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NEPAL

**ROYAL KARNALI WILDLIFE RESERVE
MANAGEMENT PLAN 1976—1981**

**NATIONAL PARKS AND
WILDLIFE CONSERVATION**

Bios
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007



**FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS**

NATIONAL PARKS AND WILDLIFE CONSERVATION

NEPAL

ROYAL KARNALI WILDLIFE RESERVE

MANAGEMENT PLAN

1976 - 1981

Prepared for the
Government of Nepal

by

Melvin Bolton
Wildlife Ecologist

UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

KATHMANDU 1976

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FAO National Parks and Wildlife Conservation Project, Nepal

Royal Karnali Wildlife Reserve Management Plan 1976-1981
by Melvin Bolton Kathmandu 1976 70pp., 3 maps, 2 figs.
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ABSTRACT

The project was established to determine and implement appropriate conservation measures to ensure the continued survival and proper management of the nation's wildlife resources.

Karnali is one of four areas in Nepal selected for protection and development as a wildlife reserve. Formerly a Royal Shikar Reserve, it supports an unusually rich variety of wildlife representative of western Terai and is one of the main strongholds of the tiger and gharial in Nepal. The management plan follows a standard format in which historical and descriptive information is followed by a statement of management objectives. These are discussed mainly under the headings of conservation, research and estate management.

It is considered that the principal purpose of the reserve must be to conserve a representative example of the fauna and flora of western Terai and in particular the tiger and its natural habitat and prey. The reserve should also play a vital role in assuring the survival of the gharial and could become important for the conservation of swamp deer and black buck in Nepal. It is recognised that during the life of this plan it would be unwise to attempt to promote tourism or incur great expense in attempting to further the educational potential of the reserve though these functions could be important in the long-term view.

Prescriptions for realising these objectives are put forward as prescriptions for management and research priorities are identified.

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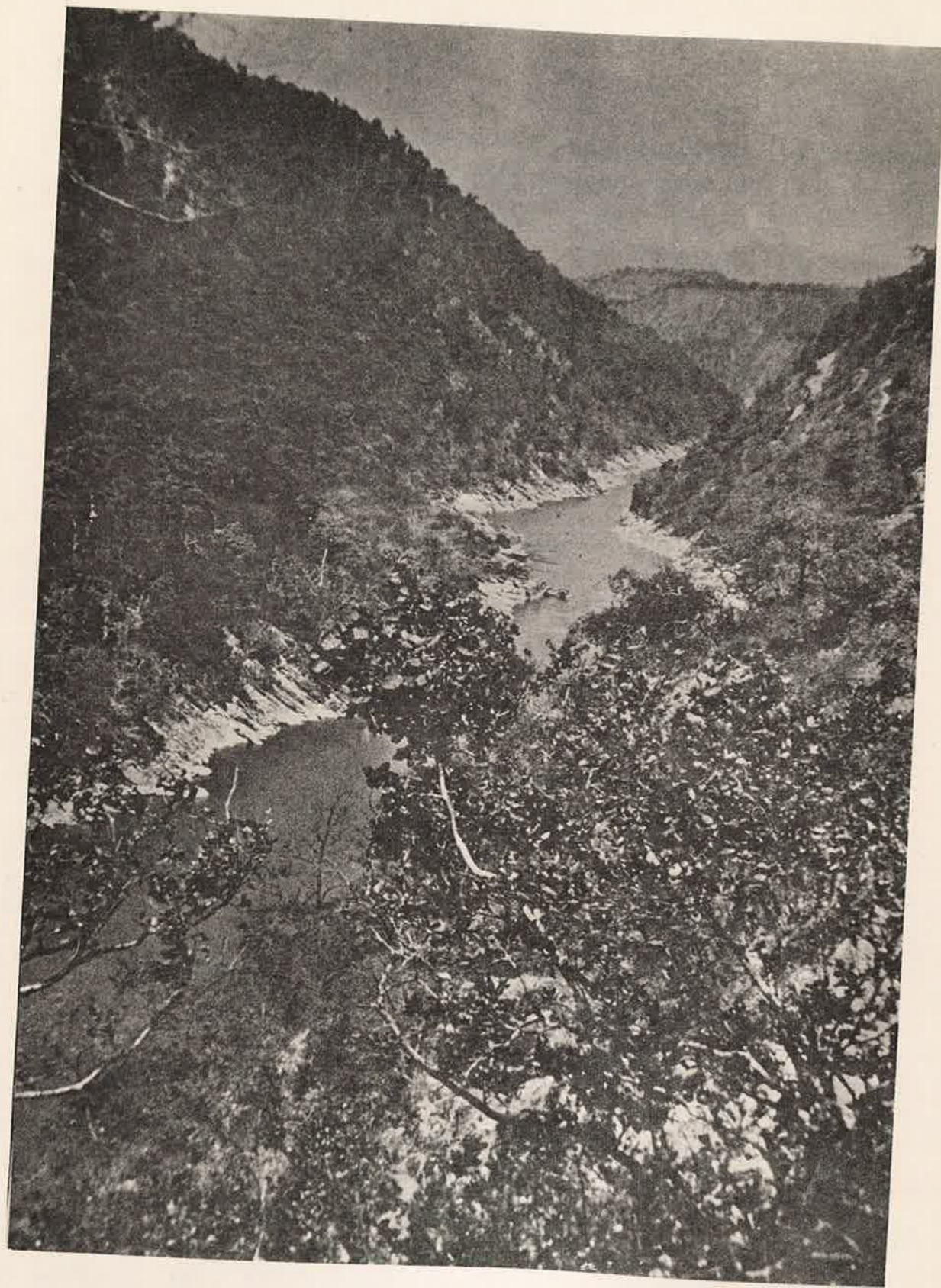
The work and readily given assistance of Mr Eric Dinerstein, Peace Corps Volunteer ecologist, has been invaluable. Gratitude is expressed also to the regional warden for unfailing help in the field and the office, and to the manager, co-manager and staff of the National Parks and Wildlife Conservation Project for their support and cooperation.

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KARNALI GORGE AT CHISAPANI
(looking north)

1. INTRODUCTION

The National Parks and Wildlife Conservation Project was established in 1973 by the Government of Nepal with assistance from the United Nations Development Programme (Special Fund Sector) and the Food and Agriculture Organization of the United Nations. The long-range objective of the project is to ensure the more effective conservation and management of the country's national parks and reserves which, in addition to their conservation role, will play a valuable part in the tourist industry.

The Royal Karnali Wildlife Reserve is not at present part of an established tourist circuit but it is expected to play a more significant role in the development of tourism when accessibility improves. Its immediate importance lies in its value for the conservation of the Terai fauna, especially the tiger and gharial. Having been for many years a protected shikar reserve the area is relatively rich in wildlife and remains comparatively unspoiled. The shikar reserve was visited in 1971 by the FAO wildlife management adviser who recommended the creation of a wildlife reserve in which hunting and other forms of exploitation should be prohibited.

The Royal Karnali Wildlife Reserve was gazetted in March 1976 and covers an area of approximately 132 square miles (348 sq.km). It includes a section of the Girwa River (the eastern branch of the Karnali downstream of its gorge), and of the Siwalik (Churia) range but the bulk of the reserve consists of fairly flat, alluvial land under sal forest.

Under the guidance and control of the reserve's warden commendable progress has been made with poaching control and infrastructural development and a good system of roads and guard posts now exists. The FAO ecologist visited the reserve in March 1976 and in this plan an attempt has been made to describe it, assess its potential and to outline the procedures and requirements necessary for appropriate management over the next five years.

It must be emphasised that both the descriptive and prescriptive parts of this plan will be subject to expansion and revision as further information comes to light. The plan is one of a series of management plans produced by HMG/UNDP/FAO and further information relevant to the Terai can be found in Working Document No 2 (Bolton 1975) and Field Document No 1 (Wegge 1976).

