the habitat types and their relationships, which give the area its great biodiversity. Second, if the area was left to nature, all of the area (core zone) would advance in natural succession to become semi-evergreen or evergreen because of the climatic factors and the geographic location of Manas. This change would certainly result in the elimination of many grassland species, which is, of course, not acceptable. Third, to maintain the grasslands, which are only a temporary phase in the progress of natural vegetative succession, the only choice was to utilise the fire carefully to cause the least damage but maintain the grassland as an "arrested sub-climax" to suit our long-term management objective. After thorough study, I decided to use the biotic influence (fire) as a management tool.

Many ecologists, including the noted ecologist Prof. Paul Leyhausen, former Chairman of IUCN's Survival Service Commission Cat Specialist Group, bitterly criticized my plan in 1977 when this area underwent serious and minute ecological evaluation. The only person to endorse my views was the renowned Indian ecologist, Mr. S.K. Seth, who was the Inspector General of Forests, India, at that time. But, he also cautioned me, saying that the application of fire has to be very careful and all persons (mostly those doing the actual work) must thoroughly understand the probable adverse effect of a sweeping "hot-burning" on wildlife.

Professor Leyhausen re-visited the area in 1981, saw the difference, and approved of my ideas, which was a source of great satisfaction for me.

Other Aspects

Conceptual management apart, two aspects not directly involving policy and technology should be considered as extremely important to successful wildlife management. The first is selection of personnel and man management, and the second is the promotion of public sympathy for active cooperation with the project.

It is unnecessary to elaborate why selection of suitable staff is important. Such persons should be dedicated and willing to work extremely hard under trying conditions. Their jobs are unorthodox, requiring mental alertness 24 hours a day and the ability to endure a tough, isolated life under inhospitable conditions. They have to live without their families and often without even medical facilities. There are also the various occupational hazards, including high risk to life from poachers' bullets. Also, because they are mostly in inaccessible areas, their work is difficult to supervise and unless they have professional integrity and dedication, complacency or inactivity may go undetected, which can greatly harm the objectives of the project.

Under the existing service conditions it is not possible to offer such key personnel all the facilities they deserve. The only way to keep their morale up and to obtain maximum output is to maintain an efficient man-mangement system, a close watch, and personal links. This is more easily said than done, and the Director must spare a lot of time for these grass root workers. All posts are to be visited as frequently as possible. Sympathy and care for field staff, mixed with strict control and discipline are essential if proper results are to be obtained.

It is also essential to maintain cordial relationships with the local people. Without their cooperation, management objectives will not be achieved. The poachers are either from this

group or are sheltered by them. Furthermore, animal depredations on crops and property, and cattle-lifting by large predators cause considerable hardship to the poor people who reside on the fringe of the sanctuary. These people depend on their crops for their living and most work their land with plough animals. When their crops are attacked by animals or their plough animals killed by predators, their economy is shattered. Antagonism towards wildlife is a natural reaction. No amount of preaching and education on ecology can save that situation.

Thus, it is essential for the park management to provide some material help to these people. Amelioration of poverty and raising the standard of living of the local people has long been Government policy and any planning in this direction is acceptable to the Government. With this in mind, the management plan of the core zone prescribes social welfare measures. This is called "eco-development planning" and it includes the provision of drinking water facilities, medical care, veterinary care, help to improve farming agricultural practices, sericulture, pisciculture, education and the organising of sports activities, These provisions will help to cement relations between the local people and the management authorities. Compensation for crop losses and loss of livestock because of animal depredation is also included.

Because of the shortage of funds, these social measures were not initiated until this year, but they will go a long way towards moblising public support for the project.

Population Pressure

The southern boundary of Manas's core zone merges with a densely populated belt. There is no buffer zone here, which makes things more difficult for the manager. Almost all these people depend on farming and are very poor with only small land holdings. Their dependence on the forest resources was once great, but the denial of these resources has created conflict and discontent.

Fortunately, a good percentage of the people understand the importance of preserving the biodiversity to guarantee a better future for them, but the pressing and immediate needs often erode such understanding. Regular and frequent meetings with the village elders to try to help them has helped immensely to enlist their cooperation. The supply of essential commodities at reasonable prices through the Government distribution system during periods of scarcity, setting up of health centres and veterinary centres, establishing some primary schools and other activities have been undertaken with promising results. All social welfare works had been arranged through contacts in the appropriate levels of government and without spending any project funds. Only when people's needs are properly acknowledged and satisfied by the Government can such beneficial activities be accomplished to the benefit of the people. When the full thrust of the eco-development plan is put into effect, the conflict with the people will end.

