STATUS OF WILDLIFE AND HABITAT CONSERVATION IN KARNATAKA

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(With a map)

This paper reviews the status of wildlife and habitats of Karnataka State in India. The overview briefly covers (i) Available habitat types in the major biogeographic zones of the state; (ii) Current distribution of important mammalian species; (iii) Protection status of wildlife and habitats in the recent years; and (iv) The existing and proposed nature reserve areas in Karnataka.

INTRODUCTION

Karnataka State in South-Western India is a region naturally endowed with a diversity of bioclimatic, topographic and edaphic variations (Pascal 1982, Rama Prasad and Malhotra 1984). For example, the annual precipitation of the order of 6000 mm at the Western edge of the State declines to less than 800 mm within a short distance of about 150 kms Eastwards. The coastal plains which are virtually at sea level rise precipitously to the Western ghat ridges at around 1500 m elevation only to slope down gently on to the Deccan plateau Eastwards. The soil types range from coastal laterites through the sandy loams of the Southern plateau to the deep black cotton soils of the Northern plains.

As a result of such natural variations, the State has a variety of wildlife habitats and a rich diversity of plant and animal communities. These habitats include many types of forests: Montane Shola, Wet-evergreen, Semi-evergreen, Moist deciduous, Dry deciduous, Dry evergreen, Thorn scrub as well as Riverine, Mangrove and other wetland vegetations. In recent times, the State has made some determined attempts to conserve this biological wealth. Arguably, this effort has been more effective than in many other parts of India, particularly in terms of restricting forest exploitation and setting up nature reserves.

In this paper I have attempted to present an overview of the conservation status of Karnataka State's wildlife and wildlife habitats. This overview is primarily restricted to terrestrial habitats and focusses on the larger mammalian fauna. I have briefly mentioned each of the habitats occurring in the four biogeographic sub-regions of the State: (1) West coast plains; (2) Western ghat slopes and foothills; (3) Southern plateau and Eastern ghat hills; (4) Northern plateau (Map 1). A brief review of the conservation status of these habitats is here. The current presence/absence data on the distribution of important mammalian species is also included as an indicator of the status of wildlife. I have summarised additional information about some species which are of special conservation interest. This is followed by a brief section on problems of wildlife and habitat protection in the State and existing and suggested nature reserve areas.

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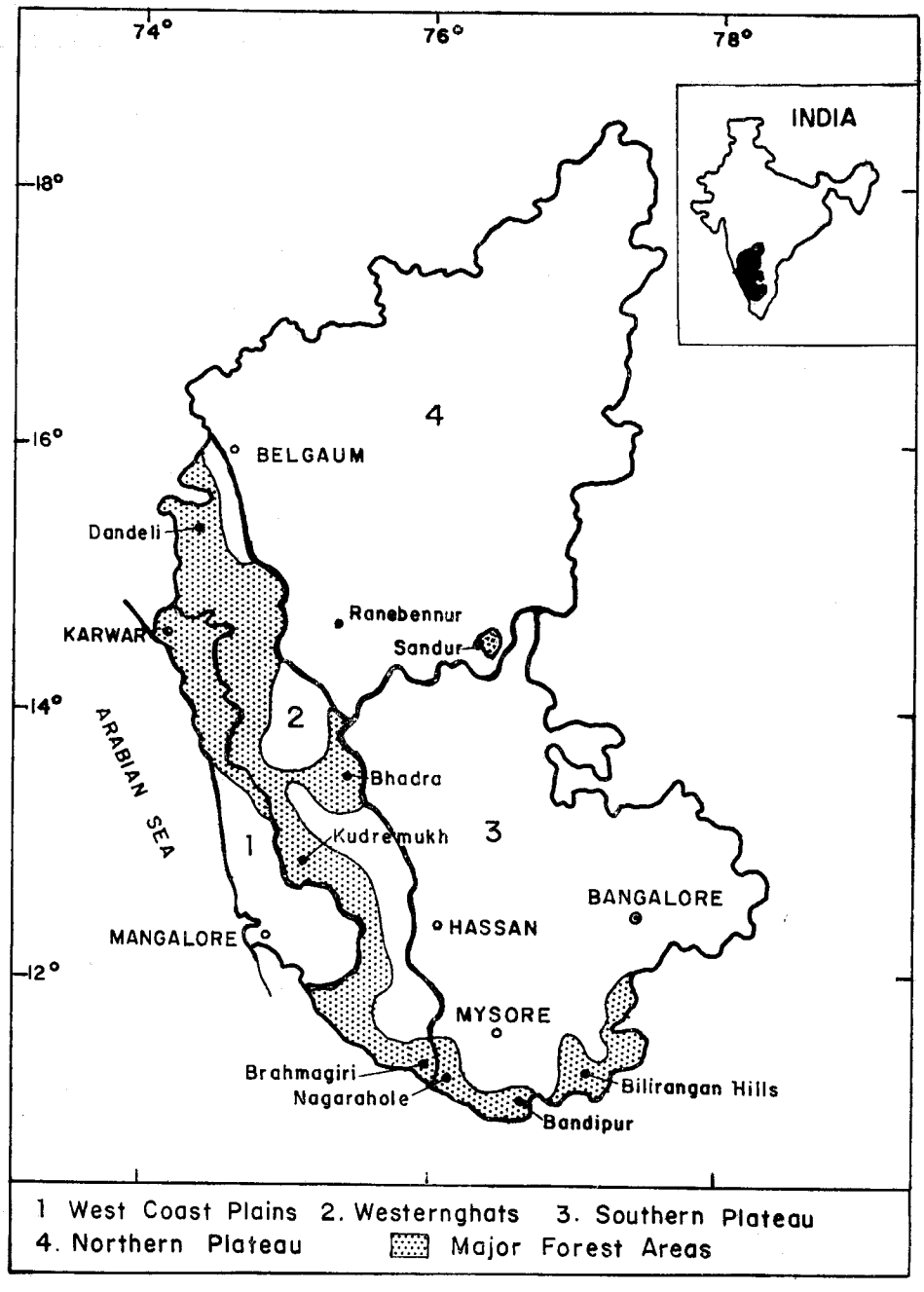