2. GENERAL INFORMATION

2.1 Location and Boundaries

The reserve is located in south-western Nepal 248 miles (396 km) west of Kathmandu in 81° 20' E 28° 35' N. The whole of the reserve lies in the Bardia District of Bheri Zone and occupies a total area of about 132 square miles (348 sq. km). The River Girwa, a branch of the Karnali, forms the western boundary. The crest of the Churia (Siwalik) range delimits the reserve to the north, and ridges of this range have been selected for the eastern boundary. In the south the boundary follows the Babai River as far as possible but most of the southern boundary has been determined by the local limits of cultivation and human settlement.

A formal boundary description, as published in the Nepal Gazette, is given in Appendix II and the boundary is indicated on Map 2.

2.2 Description in Brief

For the most part the reserve, like much of the Terai, consists of flat, forested land lying between 500 and 1000 feet (152-304m) above sea level. In the north however the foothills of the Churias rise quite steeply to the crest which in places reaches above 4000 ft (1220m) a.s.l. Temperatures range between about 10°C (Dec) and 40°C (May). Rainfall is moderately high (about 60 inches, 150cm, a year) in the southern part of the reserve and appreciably more towards the northern hills.

The land is well-drained by a number of rivers which rise in the Churias and flow to the south-west as tributaries of the Karnali. In this region the Karnali separates into several channels, the most easterly of which is the Girwa. The west bank of the Girwa forms the western boundary so that this river, more than a mile wide, and its numerous forested islands, are included within the reserve.

The river islands and other riverine regions of the reserve are commonly forested by distinct riverine associations. There are also a few small areas of open grassland but by far the greater proportion of the reserve lies under sal (*Shorea robusta*) forest or fairly similiar forest of mixed deciduous and semi-deciduous broadleaf trees.

Wildlife includes a variety of ungulates and predators, including tiger, and there are gharial, mugger and good fish stocks in the major rivers.

With the exception of Chisapani in the north there are no human settlements in the reserve though human activities are evident in fishing, stock grazing and collection of forest products in certain areas. A number of public rights of way are in regular use.

2.3 Access and Communications

Access to the reserve, while never completely impossible, is nevertheless troublesome and seasonally very difficult. From Kathmandu, at the time of writing, there are scheduled flights to Nepalganj three days a week and to Surkhet once a week but these flights are suspended during the monsoon. The aircraft involved are all Twin Otters with a seating capacity of 19 passengers. Each passenger has a baggage entitlement of 15 kg. Fares are 275 and 250 rupees to Surkhet and Nepalganj respectively. From Surkhet it is a two-day walk to the reserve but from Nepalganj there are rough, dry weather motor tracks (actually cart-tracks) for 4x4 vehicles. The drive takes about four to five hours. Diesel oil and petrol are available in Nepalganj.

Chartered STOL aircraft are able to land at all seasons at the headquarters of the Forest Development Project at Ranijharawa but only during the dry season is it possible to ford the Babai River to the north. A disused strip west of the Babai, i.e. on the same side of the river as the reserve, could be much more useful and with improvement might be made suitable for Twin Otters. The strip lies about 5 km south west of Bargada.

Travel overland from Kathmandu involves entering India at the Bhairawa Nautanwa border post (some 223 miles, 360 km by road from Kathmandu), driving through India for a day and re-entering Nepal at the Rupaidia-Nepalganj border post. Total driving distance from Kathmandu to the reserve by this route is about 550 miles (880 km).

The western section of Nepal's east-west highway is being built under an Indian aid agreement and should be completed well within the life of this plan. The highway will enable all traffic to drive as far west as Nepalganj without having to enter India. This will significantly reduce the driving time from Kathmandu. Plans for extending the highway north to Surkhet and westwards from Nepalganj are not yet finalised but are being considered by His Majesty's Government of Nepal. The existing Indian aid agreement is not involved.

It seems probable that eventually the highway will pass through the reserve in order to cross the Karnali at the gorge near Chisapani since the river could not be bridged further south. This, however, is looking to the future and far beyond the life of this management plan.

Within the wildlife reserve an adequate system of good, dry weather motor roads exists and a well-used footpath leads from Danwatal through Telpani to Surkhet. An established trekking route, on the west side of the Karnali, leads to Jumla. There is radio communication between the reserve and wildlife headquarters in Kathmandu.

2.4 History of Establishment

Before July 1969 that part of Bardia District which is now the reserve held no special status although it was generally known to be a good hunting ground. A few shikars are said to have been organized there each year, mainly by professional hunters from Kathmandu whose clients were resident in Nepal or India. Visiting Indian hunters also hunted there quite legally without the assistance of a Nepalese professional.

Commercial forestry was not practised except for about five years following 1925 when a Mr J V Collier organized the felling and export to India of sal trees at as fast a rate as they could be handled. He built a railway for the purpose and although this was taken away long ago traces of its course can still be followed through the reserve.

The destruction, according to reports, must have been very serious indeed and it is probable that the forest has still not recovered its former composition. Robbe (1954) writes of Mr Collier "when demand (for sal) slackened at the beginning of the economic crises of 1930 he had left vast areas in utter ruin and huge quantities felled but not exported."

In July 1969 His Majesty's Government, upon the personal instruction of His Majesty the late King Mahendra Bir Bikram Shah Dev, declared a Royal Shikar Reserve under the provision of the hunting regulations of 1966. Boundaries were approximately as at present. The reserve was protected by guards employed by the Ministry of Forest. Two years later, in 1971, the FAO wildlife management adviser visited the reserve and recommended the creation of a wildlife reserve in which hunting and other forms of exploitation would be prohibited. His Royal Highness Prince Gyanendra in late 1973 directed the Assistant National Parks and Wildlife Conservation Officer of HMG to further investigate and report on the reserve with a view to submitting a project proposal to the World Wildlife Fund under "Operation Tiger". The manager of the existing HMG/FAO/UNDP project accompanied the officer and their report (Poppleton and Mishra 1974) was submitted in early 1974.

A reserve warden (in addition to the existing forest guards) was appointed to the area in November 1974 and the Royal Karnali Wildlife Reserve was officially gazetted on 8 March 1976. The forest guards have now been withdrawn and are being replaced by military personnel in accordance with HMG policy for all Nepal's parks and reserves.

2.5 Regulations

Under the provisions of the 1973 National Parks and Wildlife Protection Act draft regulations for the reserve have been prepared and are currently under consideration by His Majesty's Government's legal authorities. No English translation is yet available but the draft has been submitted for approval under the title "Terai Wildlife Reserve Regulations". It is understood that the proposed regulations are based largely upon the Royal Chitwan National Park Rules 1974.

2.6 Permits

Permits are issued by the warden to local people wishing to cut thatch grass. Research workers or other visitors are expected to obtain written permission for entry or other specified activities from the warden or from headquarters in Kathmandu. The need has not arisen for a formal system of printed permits.

2.7 Reference Collections, Maps and Photographs

The Peace Corps Volunteers ecologist has assembled a collection of pressed plants which will be left for reference after his departure in late 1976. The herbarium maintained by the Ministry of Forest in Kathmandu also contains many specimens from the reserve but not in discrete collections.

The best maps are still the one inch survey of India series and sheets 62 H6 and 62 H2 cover most of the reserve. South of latitude 28 30'N however no map is available in this series. The Ministry of Forest holds 3 inch to 1 mile Forest type maps in black and white which cover the whole reserve but these show only forest distribution a decade or more ago, water-courses and selected other features. For reserve management the 1:250 000 US Army Maps (Nepalganj sheet, compiled 1954) are of little value.

Air photographs (1:12 000) 1964 covering most of the reserve are held by the Ministry of Forest. In 1971 a further series, covering the central part of the reserve was taken by the HMG/FAO/UNDP Forest Department Project using the UN aircraft and pilot. As far as can be discovered the negatives are held by the said project and the scale of the photographs is 1:20 000.

3. REASONS FOR ESTABLISHMENT

Historically the area of the Karnali Wildlife Reserve was afforded some measure of protection as a hunting ground. In consequence it remained one of the richer pockets of wildlife while other forms of exploitation affected the Terai.