One aspect probably requires immediate attention. The population in the villages around the tiger reserve needs to be stablised. At present this population is rising, as it is elsewhere in the country. Unless checked and stablised, the growing population will find it difficult or impossible to sustain itself on the land available. This is likely to exert pressure on Manas. Already some parts of Manas are under pressure from the villagers and forceful encroachment has had to be stopped on more than one occasion. But a time may come when such moves may even gain political support, which may complicate the situation. The future of this great wildlife area may turn on this issue.

Tourism

When I took charge in 1963, Manas had hardly any tourism worth mentioning. Only a few highly placed government personnel, political leaders and wildlife enthusiasts visited this area. The main obstacle to visitors was lack of transport. Few roads existed and there was no accommodation except a two-room forest inspection bungalow. Only fair weather roads were maintained by the Forest Department and even the approach road was not negotiable most of the time without a four-wheel-drive vehicle. There was no publicity and few people knew about this "Eden".

Things have changed and tourism has become a minor problem. The main impact is the large number of day visitors. These people, often in large groups, enter the area during early morning and leave during the afternoon. These are all local people and their main objective is sightseeing, not wildlife viewing. Manas has a lovely scenic setting, which attracts large crowds from December to early February. These large gatherings can exceed 5,000 people on holidays and make a great deal of disturbance. This is because they must travel 21 km. through the core zone before reaching the spot and are then confined in an area of about 2 sq. km.

There is overnight accommodation for 20 people who are serious about nature conservation. However, Project Tiger envisaged that the core zone be kept free of all disturbances, including tourism, and it has been decided by the authorities to "discourage" tourism. It is planned to move tourist accomodations outside the core zone so that tourists can visit the areas only during the daylight hours on transport provided by the management. To this end, a tourist lodge has been constructed outside the boundary of Manas, but it is not yet open.

Meanwhile, it has been decided that controlled and limited tourism should be allowed in certain areas, but whether tourism is allowed to continue is a difficult question to answer. To establish the "carrying capacity" is also a complicated question, but certain criteria have been laid down to minimise the undesirable effects on wildlife and the habitat.

Indo-Bhutan Cooperation

It would be incomplete to write about Manas without mentioning its counterpart across the border in Bhutan. The hills of Bhutan form the Bhutan sanctuary, some 640 sq.km. consisting of steeply rising slopes covered mostly by moist deciduous forest and semi-evergreen forest in the valleys. Some animals common to this area such as ghoral and Himalayan black bear do not descend to the plains, but many other species roam both sides of the border. The Bhutan sanctuary, also called Manas, contains a number of natural salt licks along the numerous streams that flow into India. These salt licks attract most herbivores and are often visited by predators such as the tiger. Elephant herds, rhinos, gaurs and sambar are the most numerous visitors to these salt licks.

The kings of Bhutan (both past and present) are keen conservationists and the area, which had earlier been a hunting ground, mostly for Royalty, was declared a sanctuary in 1964. Poaching is not the problem it is in India, mainly because the sanctuary is remote and inaccessible. There is no habitation within easy reach of the sanctuary except some villages on the east side.

The entire area is supervised by two forest rangers whose thinly spread out guards are stationed at half a dozen extemely remote places of strategic importance.

The managements of both sanctuaries maintain extremely cordial relations and help each other whenever necessary. There are a number of anti-poaching posts on the international boundary and a border road is also maintained. Bhutan anti-poaching patrols are free to use these roads and also the accommodation whenever they wish. When in pursuit of poachers, patrols may cross the border, but poachers who are apprehended are to be handed over to the respective authorities for legal action.

The Royal Government of Bhutan maintains some facilities for tourists who must enter from the India side as the Bhutan sanctuary is not approachable from the Bhutanese side.

The two Governments share the tourist revenue, though the tourist inflow is grossly unequal. As Field Director, Manas, I have been consulted often by the Royal Government of Bhutan on management matters and related issues. Frequent exchange of views takes place.

This ideal situation of mutual cooperation prevents problems affecting the management of both sanctuaries. Wildlife does not recognize boundaries, and this is never more true than in Manas. Both parts of Manas make a full unit, and fortunately the management in both the areas blend nicely to give Manas an international aura, which is highly desirable.