Map. 1. Karnataka — Bio-geographic regions and important wildlife habitats.

Apart from my own field notes, I have consulted several published and unpublished accounts by various authors. These are quoted in the appropriate context. On the whole this paper essentially highlights gaps in our knowledge about the faunal distribution in Karnataka and is meant to serve as a basis for more detailed work in future.

Wildlife Habitats in Karnataka

Coastal Plains, Western Ghat Slopes and Foothills

These two regions receive very high rainfall ranging around 1500-5000 + mm annually (Pascal 1982). The coastal plains have two main littoral habitat types — the sand dune vegetation on the seashore and the mangroves on the coast and riverine estuaries. A recent comprehensive survey by Untwale and Wafar (1986) highlights the precarious status of these habitats and estimates that only a few hundred hectares of these remain intact. It also documents their ongoing destruction by the local people for fuel, timber, conversion to agricultural uses as well as other developmental activities. These habitats are almost entirely outside the control of forest/wildlife departments and no effective protection has been possible as a result.

Most of the climax evergreen forests of the coastal plains were also not protected as reserved forests in the late 19th century, being left in the custody of local villages as common lands. These have totally vanished due to the reckless abuse by these custodians (Stebbing 1929). Such areas are now covered by degraded physiognomies like scattered shrubs, grass and tree savannas and thickets (Pascal *et al.* 1982). Even in the small pockets of reserved forests on coastal plains, the climax evergreen forest type is almost absent, having degraded into semi-evergreen and moist deciduous formations due to biotic interferences like lopping for fuel wood/green manure, cattle grazing and forestry operations.

The low and medium elevation climax evergreen forests are now confined mainly to the slopes of the Western ghats and their outspurs to the South of 14°N latitude and are fairly extensive. It is officially estimated that about 4300 km^2 area is under evergreen type and about 1500 km^2 area is under semi-evergreen type in Karnataka. These evergreens belong to several distinct vegetation series with characteristic plant associations as described by Pascal *et al.* (1982). Most of these are subtypes of the *Dipterocarpus-Mesua-Palaquium* series. However, to the North of Sharavathi river (14°N lat.) the *Persea-Macarantha-Diospyros-Holigarna* type and *Memecylon-Syzigium-Actinodaphne* types also occur. The semi evergreen series *Diospyros-Dysoxylum malabaricum-Persea macarantha,* locally known as "Kan type" is unique to this region. The high elevation montane shola vegetation is found only in small patches of *Schefflera-Gordonia-Meliosma* type forests occurring amidst extensive grass savannas above 1250 m elevation, primarily in Chikmagalur and Kodagu districts.

Southern Plateau, Eastern Ghat Hills and Northern Plains

The elevated plateau country that extends Eastwards from the foot of the Western ghats, receives an annual precipitation ranging between 1500 mm on the West to about 600 mm on the East. The plateau region South of 14°N lat. approximately still supports extensive climax deciduous forests. In tracts which receive precipitation in excess of about 1200 mm these forests are moist deciduous and belong to the *Lagerstroemia-Tectona-Dillenia* series

occurring mainly in Belgaum, Uttara Kannada, Shimoga, Chickmagalur, Hassan, Kodagu and Mysore districts. These moist deciduous forests are estimated to cover about 5700 km² area in the State, a figure which includes secondary moist deciduous forests of the coastal plains also. Most of these forests are woodlands rather than dense forests due to selective logging. A substantial area of moist forests have been converted to plantations of teak, eucalyptus, rubber, cocoa and other crops in the past.