Nowhere west of Chitwan is there known to be a greater variety of wildlife in such an attractive stretch of relatively unspoilt country. In particular the great Karnali River has no equal in Nepal and the wealth of fish and the presence of gharial, mugger and Gangetic dolphin add enormously to the importance of the area in the national conservation scheme. As stated earlier however (2.4) it was the presence of tiger which, more than anything focused new attention upon the value of Karnali as a conservation area. It remains to be explained why the area was declared a wildlife reserve (one of four possible categories of conservation area under Nepal's legislation) and to summarise the reason for its establishment.

The possible alternatives would have been to allow the area to remain a Shikar Reserve or to declare a National Park (the fourth category, "Strict Nature Reserve", is not appropriate being "for purposes of scientific study only"). A system of hunting blocks is being considered in Banke District immediately east of the reserve (Wegge 1976) and this, as His Majesty's Government fully appreciates, can be a perfectly rational form of wildlife conservation in the sense of "wise utilisation" of the resource. With careful management wildlife populations can be increased under a regime of controlled hunting but it is not practicable to afford hunting areas the maximum measure of protection from other forms of human disturbance. Yet in view of the national and international concern for the tiger and other species in Karnali it was considered that a high degree of protection should be extended to the area.

On the other hand it was thought that the region did not merit national park status. In the writer's opinion Karnali could quite easily meet the international criteria of a national park and under the proposed management policies the reserve will approach that status administratively. Nevertheless Karnali must be rated as a somewhat lower priority than Chitwan in terms of wildlife potential and the decision to declare a wildlife reserve was undoubtedly wise in view of the present problems of access and the very serious nature of the threats posed by road and dam construction projects (5.2.4). As a reserve Karnali can be legally and effectively protected, there is no risk of diluting the national park concept, and the area will have sufficient legal status and flexibility to best enable it to meet the contingencies of future developments. Certainly every effort must be made to protect the interests of the reserve as

far as possible in future development planning but in view of the magnitude and national importance of the road and dam projects it would be unrealistic and unwise to declare and develop a national park at this stage.

In brief, the Karnali Wildlife Reserve was established specifically for the conservation of the indigenous Terai fauna in its natural habitat; especially the tiger and the gharial both of which are listed as "endangered" in the IUCN Red Data Book (IUCN 1968 & 1974). Since its establishment the reserve has also been found to contain swamp deer, another endangered species. Other animals recorded in the reserve and listed as "vulnerable" are the Asiatic wild dog, leopard and Asiatic elephant.

Tourism, while not a factor influencing the decision to establish a reserve, is a possibility in the long term view.

4. SCIENTIFIC SURVEY DATA

4.1 Climate

The dominant climatic factor is, of course, the monsoon. Since the rain-bearing winds reach Nepal from the east it is a general rule that the western Terai receives less rain and tends to have a shorter monsoon than the east. Local topography may completely override this simple pattern however. Fig 1 shows monthly rainfall, averaged over five years, for Gularia and Chisapani. It can be seen that the monsoon lasts from June through September and that with 90.8 inches (231cm) a year Chisapani, at the foot of the Churias, received about 49% more rain than did Gularia which had only 61 inches (155.5cm) a year. The records for Nepalganj are available for only four consecutive years (1969-72) but during this period the average annual rainfall was 52.1 inches (133.7 cm) compared with 60.2 inches (153.4cm) at Gularia and 91.3 inches (232.4cm) at Chisapani for the same period.

When the rainfall for Chisapani is averaged over a period of 9 years (1964-72) the annual mean falls to 87.4 inches (222.5cm). But it is interesting to note that this is still slightly higher than that recorded for Chitwan (1958-66) at the Rapti Agricultural station 200 miles (320km) to the east but not quite so close to the foothills.

Table 1 shows the annual range of temperatures recorded at Chisapani. As one would expect, December and January are the coolest months with temperatures rising during the spring to reach a maximum in May and falling again with the onset of the monsoon.

At Chisapani a strong northerly wind funnelled down the gorge of the Karnali seems to be a persistent feature of the local climate but no systematic records are available. This is presumably a katabatic affect with cooler, denser air from the mountains being forced along the river gorge to lower levels.

4.2 Topography

The reserve lies cradled against the foothills of the Himalayas such that its northern boundary follows the crest of the first great ridge. The Siwalik (or Churia) Range, and a spur of this range forms the boundary to the east. Much of the northern border lies well above 4000 ft (1,219m) and at its highest point reaches 4,728 ft (1441m) but the southern slopes of the hills fall quite steeply to the 1000 ft contour so that approximately two thirds of the reserve lies below that elevation. The bulk of the land thus consists of fairly flat, forested country falling gently to about 500 ft (152m) a.s.l. in the south west of the reserve.

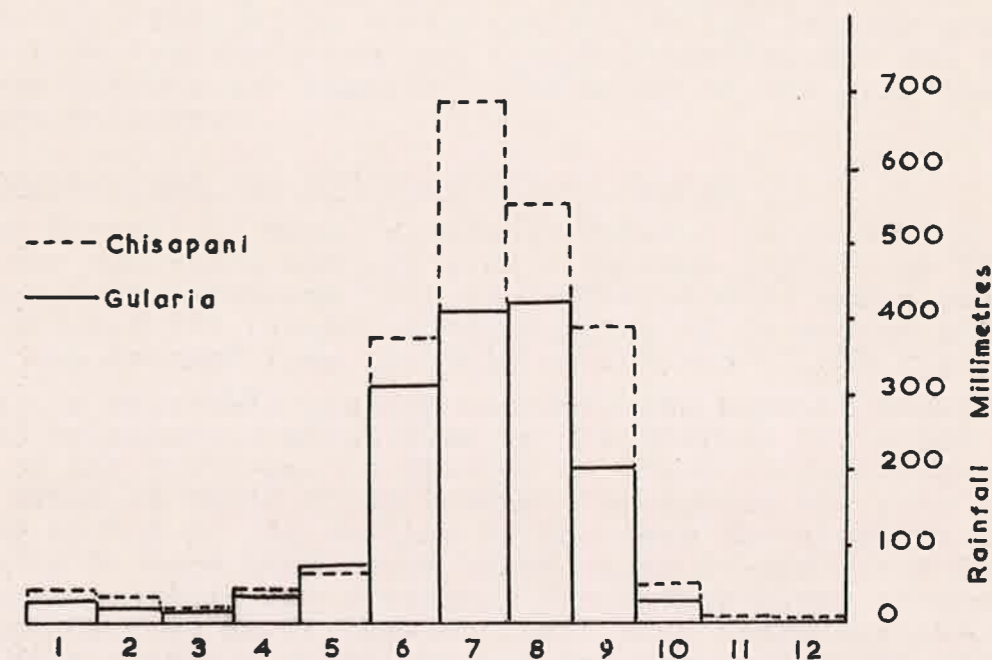


Fig. 1

Average annual rainfall 1968-1972 (five years)

	JAN	FEB	MCH	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Mean												
Max	21.0	24.8	30.6	35.9	39.4	35.8	33.5	32.2	32.3	30.5	26.0	21.4
Mean												
Min	10.3	12.1	16.4	20.9	24.9	25.8	25.2	24.7	23.7	19.7	15.0	10.9
Max	22.2	27.1	32.8	38.1	41.3	39.8	38.6	33.3	33.6	31.5	26.7	22.3
Min	9.5	10.9	15.0	19.9	22.2	24.5	24.8	24.4	23.1	18.6	13.4	10.1

Table 1 Temperatures (centigrade) recorded at Chisapani 1965-1972

To the west the reserve is bordered by the Karnali River which, in this region, is characterised by low islands and flood plains but to the north has cut a rather spectacular and attractive gorge through the Churias. The mouth of the gorge lies within the reserve.

4.3 Drainage and the Hydrobiological Regime

The Karnali is Nepal's biggest river. At Chisapani records for the years 1962-72 show a minimum dry season flow of 7560 cubic feet per second (214 cu.metres/second) and a peak flow of 579,175 cfs (16,400 cms), a range of 76 orders of magnitude. The average flow for this period was 47,075 cfs (1,333cms).

As the reserve's western boundary the Karnali receives a number of tributaries which rise in the Churias and drain the reserve to the south-west. Several of these large streams contain running water in their upper reaches throughout the year as indicated on Map 2. At no time of the year therefore is it possible to be more than about three miles (4-5km) from fresh surface water within the reserve. The Koraha River in the south west originated as an irrigation canal many years ago but now appears as a sizeable river which flows the year round and in effect creates an island to the west (i.e. between the Koraha and the Girwa).

Kodhawa Tal is the only static body of water and that, at least for much of the year, is small and muddy, a pond rather than a lake. It is said to dry completely at the end of the dry season. During the monsoon flood depressions within the lower forests became swampy.

4.4 Geology and Soils

The Siwalik Range is of late Tertiary origin and in Bheri zone exposed rocks consist of fine-grained sandstone with pockets of clay, shale, conglomerate and freshwater limestone. These rocks have been the source of most of the alluvial materials deposited by streams on the plains immediately south of the foothills in what is known as the bhabar.

Bhabar, the gently-sloping alluvial zone at the base of the Siwaliks, thus constitutes the bulk of the wildlife reserve. The usual pattern of deposition takes the form of broad alluvial fans spreading out from the point where streams and rivers debouch onto the plains. The Karnali however has laid down bhabar deposits in a very wide belt extending into India and has carried alluvium also from the Mahabharat Range which lies behind the Siwaliks. In composition bhabar deposits consist of boulders, cobbles, gravels and coarse sand interbedded with silt and clay.

Beneath the bhabar (and in places interfingering with it) lie the older deposits of Gangetic alluvium consisting of beds of silt, clay, sand and pebble gravel. This is the northern

extension of the Gangetic alluvium of India and it lies to a very great depth. In Bheri Zone drillings carried out by hydrological survey teams have penetrated unconsolidated fluvial deposits to a depth of 1,500 ft (457m) without encountering bedrock (Evet 1969. Ogilbee 1973)

Soils of the flat or more gently-sloping parts of the reserve are generally well-drained and quite deep. Brown or yellow-brown sandy loams predominate and are mostly calcareous and slightly alkaline in reaction. In well-drained riverine localities the recent alluvium may range from sandy loam to sand and be more grey in the surface layer.

As one would expect, soils of the steeper slopes of the Churias tend to be very shallow and skeletal with much exposed rock. Some parts are seriously eroded and the steepest slopes, near the crest of the ridge are subject to landslides.

4.5 Vegetation

Very broadly there are five distinct vegetation zones in the reserve: sal forest, hill sal forest, riverine forest, riverine (flood plain) grassland and non-riverine grassland or phanta. These are best discussed separately since within these crude divisions quite major sub-types can be recognised. Distribution of vegetation types is indicated on Map 3.

4.5.1 Sal Forest

Stainton (1972) described the composition of bhabar sal forest north of Nepalganj. He distinguishes an upper canopy, a second storey and a small tree/shrub layer with the following composition:

Canopy

Shorea robusta, Terminalia tomentosa, Terminalia belerica, Terminalia chebula, Adina cordifolia, Anogeissus latifolia, Lannea grandis, Schleichera trijuga, Eugenia jambolana (to this might be added Lagerstroemia parviflora, at least within the reserve).

Second Storey

Mallotus philippinensis, Semecarpus anacardium, Dillenia pentagyna, Kydia calycina, Aporosa dioica, Casearia tomentosa, Buchanania latifolia

Shrub Layer

Ardisia humilis, Zizyphus rugosa, Clausena sp., Barleria cristata. Climbers include Spatholobus roxburghii and Bauhinia vahlii

Within the reserve Dinerstein (1976) distinguishes

two main types of lowland sal forest. In the south-west of the reserve, where ground water is shallower, smaller trees especially Buchanania latifolia, are more abundant and there is a generally denser understorey. The herbaceous layer consists mainly of short grasses (including Cynodon dactylon and Imperata cylindrica), sedges and forbs. In the interior of the reserve a drier, taller sal forest prevails in which well-grown sal trees, (80 ft or over) Terminalia tomentosa and Anogeissus latifolia dominate the canopy. The understorey is much less dense and taller grasses make up the herbaceous layer (Thysanolaena maxima, Apluda mutica, Erianthus and Themeda species). This latter is the typical fine sal forest of the reserve which has been described as "some of the best mature timber in western Nepal" (Bryan 1972).

Various forest surveys have identified areas of "mixed Terai hardwoods" in which sal is not predominant but still persists as a component species. Because of the commercial value of sal timber it is important, in commercial forest management plans, to distinguish these variations in the relative abundance of sal but the ecological significance of Shorea in the context of wildlife management is not so obvious. Indeed, as wildlife food and cover, many other tree species are more valuable than sal, but the ecological contribution of any common species to the complex forest habitat as a whole is impossible to assess without exhaustive research. Having located areas in which sal is not pre-dominant (using aerial photographs and field investigation) forest surveyers have delineated them on forest type maps although it is accepted that the boundaries are very approximate or even arbitrary. Again this is valuable for commercial foresters but could be positively misleading ecologically, especially since past selection of sal timber may have altered the forest composition in favour of other hardwoods within the reserve; it has certainly done so elsewhere. For these reasons areas of "mixed Terai hardwoods" are not indicated on Map 3 and the term 'sal forest' must be taken to include areas in which sal, though usually present, is not the most frequently occurring species.

As described above sal forest covers approximately 42% of the reserve.

4.5.2 Hill Sal Forest

Sal commonly grows to about 3,500 feet (1067m) on the Himalayan foothills but rarely attains more than 40-50 ft in this situation. This, as Stainton points out, is almost certainly the result of shallower and less fertile soil rather than the effect of altitude.

In the reserve the land begins to rise steeply above about 1000 feet (304m) and the trees of the forest become noticeably stunted. Forest composition does not alter radically but the relative frequency of species changes. Dinerstein (1976) has observed, for example, that Terminalia tomentosa, Lagerstroemia parviflora and Anogeissus latifolia become more plentiful. Because of stunting of taller trees there is also a merging of canopy with second storey and, more so than with other forms of sal forest described here, there are areas where Shorea is not the most frequent or conspicuous tree.

A number of bushes and shrubs occur in the hill sal which occur scarcely or not at all in the lower forests - notably the palm Phoenix. In the hills of central Nepal Stainton has recorded the species listed below. He had detected very little difference in the hills north of Nepalganj except that Terminalia tomentosa and Anogeissus latifolia are "a good deal more abundant" in the canopy.

Canopy

Shorea robusta, Lagerstroemia parviflora, Terminalia tomentosa, Anogeissus latifolia, Adina cordifolia, Semecarpus anacardium, Bauhinia variegata, Dillenia pentagyna, Buchanania latifolia.

Second Storey

Nyctanthes arbortristis, Kydia calcina, Leucomeris spectabilis, Glochidion velutinum, Symplocos racemosa

Shrub Layer

Hamiltonia suaveolens, Phoenix humilis, Indigofera pulchella, Flemingia strobilifera. Climbers include Bauhinia vahlii and Spatholobus roxburghii. On the higher, south facing slopes of the Churias in the reserve Pinus roxburghii appears among the broad-leaf species. Hill sal forest covers about 35% of the wildlife reserve.

4.5.3 Riverine Forest

The term 'riverine forest' is useful and obviously refers to forest along watercourses. But in this situation the forest is by no means constant in floristic composition or even general appearance. Three distinct types can be distinguished.

a. Khair Sissoo

This is the pioneer association on riverside gravels. Khair (Acacia catechu) and sissoo (Dalbergia sissoo) occur

together (sometimes with one or the other strongly predominating) on the islands of the Girwa and along all major watercourses of the reserve as indicated on Map 3. The trees reach about 50 ft (15.5m) in height, varying in density and sometimes having a dense undergrowth of Pogostemum plectranthoides or Colebrookea oppositifolia. Dinerstein (1976) mentions that where heavy grazing by stock has occurred in the reserve Ziziphus mauritanica and Cassia tora (an unpalatable legume) have become the most prominent species in the undergrowth. He also observes that during the monsoon the grass becomes lush with Imperata cylindrica, Vetiveria zizanioides, Erianthus ravennae and Cynodon dactylon among the predominant species.