The natural climax vegetations over most of the plateau region receiving less than about 1100 mm annual precipitation are dry deciduous forests. These are primarily of two types: *Anogeissus-Tectona-Terminalia* series in the Southern plateau region and *Anogeissus-Hardwickia* series in the North. A transitional type, *Anogeissus-Chloroxylon-Albizzia* series is also recorded (Saldanha 1984). The Southern plateau and the Eastern ghat hills still have substantial areas under the first type in the reserved forests. The second type is confined to degraded small pockets of reserved forests, which occupy only around 5% of the land area in the Northern plateau and probably no patches in near climax conditions are available anywhere in the State.

The other vegetation types that are of interest which occur in small fragments are: (i) Dry evergreen forests in Eastern part of both North and Southern plateau; (ii) Semi arid thorn forests in drier parts of Bellary and Chitradurga; (iii) Riverine gallery forests along the Kaveri river in Southern plateau region; and (iv) 'Evergreen' shola type patches dominated by *Shorea talura* in the upper reaches of Mahadeshwara malai hills in the Eastern ghats.

Status of Wildlife

The diverse habitat types described above naturally support an equally rich diversity of animal species; mammals, birds, reptiles, amphibians, fishes and insects etc. No detailed inventory of the faunal wealth is available. Further, the recent conservation status of most of the non-mammalian species is virtually unassessed. I have restricted this overview of conservation status of wildlife in the State primarily to some of the terrestrial mammals.

Table 1 contains the available presence/absence data on the current distribution of 53 mammalian species in each of the four regions of the State described earlier. Some typical localities where each species occurs is also mentioned where possible. The following notes provide additional information on some species (Scientific names in Table 1) which are of special interest.

Primates

The earlier accounts (Green and Minkowski 1977, Kurup 1978) have considered the lion-tailed macaque as a species on the verge of extinction in Karnataka and that conservation efforts for this species are not viable in the State for want of adequate habitats. The population estimates were placed as low as two groups in the entire State without any detailed survey. Subsequent efforts by Bhat (1984) indicated additional localities. In 1983-84 a detailed field survey by me (Karanth 1985) has revealed that about 1000 km² area of potential liontailed macaque habitat is available in Karnataka. Based on sighting reports by reliable informants (the same technique used by Green and Minkowski 1977, Kurup 1978), actual sightings and wild caught captives, locations of 133 groups of macaques between 14°30′-12°N lat. in Karnataka

TABLE 1

DISTRIBUTION OF WILD MAMMALS IN KARNATAKA

Sl. No.	Common Name	Scientific Name	Present occurrence in different regions				Typical Localities
			West Coast	Western ghats	Plateau (South)	Plateau (North)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1.	Bonnet Macaque	*Macaca radiata*	P	P	P	P	All over the State
2.	Liontailed Macaque	*M. silenus*	A*	P	A	A	Brahmagiris, Kudremukh
3.	Hanuman Langur	*Presbytis entellus*	P	P	P	P	All over the State
4.	Nilgiri Langur	*P. johnii*	A	P	A	A	Brahmagiris
5.	Slender Loris	*Loris tardigradus*	L	P	P	L	Nagarahole, Bandipur
6.	Tiger	*Panthera tigris*	A*	P	P	A*	Nagarahole, Bhadra
7.	Leopard	*P. pardus*	P	P	P	P	Nagarahole, Bandipur
8.	Fishing Cat	*Felis viverrina*	O*	A	A	A	—
9.	Jungle Cat	*F. chaus*	P	P	P	P	Mangalore, Bandipur
10.	Leopard Cat	*F. bengalensis*	A	L	P	O	Nagarahole, Bangalore
11.	Rusty Spotted Cat	*F. rubiginosa*	A	L	P	O	Nagarahole, Bangalore District
12.	Desert Cat	*F. lybica*	A	A	A	O	—
13.	Cheetah	*Acionyx jubatus*	A	A	A*	A*	—
14.	Malabar Civet	*Viverra megaspila*	L	P	O	A	Kudremukh
15.	Small Indian Civet	*Viverricula indica*	P	P	P	L	Common everywhere
16.	Common Palm Civet	*Paradoxurus hermaphroditus*	P	P	P	L	Common everywhere
17.	Brown Palm Civet	*P. jerdoni*	A	O*	A	A	—
18.	Common Mongoose	*Herpestes edwardsi*	P	P	P	P	Bandipur, Ranebennur
19.	Stripenecked Mongoose	*H. vitticollis*	A	P	P	A	Bandipur, Nagarahole
20.	Brown Mongoose	*H. fuscus*	A	P	P	A	Nagarahole
21.	Ruddy Mongoose	*H. smithi*	A	L	P	A	Bandipur
22.	Striped Hyena	*Hyaena hyaena*	P	A	P	P	Mangalore, Mysore District
23.	Wolf	*Canis lupus*	A	A	P	P	Melkote, Ranebennur
24.	Golden Jackal	*C. aureus*	P	P	P	P	Common everywhere
25.	Indian fox	*Vulpes bengalensis*	A	A	P	P	Ranebennur
26.	Dhole	*Cuon alpinus*	A	P	P	A	Bandipur, Dandeli
27.	Sloth Bear	*Melursus ursinus*	A	P	P	P	Nagarahole, Bangalore District