Khair and sissoo ascend well into the foothills along the bigger streams and Stainton mentions that they extend along the Karnali Valley to above 4000 ft (1219m).

b. Deciduous Riverine Forest

Khair-sissoo tends to stabilise fresh alluvium and in doing so helps to prepare the ground for the next stage in the succession - the deciduous riverine forest. In classic form, and undisturbed, this borders the khair-sissoo zone in a distinct band. Khair often persists but sissoo is not usually present in this later seral stage.

Waterside terraces on stable soil are naturally favoured for both cultivation and stock grazing and in consequence the composition of deciduous riverine forest tends to be more variable than would otherwise be the case. The following are among the most constant of the tree species: Bombax malabaricum (simal), Mallotus philippinensis, Eugenia jambolana and Garuga pinnata.

According to Stainton "cattle and sheep from the Jumla area descend during the winter into the low-altitude forests north of Nepalganj in much greater numbers than is customary elsewhere in Nepal. In consequence the deciduous riverine forest found in these places is usually much cut and burnt, and often is reduced to isolated trees forming a savannah - like forest on open grazing ground."

In the south west of the reserve Dinerstein (1976) has described exactly these conditions and although not now grazed by stock it is possible that this "simal savannah" was produced by human agency in the past. In addition to the trees listed above Dinerstein includes Adina cordifolia, Randia dumetorium, Dalbergia sissoo, Casearia tomentosa, Aegle marmelas and Bauginea racemosa among the more common trees which are scattered or growing in clumps on the otherwise open grassland. The grassland is heavily dominated by Imperata cylindrica, Erianthus

ravenae, Fimbristylis dichotoma and sedges.

c. Evergreen Riverine Forest

This is described by Stainton under the name of Tropical Evergreen Forest but he states that in Nepal it "occurs only as narrow strips along watercourses or in gulleys, and it has a marked preference for shady north-facing sites." Whether it is confined to these sites because the rainfall is too low to support it elsewhere or whether it is restricted by fire which favours sal forest is uncertain. In the reserve it is well-developed along the Koraha River where Dinerstein has studied it in detail. It is from his work that the following description is taken:

Canopy

This consists mainly of Ficus glomerata, Eugenia jambolana, and less frequently, Acacia catechu reaching up to about 65 feet (20m).

Second Storey

Mallotus philippinensis with Murraya koenigii, Streblus asper, Grewia elastica, Ficus cunea, Casearia tomentosa, Litsea polyantha and others of less frequent occurrence.

Shrub Layer

Calamus tenuis, Pogostemon plectranthoides, Colebrookia oppositifolia, Clerodendron infortunatum, Clausena sp. and others. Climbers (lianes) are present but have yet to be identified.

This forest is at all times shady and ground vegetation is sparse, the forest floor being carpeted for the most part by leaf litter on bare ground. Some grasses do occur however, especially Vetiveria zizanoides and, less commonly, Cynodon dactylon and Saccharum spontaneum.

4.5.4 Riverine (Flood Plain) Grassland

This is a rapidly-growing association which is able to colonise newly exposed sand as the water level begins to fall. It is mainly composed of Saccharum spontaneum with bushes of Tamarix indica the seeds of which are water-borne and thus deposited in the sand.

4.5.5 Non Riverine Grassland or Phanta

There are two major phantas (Baghora and Lamkhole) within the wildlife reserve as shown on Map 2. There are also smaller areas of savanna with good grass cover on Koraha Island but these, like the area south of Baghora

phanta, have probably been produced by human activity from deciduous riverine forest. Both phantas are said to have been cultivated within the last ten years (Dinerstein 1975). In the same report differences in the present character of the two phantas were described and are summarised below:

Lamkhole Phanta

Appears to be dominated by a tall grass locally known as dudhi but as yet unidentified, together with Cyperus sp. and Cynodon dactylon.

Baghora Phanta

The northern parts support a dense growth of tall grass (Saccharum spontaneum) reminiscent of the flood plain grasslands of Chitwan. The southern part does not differ markedly in floristic composition from the grass cover beneath the simal savanna with which it merges to the south. Fimbristylis sp. Imperata cylindrica, Echinochoa sp. and Cynodon dactylon make up the bulk of the cover.

4.6 Fauna

In general the fauna of Karnali is similar to that of Chitwan but there are some notable exceptions. Rhino and gaur, for example, do not occur at Karnali. Nilgai are commonly seen in the reserve but (apart from one unconfirmed report) they are not found at Chitwan. Nor do swamp deer or goral occur in Chitwan though both have been seen at Karnali.

Provisional check lists of mammals (annotated) and birds appear in Appendices III and IV. Available information on some of the more important animals from a conservation viewpoint is summarised below. Species not included in this section of the Chitwan management plan are also very briefly described.

4.6.1 Mammals

Rhesus Macaque (Macaca mulatta)

Common Langur (Presbytis entellus)

Both these monkeys are particularly common in Karnali. A brief survey by researchers from the Johns Hopkins University was carried out in early 1976 and a report is awaited. In general the langurs tend to occupy the forest throughout the reserve while the rhesus favour the southern border adjacent to cultivation. The Johns Hopkins Census recorded 25 troops of langurs inside the reserve and 10 troops of rhesus along the southern border

In both types average troop size was about 30 individuals.

Leopard (Panthera pardus)

No census has been conducted but Dinerstein has found evidence of at least six individuals, mainly in the southern border area and near Chisapani. Droppings were noticed on the track between Danwatal and Telpani. The leopard of course is notoriously adaptable. It is also extremely secretive and it would be surprising if, in Karnali, there were not at least double the number of leopards that we have evidence for.

Tiger (Panthera tigris)

General observations indicate that the tiger population of Karnali is unlikely to exceed that of the Chitwan National Park and is probably rather less. The ecologically richer areas of the south west, the thicker cover along the Girwa River and the forested islands of the reserve appear to be frequented in marked preference to the more uniform forests of the interior of the reserve. This is hardly surprising in view of the distribution of prey, water and dense cover.

Outside the reserve an adult male tiger appears to be resident near the Aurai River and reportedly kills domestic stock frequently. A tigress with cubs has also been observed in the same general area. (Dinerstein 1975a) A reasonable estimate of the total number of tigers within and immediately adjacent to the reserve would be about twenty individuals.

Chital or Spotted Deer (Axis axis)

This is the most frequently observed and undoubtedly the most numerous deer of the reserve. A high proportion of fawns in the herds indicates a healthy population and apart from the hills the species appears to be well distributed throughout the reserve, though showing a preference for the southern and western regions. Chital probably need to drink at least once a day during hot weather, possibly twice. In the months immediately before the monsoon therefore they are unlikely to be found very far from water since (except for rutting males) chital do not normally wander more than half a mile or so from the centre of their home range.

Systematic counts and data on herd composition have not been recorded but Dinerstein (1975a) has counted a total of 227 animals mostly in small herds but occasionally in larger herds of up to 60. In the areas inhabited by chital the regional warden for the Terai has estimated their

densities at 80-100 per square mile (32-36 sq km). It is unlikely that this density can be applied to more than about a third of the reserve area but even so the total chital population must be numbered in thousands and there is nothing to suggest that they are as numerous as they might be. In the sal forest of Chitwan pellet group counts conducted by the Smithsonian Tiger Ecology Project indicated a chital density of 424 per sq. mile (164 per sq km) during spring 1975 although it seems unlikely that this density could be sustained. This deer is clearly of paramount importance not only for its own worth but as prey for both tiger and leopard.

Swamp Deer or Barasingha (Cervus duvauceli)

Very like the red deer of Europe, in general appearance the barasingha is a big animal standing 44-46 inches (112-117 cm) at the shoulder according to Blandford (in Schaller 1967) but reaching 54 inches (137cm) according to Prater who puts the weight of such a stag at 370-450 lb (170-180 kg). Schaller mentions published weights of 460 and 570 lbs (209 and 259 kg) for exceptional stags.

The fully developed antler is 12-tined (though a small proportion may develop 13-14 tines) and measures about 30 inches round the curve. The record is 41 inches (104 cm).

Swamp deer show a marked seasonal change of coat. The summer pelage is chestnut on the back, lighter brown on the sides and creamy white inside the legs, on the rump and underside of the tail. In winter the animals are a dull brown and adult stags become very dark indeed. The spring and autumn moults are completed by May and November in India and it is unlikely to be significantly different in Nepal. Fawns are brown without spots.

Formerly well distributed in northern and central India the barasingha is now reduced to perhaps 3000 animals surviving in a few scattered localities. The IUCN Red Data Book lists the species as Endangered. Sukla Phanta in the extreme south west of Nepal holds one of the two main concentrations and until very recently the species was considered to have disappeared completely from the rest of Nepal. In April this year however at least 12 different individuals were observed by the regional warden and Peace Corps ecologist on Koraha island in the reserve. One adult and two subadult males were distinguished, the rest being adult hinds. The small proportion of immatures is disturbing. It is likely that the seasonal cycle would be similar to that further west, at Sukla Phanta and in the adjacent part of Utter Pradesh. There the rut occurs in October-December and fawns are dropped the following June-August.

Swamp deer are almost exclusively grazers and possibly only a small proportion of the reserve offers ideal habitat but they are apparently able to remain healthy and contented on a diet of coarse, dry grasses including the leaves and stalks of Saccharum spontaneum and Vetiveria zyzanioides (Schaller 1967) which are quite common and fairly widespread species at Karnali. In the Kanha Sanctuary of India Schaller found barasingha to congregate on meadowland in January and most stayed until August but there was reason to suspect that this concentration in the open was behaviour connected with the rut rather than food supply (the rut there being later than in N. India). During the remainder of the year the deer were dispersed throughout the sal and other forest types. Barasingha are known to drink at least twice a day in hot weather.

At Karnali the swamp deer were seen feeding on Imperata cylindrica (thatch grass) which also features prominently in the diets of most other ungulates. The Baghora Phanta area might meet the feeding, watering and behavioural requirements for the rut but the importance of wallowing at this time (as described by Schaller 1967) is not yet known. Nor is it possible to assess the potential suitability of the Koraha River for this purpose. However, a two-year study of swamp deer has recently been completed at Sukla Phanta under the IUCN Endangered Deer Programme and a report is awaited. It will be easier to assess the potential of Karnali as habitat for swamp deer when more is known of the animals' specific requirements in the western Terai.

Nilgai or Blue Bull (Boselaphus tragocamelus)

This is a large, ungainly bovid the bulls of which usually stand 52-56 inches (132-142cm) at the shoulder and carry short, rather conical horns about 8 inches (20cm) long. Females are hornless and noticeably smaller. Two adult females weighed only 240 and 290 lb (109 and 131 kg) (Schaller 1967).

The sexes are also easily distinguished by colour; bulls are dark grey overall while cows and calves are tawny. Both sexes carry a dark mane, have white rings above the hoof and whitish buttocks. Mature bulls have a pendent black tuft on the throat.

Nilgai are typically animals of light woodland and country which is reasonably flat or at least not predominantly rugged. At Karnali they may be encountered throughout the lower parts of the reserve but show a preference for the south-western sector where in 17 square miles (44 sq km) Dinerstein has estimated about 80-100 individuals.

There are probably not less than 200 in the reserve. They move in small herds or family groups though bulls are often solitary.

Nilgai are both grazers and browsers and are said to be fond of the spiny leaves of Ziziphus (ber) and Acacia. They also include fruits and flowers in the diet and in Karnali have often been seen eating the fallen fruits of Ficus glomerata and F. benghalensis (as have Chital and wild boar). As with most grazers the young shoots are preferred and the predominant grass species of the south-western sector of the reserve (Imperata, Cynodon, Saccharum, Erianthus, Vetiveria) are all utilised (Dinerstein 1976).

In eastern Rajasthan Schaller (1967) found Nilgai to have a definite rutting season with a possible peak in November and December. During the rut bulls establish their own territories and form breeding herds of 2 to 10 cows. Gestation is about 8 months and although single young are the rule twins are reported to be common. As yet no comparable information is available from Karnali.

Elephant (Elephas maximus)

Wild elephants are known to visit the reserve seasonally. Local information, though conflicting, indicates that small numbers of elephant (less than 12) raid paddy fields along the south border of the reserve each year, spending the day in the Amraini area and feeding on crops during the night. Observations by Dinerstein (1975b) support the view that the elephants, (notorious wanderers) enter the reserve at the end of the monsoon from across the Karnali in Kailali district.

In 1975 four elephant were noted in the Amraini area towards the end of September and there were several sightings during October. In early November further evidence of elephant was discovered in Baghora Phanta but by the end of the month no fresh signs could be found although old tracks stretched almost all the way from Amraini and Thakurdwara to Chisapani.

In view of the migratory habits of these elephants it is most unlikely that the reserve can play more than a partial role in their conservation but the seasonal presence of elephant could be important in the context of crop depredation and damage to the southern boundary fence (5.2.6). At least during 1975 there was no evidence that crop damage was severe.

4.6.2 Other Vertebrates

Gharial or Gavial (Gavialis gangeticus)

Mugger (Crocodylus palustris)

In April 1976 six gharial, all adult and probably female were observed in the gorge of the Karnali above Chisapani. Three mugger (2 young adults and a juvenile) were also seen. Several reliable observers agree that in very recent years gharial were much more plentiful and unquestionably the disturbance caused by blasting and other activities in connection with the dam feasibility study (section 5.2.4) has affected the gharial population (and other river creatures) adversely.

On the Babai River, outside the south-eastern boundary of the reserve, a further six gharial were observed but no evidence of nesting was discovered on either the Babai or the Karnali. Regular nesting sites however are known to the local people wherever crocodilians occur in Nepal and eggs are gathered for food with unflinching regularity.

Mahseer (Tor (Barbus) tor) and other fish

The Karnali River in Nepal is generally recognised as one of the finest mahseer waters for sport fishing. Some anglers believe it to be unrivalled. In general appearance the mahseer (a member of the carp family - Cyprinidae) is a streamlined fish with 2 pairs of small barbels and large scales. Specimens in the Karnali were greenish above, silvery elsewhere but with reddish fins. A rather abrupt narrowing of the body, immediately behind the anal fin (in lateral view) is said to be a useful aid to identification. This fish reaches weights of over 100 lb (45 kg) at which it will be 5-6 feet in length.

Mahseer are known to migrate upriver, into the Karnali gorge, to spawn. Breeding is said to take place in February-March but a scientific study has yet to be conducted, this is planned for the near future by the Fishery and Fish Culture Development Project in Nepal.

Although a premier sporting fish the mahseer is only one of many species to be found in the Karnali; there are several related barbel (Barbus spp.), large silurid catfish and others including Ompac bimaculatus a veritable table delicacy.

5 LAND USE AND DEVELOPMENT IN AND AROUND KARNALI

WILDLIFE RESERVE

5.1 Historical

Land use around the reserve remains very largely in the traditional pattern as described below. Historically there has been no known significant development affecting the reserve other than the factors mentioned in section 2.4. The phantas are said to have been cultivated by Tharu villagers within the last decade but no written records or precise dates are available. A deep well located close to the Chisapani-Amraini road almost certainly pre-dates living memory but again no records are available and no other sign of settlement can be found there.

5.2 Current Land Use

5.2.1 Activities of Local People

As Map 2 shows, only the village of Chisapani (22 huts, population about 110) is situated within the reserve but numerous settlements lie immediately outside the boundaries. The people are mostly Tharu who live by subsistence agriculture. On the hills the chief monsoon crop is maize followed by winter crops of oil seeds, pulses or wheat. In the lowlands rice is grown during the monsoon after which the fields are usually left fallow (McMillan 1972).

Stock is kept (cattle, buffalos, goats, sheep and pigs) and herded around the reserve boundary. Before the very recent construction of a southern boundary fence domestic animals were frequently found wandering into the reserve. Cutting of thatch grass, collection of fern shoots, herbs and other forest produce are traditionally carried out in the reserve. Grass cutting is on quite a large scale and is permitted for about twenty days in each year subject to supervision.