TABLE 1 (contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
28.	Common Otter	*Lutra lutra*	P	P	P	A	Kabini, Bhadra reservoirs
29.	Smooth Indian Otter	*L. perspicillata*	A	A	O	L	—
30.	Clawless Otter	*Aonyx cinerea*	A	P	A	A	Brahmagiris
31.	Nilgiri Marten	*Martes gwatkinsi*	A	P	A	A	Brahmagiris
32.	Honey Badger	*Mellivora capensis*	A	A	P	L	Kolar District
33.	Indian Elephant	*Elephas maximus*	A*	P	P	A	Nagarahole, Biligirirangans
34.	Gaur	*Bos gaurus*	A*	P	P	A	Dandeli, Kudremukh
35.	Nilgiri Tahr	*Hemitragus hylocrius*	A	A*	A	A	—
36.	Chinkara	*Gazella gazella*	A	A	A*	P	Sandur
37.	Blackbuck	*Antilope cervicapra*	A	A	P	P	Naganapura, Ranebennur
38.	Four horned Antelope	*Tetracerus quadricornis*	A	A	P	P	Bandipur, Sandur
39.	Nilgai	*Boselephus tragocamelus*	A	A	A*	A*	—
40.	Sambar	*Cervus unicolor*	L	P	P	L	Kudremukh, Nagarahole
41.	Chital	*Axis axis*	P	P	P	P	Bandipur, Dandeli
42.	Muntjac	*Muntiacus muntjak*	P	P	P	O	Bandipur, Brahmagiris
43.	Chevrotain	*Tragulus meminna*	P	P	P	O	Nagarahole
44.	Wild Pig	*Sus scrofa*	P	P	P	P	Common everywhere
45.	Blacknaped Hare	*Lepus nigricollis*	P	P	P	P	Common everywhere
46.	Indian Porcupine	*Hystrix indica*	P	P	P	L	Bandipur, Nagarahole
47.	Giant Squirrel	*Ratufa indica*	L	P	P	A	Nagarahole, Bhadra
48.	Grizzled Giant Squirrel	*Ratufa macroura*	A	A	P	A	Kaveri Valley, Mysore District.
49.	Flying Squirrel	*Petaurista petaurista*	A*	P	P	A	Nagarahole, Bandipur
50.	Pale Hedgehog	*Paraechinus micropus*	O	O	O	O	—
51.	Indian Tree Shrew	*Anathana ellioti*	O	O	O	O	—
52.	Flying Fox	*Pteropus giganteus*	P	P	P	P	Common everywhere
53.	Pangolin	*Manis crassicaudata*	L	L	P	P	Mysore & Bangalore Districts.

Note: P — Present. Based on personal sightings or dead/live specimens or sightings by reliable informants.
L — Likely to be present based on past distribution.
A — Absent or nearly so.
O — No reliable information available.
* — Recorded past occurrence.

Western ghats were determined. The factors that have contributed to the relatively better status of the species in Karnataka when compared to Kerala and Tamil Nadu are: (i) Protection against hunting enjoyed by the species due to cultural factors North of 13°N lat; (ii) Relatively conservation oriented logging practiced in Karnataka State forests; and (iii) The large extent of habitat still remaining in good condition.

The status of Nilgiri langur seems to be precarious and it is now restricted to the Southern extremity of Western ghats in Kodagu district known as Brahmagiris. Situated at the junction of two different evergreen forest types, *Cullenia exarillata* dominant and *Dipterocarpus* dominant, Brahmagiris are unique in that four monkey species; bonnet macaque, liontailed macaque, nilgiri langur, and hanuman langur share the same habitat.

Carnivores

Asiatic cheetah occurred in Karnataka in the past and was called 'Sivangi' in Kannada language (Russel 1900). However, even as early as the 19th century it was apparently rare. Sanderson (1882) saw only six skins with 'native shikaris' during his long experience. Russel (1900) saw five cheetahs together in the Beerambadi forests of Mysore district and shot one of them! Interestingly, Beerambadi is a dry deciduous forest area and not the typical open plains country associated with Cheetahs further North. However, cheetahs are reported to occur in fairly dense *Acacia* forests in Kenya (M. J. Coe, personal communication). Cheetah has been extinct in the State for over 4-5 decades now.