Fishing with nets, simple traps and poisonous plants is carried out on all rivers where fish occur. Much of this is done by locals for home consumption but small scale commercial elements are also involved. On the Koraha River, for example, nets were set in the evening and hauled in next morning containing hundreds of fish of upwards of half a kilogram. These were taken for sale outside the immediate area.

Poaching occurs, especially in the region of Chisapani and both guns and snares are used. Grass fires are

frequently started, deliberately and accidentally, by unauthorised people inside the wildlife reserve.

5.2.2 Public Rights of Way

At present public throughfares are in use between Amraini and Telpani. A further much-used route runs across Koraha island between Thakurdwara and the settlements west of the Girwa.

5.2.3 Commercial Forestry

Bardia District has received due attention from HMG Ministry of Forest. The HMG/UNDP/FAO Forest Development Project with field headquarters at Ranijharwa, has prepared detailed management plans for the forests of Bardia. The reserve itself will not be directly affected by forestry operations but it is pertinent to mention what the forest management plans are in the immediate vicinity.

Hill forest adjacent to the reserve falls within the "protection working circle" for which no harvesting or other interference is prescribed. Forest on the left bank of the Babai River, opposite the reserve, falls within the "plantation working circle" in which introduced tree species will be managed. Trial results will determine the species and at this stage it is possible only to say that "Eucalyptus grandis and E. tereticornis will form a significant proportion of the crop" (Moore 1974). It is very probable that teak will be another major component so that the nature of the forest will entirely change.

To the south of the reserve the remnant patches of forest, roughly north of a line from Thakurdwara to Bargada, are all within the "exploitation working circle" which is destined to be "exploited progressively during a period of twenty five years and the forest growth completely felled and utilised for timber, poles and firewood." If the plan is followed the cleared land will be progressively released for settlement. It is intended that the exploitation will support a saw milling industry which will eventually draw its raw material from the plantations.

5.2.4 Dam and Road Construction

Feasibility studies on the "Chisapani High Dam Project" have been in progress for more than a decade. An early recommendation was a concrete dam 207 metres (675ft) high near the mouth of the Karnali gorge. Subsequent teams have investigated the possibility of a rock or gravel fill dam in the same general locality. Whatever the final choice, the dam, if it is to be built at all,

will be several years more in the pre-construction phases of the project, will probably take about fifteen years to build and will cost something in the order of US\$300 million at current costs. The aim is to generate electricity partly for national use but mostly for sale to India. Profound downstream effects of the dam cannot be discounted but at least the access road, railway and transmission lines are all planned for location west of the Karnali and will not run through the reserve. The dam need not destroy the wildlife reserve but a considerable impact, ecologically and scenically, will obviously be unavoidable. Certainly upstream of the dam and possibly downstream, the habitat for gharial will be destroyed. On the other hand the dam itself will no doubt be an attraction to parties of students and other visitors and to this extent the reserve could benefit from its presence and from the improved access and facilities which it will bring.

The east-west highway project has been mentioned in section 2.3. An obvious possibility being borne in mind by HMG highways authority is that the dam could also serve as a bridge for the highway. There will be no separate bridge construction while this possibility exists. Road construction could proceed in advance of the dam however by using a ferry boat.

5.2.5 Research and Tourism

Small research projects have been carried out by the resident (Peace Corps Volunteer) ecologist and visiting scientists but no special facilities exist for research or tourism. So far there have been no tourists as such; all visitors have had some business in connection with the reserve or the various projects in the area.

5.2.6 Wardening and Park Development to Date

At the time of writing (July 1976) the reserve is in a period of transition in that it has hitherto been under control of guards of the forest ministry under immediate command of their superior officer. A keen, hard working Nepali warden with an assistant has been based at Thakurdwara with direct responsibility to the National Parks and Wildlife Conservation Office. The warden has his own small administrative and field staff of about eight men. The warden and his staff are to remain in post but the forest guards have now been withdrawn and are being replaced by military personnel under the immediate control of their own military commanding officer. This arrangement has already been put into effect in the Royal Chitwan National Park.

A system of good, well maintained roads exists as shown on Map 2. Brick-built accommodation for the warden and military headquarters staff is located at Thakurdwara, the present reserve HQ. Junior staff accommodation and a new office/rest house is also being built at Thakurdwara. Five temporary guards' huts have been replaced by more permanent timber constructions at the outposts.

Some 21 miles (34 km) of fencing (6 strands of barbed wire on sal posts 4ft 6ins (1.37m) high is to be erected along the southern border using funds provided by WWF under 'Operation Tiger.' Most of the fencing has already been done.

6. AIMS OF MANAGEMENT

As a logical principle the aims of management must derive from the reasons for establishing the reserve. The aims may therefore be briefly stated as follows:

6.1 Conservation and Relationship with Local Residents

- a. To protect the reserve in accordance with the National Parks and Wildlife Protection Act and the Terai Wildlife Reserve Regulations (regulations currently in preparation and English title not yet confirmed).
- b. To maintain the natural diversity of habitats within the reserve. While this does not preclude some habitat manipulation if such a policy is properly recommended on the basis of future research, no habitat should be reduced in extent to such a degree that its continued existence within the reserve is jeopardised.
- c. To conserve all indigenous fauna of the park and, if possible, promote an increase in the numbers of wild animals, especially tiger and swamp deer. This does not preclude the possibility of reintroducing species known to have occurred in the past such as blackbuck and rhino.
- d. To ensure, as far as possible, the survival and successful breeding of the gharial in rivers bordering the reserve.
- e. To protect the reserve, where possible, from disturbance by road, dam or other construction work.
- f. To maintain good relations and spirit of cooperation with local residents.

6.2 Research

To facilitate and encourage research with priority given to:

- a. Maintaining meteorological records and monitoring long term vegetation changes along transects established by the Peace Corps ecologist.
- b. Surveys necessary for the production of a more detailed vegetation map and regular standardised censuses of at least crocodylians and large mammals.
- c. Specific investigations into practical problems of reserve management.

6.3 Estate Management

As a guiding principal all buildings should be located at the periphery of the reserve and should be unobtrusive and planned so as to have minimal impact on environment and scenery. At Karnali it would be wise also to try to retain a degree of flexibility in connection with headquarters constructions in view of the present uncertainty of a future road alignment. Chisapani could become the most suitable location. It is, of course, imperative that the impact of road and dam construction should be kept to a minimum.

6.4 Education and Recreation

While it remains a long-term possibility for the reserve to play an important recreational role it should not be considered a management objective to promote that role during the life of this plan. In future management plans however, it is to be hoped that Karnali will be incorporated into a tourist circuit, perhaps including Lake Rara National Park. The possibility of providing high quality sport fishing should not be overlooked.

The educational function for the present must be confined to an interpretive service designed to ensure a better understanding of the reserve and its purposes on the part of the local people.

7. PRESCRIPTIONS FOR MANAGEMENT

Management policies directed towards fulfilling the aim listed in the previous section will not fall neatly into the categories of conservation, research etc. but will sometimes involve two or more management objectives. It is for convenience in presentation only that the following recommendations are listed below their respective headings.

7.1 Management for Conservation

7.1.1 Boundary Demarcation

Boundaries are clearly marked by natural features in some places and have been demarcated in others. There appears to be uncertainty or confusion however on the part of the local people with respect to certain sections; in particular the north west (Gyanakhanda to the Karnali), south west (Thakurdwara to western border) and the eastern border from the Babai to Telpani. These sections should be clarified and marked.

7.1.2 Removal of Villages

It is understood that the village of Amraini is now outside the reserve boundary and that Chisapani remains the only permanent settlement within. It is further understood that the decision to resettle the people of Chisapani outside the reserve has already been taken by His Majesty's Government. This, in the opinion of the writer, is a wise decision for it will simplify not only the control of poaching and other destruction in the vicinity of the village but will release land for an airstrip and will facilitate the restriction of public travel through the reserve to that area.

7.1.3 Stock Encroachment and Public Rights of Way

The south boundary fence should prove to be extremely effective in preventing stock encroachment but it remains to be seen how far the fence will be respected by villagers and whether or not there will be extensive seasonal elephant damage. The removal of Chisapani can scarcely fail to be a great advantage in the struggle against both straying stock and unauthorised travel.