Breeding populations of tigers occur in Nagarahole, Bandipur and Bhadra sanctuaries where cubs are frequently seen. Tigers also occur in low densities on the Western ghat slopes, other forests of Southern plateau and Eastern ghat hills. Their conservation status has improved considerably since the early seventies and they are reported from localities in which they were eliminated in the 1960s due to poisoning and poaching. However, the official 1984 Tiger Census figure of 202 animals for the State is perhaps an overestimate, primarily due to the overcounts in Bandipur Tiger Reserve due to faulty census methods (Karanth, in press).

Similarly, the status of the leopard has shown a considerable improvement. Partly as a consequence, many dispersing leopards are straying into densely populated areas and getting killed. Long term conservation strategies for these two endangered large felids need to be developed based on scientific studies.

Among the lesser cats, the fishing cat is probably locally extinct in coastal Karnataka because its littoral habitats themselves are almost entirely gone. Rusty spotted cat occurs in Nagarahole National Park and probably in many other areas since I have seen the skin of one shot on the outskirts of Bangalore city.

The rare Malabar Civet was seen by me in 1975 in the Kudremukh area (Karanth 1986) but there is no other information about its present distribution. Similarly, nothing is known about the current distribution of the brown palm civet though some skins in the British Museum collection are from Kodagu district. During my liontailed macaque survey informants in Kodagu mentioned two 'kinds' of tree civets but whether one of them is the brown palm civet or is merely a variant of the common palm civet needs to be verified.

Striped hyena has a curious discontinuous distribution in Karnataka. It occurs in the secondary deciduous forests of the wet coastal plains and once again on the drier parts of Deccan plateau. But it is absent in the inter-

vening large tracts of evergreen and moist deciduous forest areas.

The wolf occurs in small packs in widely scattered localities of Northern and Southern plateau region. 13 wolves were shot in Pavagada taluk in 1983 in a panicky response to a child-lifting scare. Wolves are reported from Gulbarga, Raichur, Bellary, Dharwar, Chitradurga, Tumkur, Kolar, Mandya and Mysore districts. Ranebennur Black Buck Sanctuary in Dharwar district is a good locality where I saw wolves on three occasions in 10 days and also saw tracks of pups. The wolves in Karnataka are preying primarily on sheep rather than on wild antelopes. The wolf habitat in State is now a mosaic of scattered scrub or plantations amidst extensive stretches of farm land. The long term survival of wolves is doubtful because no substantial protected area harbouring them exists in the State now. The other large canid predator, dhole, being a forest-dweller is much better off in nature reserves like Nagarahole, Bandipur, Bhadra and Biligirirangans where it subsists on wild prey. But in some other parts of Karnataka Western ghats like Agumbe and Koppa, dhole are also cattle killers in the absence of sufficient wild prey.

The sloth bear inhabits an amazing diversity of habitats in Karnataka; wet evergreen montane forests of Western ghats. the moist and dry deciduous forests of the plateau and Eastern ghats and boulder strewn hillocks that dot many parts of the tree-less dry plains. Apart from being a specialised termite eater, it apparently has adapted to a wide range of other plant foods in these different habitats.

The clawless otter is adopted to feeding on crustaceans and other small animals of hill streams in the Western ghats of Kodagu district. Apart from the fact that it is occasionally captured by professional hunting tribes with the help of dogs, nothing is known about its present status. The nilgiri marten still occurs in the Western ghats of Kodagu though it has almost vanished from the foothills region. Though an informant mentioned seeing it in the ghat forests of Dakshina Kannada its present occurrence to the North of Kodagu district needs confirmation. Even in Kodagu it is frequently shot by Apiary keepers as it raids the beehives kept in coffee and cardamom plantations. Very little is also known about the present status of the ratel or honey badger whose nominal distributional range covers the entire State except the West coast/ Western ghats. A wild caught specimen from Srinivasapura area of Kolar district in 1974 lived in the Mysore Zoo for a short time. All these three rare Mustelids need urgent and specific conservation efforts in the State.

Elephants and other Ungulates

The distribution of the elephants in the State is relatively better known (Nair and Gadgil 1978). The official Census estimates the elephant population at 3579 animals. This also may be an overestimate due to multiple counts of herds and other methodological problems. However, a substantial elephant population exceeding 1000 animals occurs in the Nagarahole, Bandipur and Biligirirangan sanctuaries. Adjacent Kollegal hills and Kaveri valley also support additional large populations. The populations along the Western ghat slopes in Kodagu, Hassan, Dakshina Kannada, Chikmagalur, Shimoga, and Uttara Kannada are small, disjunct and occupy a highly fragmented habitat (Nair and Gadgil 1978) and their long term viability is doubtful. Bhadra wildlife sanctuary has an almost isolated population of 60 + elephants.

Karnataka is the stronghold of gaur. Large populations of 1000 + each exist in Nagara-

hole and Bhadra sanctuaries. Substantial populations also occur in Bandipur, Biligirirangans and the Western ghat crest line.

Nilgiri tahr does not occur in Karnataka now. Whether its past distribution extended to Brahmagiris and Biligirirangans, where apparently suitable habitat exists needs to be investigated, since there are unconfirmed local reports indicating such a possibility. The present distribution of the chinkara is also unknown. But reliable observers mention its presence in Sandur, Bellary district (M. Y. Ghorpade, personal communication) and past occurrence near Kadur (K. R. Sethna and J. Van Ingen, personal communication) and in Gulbarga district (D. K. Deshmukh, personal communication). I have seen a female captive specimen obtained from an unknown locality in Northern interior Karnataka about 10 years ago.

Blackbuck occur in scattered localities of both Northern and Southern plains. A large population exceeding 2000 animals exists in Ranebennur sanctuary and adjoining areas. An interesting observation is that plantations of *Eucalyptus* raised in several barren localities (Ranebennur, Byadagi and Guttal in Dharwar district, Omkara-Naganapura in Mysore district) have offered some badly needed cover to these animals and their populations has grown as a result (Karanth and Singh, in press). The four-horned antelope is seen in drier parts of Nagarahole, Bandipur and Biligirirangans. It is perhaps more widely distributed than presumed, because local people often fail to distinguish it from the more common Muntjac.

In the past, nilgai was distributed right up to the Southern extremity of the State and adjacent areas of Tamil Nadu. Interestingly, Russel (1900) does not mention it among the native animals of Mysore district. It is probably extinct in Karnataka now, though there are unconfirmed reports of its occurrence upto the nineteen sixties. Karnataka forest department has just initiated a project to reintroduce captive bred Nilgai into the wilds in Bannerghatta National Park area.

Birds

Among birds, the Great Indian Bustard (*Choriotis nigriceps*) occurs in Ranebennur sanctuary and probably in Bellary and Gulbarga areas on the Northern plateau. In the Southern plateau region a sub-adult male, illegally caught in Yediyur area of Tumkur district is now in Mysore Zoo. Reliable informants have also reported bustard sightings from Bukkapatna (Tumkur district), Jakkahalli-Nagamangala (Mandya district) and Dasana Koppalu (Mysore district). The bird is known as "Yeraloddu' and "Dorvayana Hakki" respectively in Northern and Southern parts of the State. Migrant white storks (*Ciconia ciconia ciconia*) were sighted by me in two localities in Mysore district recently. Grey pelicans (*Pelecanus philippensis*) regularly breed in Kokkare Bellur (Mandya district).

Rangana Thittu and Kokkare Bellur (Both in Mandya district) and Mandagadde (in Shimoga district) are the well known water fowl breeding protected sites in Karnataka. The backwaters of Kabini reservoir located between Bandipur and Nagarahole National Parks also shelters large water bird congregations.

Reptiles

Marsh crocodile (*Crocodilus palustris*) occurs in the Kaveri river in Rangana Thittu and also in Nugu, Kabini and Bhadra reservoirs. On the West coast more than 10 sea turtle (mainly Olive Riddley) hatching areas have been located, where the forest department has

already initiated a turtle conservation programme (M. K. Appayya, personal communication).

CONSERVATION

Wildlife Protection

Normally poaching of wild animals is carried on by three classes of people: (i) local villagers for own consumption; (ii) traditional hunting tribes such as Hakki Pakkis for own consumption and sale; (iii) urban/semiurban hunters for 'sport' and trophies; (iv) specialised professionals like ivory hunters. Until the early 1970s poaching by all these categories was rampant in Karnataka. With the introduction and enforcement of the Wildlife Protection Act since 1974, the blatant poaching of earlier years has been gradually curtailed. Day time hunting in reserved forests with the help of dogs, public display and parading of trophies have all virtually come to an end. The poaching that goes on is essentially surruptious though still widespread. Every year probably more than a fifty poaching offences are booked by the forest department. The sport hunting by urban poachers has declined most, followed by pot hunting by villagers, within the reserved forests. The poaching in farms, estates and non-reserved forest areas is still substantial and most professional hunting tribes operate in these areas.

Poaching of elephants for ivory by organised gangs is however a serious problem. There have been several instances of exchange of fire between forest protection staff and ivory poachers, resulting in casualities on both sides. Illegal dynamiting of rivers for fish, which also kills other aquatic animals like crocodiles and otters, also continues to be a problem in the absence of effective laws.

Inadequate funds and staff, poor housing, equipments, ammunitions and other facilities are the major constraints in improving the present levels of protection.

The total ban on hunting (including licenced hunting) in the State for over ten years continuously has been very helpful to the wildlife protection staff in booking offenders who do not have any legal loopholes for escape.

Problems of Conserving Habitats

As elsewhere in the country Karnataka also faces serious problems in conserving the remaining wildlife habitats. The pressures that threaten the State's wildlife habitats originate from the efforts to meet the basic and developmental needs of a growing human population. Without trying to be exhaustive, in this section, I have tried to highlight some of these threats to conservation of wildlife habitats in Karnataka.

Conversion of Habitats to Agricultural Use

This is perhaps the single most destructive cause as large extents of forests, woodlands, wetlands and savannas outside the reserved forests which are administered by the Revenue department have been continuously converted in to farm lands through encroachments and land grants. While it is difficult to estimate the extent of such threatened habitats, the fact that about 40,000 hectares of reserved forest area alone is under illegal encroachment in the State highlights the magnitude of the problem. In Chikmagalur district alone moist deciduous and semi evergreen forests exceeding 5000 hectares are being parelleled out to cultivators by the revenue authorities, to cite just one example. All the mangrove ecosystems in Karnataka coast are likely to be similarly lost.

Habitat Loss Due to Large Developmental Projects

Large projects for irrigation, power generation, mining and railway lines have also caused substantial loss of habitats in the last three decades. An estimate puts this habitat loss in reserved forests alone at over 200,000 hectares between 1956 and 1983 in Karnataka (Anon. 1984). Some of the notably damaging projects in the past have been Kalinadi and associated projects in Uttara Kannada, Sharavathi project in Shimoga, Bhadra project in Chikmagalur, Kabini project in Mysore district for power generation/irrigation. Similarly, mining projects in Kudremukh, Sandur and Kollegal hills and the Hassan-Mangalore railway project have been some other large projects with severe accompanying habitat destruction.

Proposed Upper Bhadra, Upper Thunga and Barapole irrigation projects are also potentially capable of substantial damage.

Habitat Degradation Due to Local Factors

Excessive removal of firewood, small timber, green and dry leaf manure as well as cattle grazing and fires caused by local village communities in and around the forests have already resulted in the gradual but substantial degradation and fragmentation of wildlife habitats. Such biotic pressures have almost entirely eliminated the original plant communities in almost all the dry zone areas of the State (Shyamsunder and Reddy 1986).

The efforts of various developmental agencies of the government to deliver social services like electricity, roads, telecommunications, transport and education to human settlements honeycombing the forests are also fragmenting and degrading the wildlife habitats.

Habitat Damage Due to Forestry and Allied Activities

Forestry practices in the State have also in the past contributed to the habitat damage. The earlier practice of clearfelling extensive stands of moist forests for raising plantations of teak and rubber has significantly altered the original habitats. Clearfelling of dry forests under some silvicultural prescriptions resulted in similar damage. The impact of long rotation selection felling on wildlife is hard to assess in the absence of any good studies in the tract. While there is some evidence that such logging might even improve the habitat for some ungulates, the negative consequences like disturbance, road building and rapid spreading of exotic weeds like *Eupatorium* usually associated with selection felling cannot be ignored.

Large scale collection of minor forest produce like canes, fruits, nuts and barks of various tree species either by tribal cooperatives or others is also another factor likely to gradually alter the composition of the habitat and deny critical food resources to some wildlife species, particularly in wet evergreen forests.

In summing up the impact of all the problems of conserving habitats, it appears as though activities of local communities are the dominant cause of habitat damage in the dry zone and lower levels and peripheries of the moist zone habitats, and large developmental projects as well as forestry related activities are additional degrading factors at higher elevations and in remotely located wildlife habitats of Karnataka.

Protecting the Habitats

Inspite of many negative factors outlined above, some positive steps have also been taken in recent times by the State government

TABLE 2

NATURE RESERVES IN KARNATAKA

Sl. No.		Area km²	Habitat types	Protection status
1.	Bandipur National Park	874	Moist and dry deciduous forests	Adequate
2.	Nagarahole National Park	572	Moist and dry deciduous forests	Adequate
3.	Bannerghatta National Park	104	Dry deciduous (transitional type)	Inadequate
4.	Biligirirangaswamy sanctuary	324	Dry, moist, montane shola forests	Adequate
5.	Bhadra sanctuary	492	Dry, moist, semi evergreen and montane shola forests	Adequate
6.	Dandeli sanctuary	5729	Dry/moist, deciduous and semi evergreen forests	Inadequate
7.	Melkote Temple sanctuary	49	Dry-open scrub forest	Inadequate
8.	Mookambika sanctuary	247	Coastal deciduous, semi evergreen and medium elevation evergreens	Inadequate
9.	Nugu sanctuary	30	Degraded dry deciduous	Inadequate
10.	Sharavathy valley sanctuary	431	Evergreen, semi evergreen and moist deciduous forests	Inadequate
11.	Shettihally sanctuary	395	Dry/moist deciduous and semi evergreen forests	Inadequate
12.	Someshwara sanctuary	88	Evergreen/semi evergreen forests	Inadequate
13.	Ranebennur sanctuary	119	Eucalyptus plantation	Adequate
14.	Arabi Thittu game reserve	13	Degraded deciduous forests	Inadequate
15.	Ghataprabha bird sanctuary	29	Foreshore of reservoir	Inadequate
16.	Adichunchanagiri sanctuary	0.8	Temple surroundings	Adequate
17.	Ranganathittu bird sanctuary	0.67	River and islands on Kaveri	Adequate
18.	Mandagadde bird sanctuary*	—	River and islands on Thunga	Adequate
19.	Kokkare Bellur bird sanctuary*	—	Village premises	Adequate
20.	Brahmagiri sanctuary	181	Evergreen forests	Inadequate

* Not officially gazetted as sanctuaries.

to alleviate some of these problems. These are listed briefly here below:

1. In 1975 the executive wing of the State government shed its own powers to release reserved forests for agricultural use and vested it in the legislature. A similar All India measure (The Forest Conservation Act, 1980) came in to force only six years later.
2. In the 1974-1977 period, the grossly misused privilege of allowing people to take carts in to forests ostensibly to collect 'dry wood' under prepaid licences was stopped. Powers to evict encroachers and confiscate vehicles used in forest offences were given to forest officers.
3. In the 1974-1980 period the practice of clearfelling natural forests for monoculture plantations was stopped. Even under selection felling the intensity of exploitation was considerably reduced. As a result of these conservation measures the annual production of firewood and timber from reserved forests declined by 52% between 1975 and 1983. (Karanth 1985).
4. In 1976 a major afforestation programme was drawn up by the State forest department to raise plantations in unwooded and barren areas to meet the growing needs of fuel, timber and industrial wood. Though this plan was rejected by Government of India, later in the 1980s a substantial social forestry project was launched with the World Bank assistance to meet fuelwood/timber needs.

Nature Reserves in Karnataka

Karnataka has 3 National Parks and 14 Wildlife Sanctuaries which cover 9900 km^2 or 26% of the total reserved forest area (5% of the geographical area) of the State. These figures are, however, misleading because Dandeli wildlife sanctuary, which is virtually unprotected and includes a large part of Uttara Kannada district accounts for 5700 km^2 or 58% of the area under nature reserves. Actually, apart from Nagarahole, Bandipur, Biligirirangans, Bhadra and Ranebennur, other notified nature reserves are merely reserved forests with no extra efforts on wildlife protection. Moreover, in terms of biogeographic representation also, the existing nature reserves tend to overrepresent deciduous forests while inadequately serving all other biomes/habitat types. Table 2 shows the existing nature reserve areas, habitat types represented and status of wildlife protection in them on a subjective scale.

To overcome these drawbacks, the state wildlife advisory board has recommended rationalisation of the nature reserve network by the addition of some unrepresented/under represented habitat types and deletion of unviable areas and over-represented habitats. If these proposals are accepted by the government many of the diverse plant and animal communities in the State will receive protected area status. But some of the habitats like mangroves, thorn scrub and dry evergreen vegetation might already be eroded beyond the levels needed for providing adequate sized reserves.

Summary and Conclusions

Since 1974 several positive measures have been implemented to improve the conservation status of wildlife and habitats in Karnataka. Large areas have been declared as protected areas. Antipoaching measures have been reasonably effective at least in some nature reserves like Nagarahole, Bandipur, Biligirirangans, Bhadra and Ranebennur. In general there has been probably a decline in the levels of poaching in the reserved forests

all over the State when compared to the earlier two or three decades. Schemes for provision of monetary compensation to farmers for life, livestock and crops lost due to wildlife are also operating reasonably well. Forestry activities has been considerably curtailed as a conservation measure.

However, many problems still need to be overcome. Existing nature reserve system does not represent all wildlife habitat types and biomes. The paucity of funding, staff, equipment and infrastructural facilities have resulted in wholly inadequate levels of protection in many notified nature reserves. Even the better funded reserves like Bandipur, Nagarahole, Bhadra and Ranebennur are managed on an adhoc basis without any coherent wildlife management concepts or plans. On a broader scale, conversion of wildlife habitats to agricultural use by the revenue department, large developmental projects, leases for extraction of plywoods and for cultivation and fragmentation/destruction due to developmental activities pose long term threats.

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