As an immediate measure the de facto right of way between Thakurdwara and the western border should be closed (in conjunction with clarifying and demarcating that section of boundary). It will cause no great inconvenience for people to walk a little further south, skirt-

ing the boundary instead of crossing Koraha Island. Secondly, restrictions should be imposed upon travellers between Telpani and Amraini though, as the main route to Surkhet, this right of way must always be open. The restrictions should merely seek to prevent overnight encampment in any but authorised stopping places. If possible, camping at Danwatal should be prohibited and Godam established as the place to spend the night. Certainly it is not reasonable to expect loaded travellers and stock to pass through the whole route in one day but since the Godam-Telpani section is by far the steepest and most difficult stretch, breaking the journey at Godam ought not to cause hardship. This will need to be confirmed by discreet observation however and if the Godam-Amraini leg of the journey is too lengthy for some travellers then supervised camping at Danwatal will probably have to be permitted. But it must be supervised. As it is Danwatal is quite obviously used for camping, poaching, trapping and poisoning of fish and general foraging along the stream and riverine forest. And it is an attractive region which ideally should have been left undisturbed.

Following the removal of Chisapani there need be no other public rights of way unless and until the east-west highway enters the reserve.

7.1.4 Poaching, Fishing and Gharial Protection

It is confidently expected that the anticipated appointment of an increased guard force will further discourage poaching to the point where it will cease to be a problem, but fishing too should be brought under control.

Once the guards are installed fishing should be prohibited on the rivers and streams in the interior of the reserve. This will prevent unnecessary disturbance without causing any hardship to the local people who should be allowed to continue fishing for home consumption on the major rivers which border the reserve. This privilege should be extended to rod and line angling by reserve staff, visiting scientists or other authorised visitors but commercial fishing should be prohibited everywhere within the reserve boundary.

The gharial will almost certainly be found to nest in the rivers (especially the Babai) bordering the reserve. Even though the nests may be located on the bank outside the reserve it is vitally important that the nesting grounds (which are used on a regular basis) be guarded day and night during the egg-laying season (April-May). The clutches can then be transferred to a safer place if

necessary. They are eagerly collected and eaten by Tharu people year after year. It is very much hoped that a field station for gharial conservation will shortly be set up in Chitwan. Karnali could then become a major source of eggs for protected incubation, rearing and subsequent release of young gharial in relative safety.

7.1.5 Grass Burning

Comments made in the management plan for Chitwan are relevant here but the situation is not entirely comparable. At Karnali there is much less grassland and the two phantas are mostly of shorter grasses. There is the same prevailing ignorance of the effects of different burning practices but in Karnali the need for tourist game viewing early in the dry season is not important so that management need not take this factor into account for the time being. But the principal aim remains to increase the number of wild herbivores (and thus food for predators) by increasing the carrying capacity of the reserve.

The present haphazard and unrecorded burning must certainly be discouraged if only because we learn so little from it. Instead a burning policy should be introduced based upon what is already known and designed to reveal more information if the effects are monitored. The following general principles should be followed for the next five years:

1. There should be no burning of the steeper slopes of the Churias. Grass cover is generally too sparse to constitute a fire hazard and in view of the very real erosion risk it is preferable to leave as much ground vegetation as possible.
2. There should be no burning of riverine vegetation.
3. Burning beneath sal should seek to reduce fire hazard and produce a green bite late in the dry season. Dixon and Bhatta (1976) have found mid-March to be a suitable time for controlled burning in forest because of the very heavy nightly dewfall. Fires lit in the afternoon usually go out at night. This is probably late enough in the season to avoid weakening perennial grasses by burning before nutrients have been translocated to the roots for storage. It would seem sensible therefore to patch burn in the wetter sal at this time and also to burn long grass (such as Thysanolaena stands) in the

dry sal. A proportion of the remaining patches could be burnt later in the season for a second crop of new shoots. There may be no point in attempting to burn the shorter or otherwise less combustible grass in the dry sal until the very end of the dry season since new shoots are apparently not produced until May in any case (Dinerstein 1976).

If pockets of weak or moribund sal forest are located it would do no harm to open up areas of one or two hectares by felling and burning.

4. Most herbivores show a preference for young stages of growth in many grasses. Yet the density of herbivores on the two phantas is such that they cannot fully utilise the available grazing at this stage when the phantas are burnt all at once. Dinerstein (1976) has suggested staggering the burn on the phantas and this seems wise. Three burns could probably be conveniently managed, the first being as early as possible in the dry season. It is NOT suggested that the phantas be strictly managed as experimental burning plots, this would be an unreasonable imposition upon the warden and would involve far too much work, expense and destruction to maintain fire breaks. But it is strongly recommended that no part should be deliberately burnt early more than once in three (preferably four) years. This ought not to be so difficult to manage considering that at least one burn (possibly two) will be fairly easy to control and that no-burn sections can with benefit be left each year. It is recognised that burns will be patchy and irregular but a record should be kept of what was attempted and what approximately occurred.

7.1.6 Provision of Waterholes

a. Discussion

Throughout the year water is always within easy walking distance of deer and other large mammals. But the distances involved (never more than 3-4 miles) exceed the maximum straight line distance encompassed by even the largest recorded home ranges of certain species. It is possible therefore that a significant proportion of the reserve, although apparently within easy physical reach of water, may be unacceptably (or even intolerably) distant from it for some animals during the dry season.

Chital, for example, throughout the year, normally occupy only a few square kilometers around a watering place. Rutting bucks wander more widely, but even then, in Schaller (1967) a nocturnal trek of 1.5 miles by a buck was evidently considered worthy of comment. The provision of water will not, of course, render an area attractive to deer unless the other habitat requirements are also present. It appears probable that adequate cover and grazing exist in certain parts of the reserve where water disappears during the dry season, although this was not born out by observation at Kodhawa tal during March. Here use of the water hole, as revealed by spoor, was light but this tal is not permanent as it dries by evaporation in the late dry season.

Yet it would obviously be extremely beneficial if deer could be drawn into relatively little used parts of the reserve to colonise, as it were, new areas. This could be expected to support higher total populations and increased chital numbers could support a higher density of predators including tiger. This brings another problem immediately to mind for it may be thought that tiger (and other predators) have behaviourally or otherwise fixed limits to their density irrespective of availability of prey and other obvious needs.

There must, of course, be limits but the available evidence indicates that the upper density limits are not even approached by tigers at present in Karnali and Chitwan. Old hunting records, though frequently sensational, are also often authoritatively recorded as to the numbers bagged, the duration of the hunt and area hunted. Thus, in 1911 more tigers were shot on one hunting trip in what is now the Chitwan National Park than are presently estimated to exist there (Smythies 1942). Many factors are involved, not least the fact that adjacent country, once wild, is now settled. But even so, on shoots of short duration over a small area it is unlikely that tigers would have been drawn from a wide catchment. They were in the vicinity to start with. And it is inconceivable that in a few generations tigers have changed this facet of their inherent nature.

Current findings on tiger movements and home range size are obviously only valid for prevailing conditions. The Smithsonian Tiger Ecology team, after studying social interactions between radio-tagged tigers in Chitwan, have been led to the view that the tiger is "essentially solitary but not unsociable" and to suspect that "tigers have a flexible social organisation adaptable to varying conditions" (Tamang *et al* 1976).

The foregoing remarks support the belief that tiger numbers could be substantially increased in Karnali (and elsewhere) by raising the carrying capacity of the reserve and increasing the abundance of prey. Whether this can be done or not remains to be seen. There are in fact precious few habitat manipulation techniques which, on a big enough scale for wildlife management, are not prohibitively expensive. Fire is uniquely cheap and potent and the provision of water where it is needed can also achieve remarkable results cheaply. In nature it has often been noticed that the African elephant, by its diggings in seasonal stream beds, exposes water for other animals which would otherwise be forced to move elsewhere. In Chitwan the rhino wallows retain water long after other hollows are dry and these are heavily used as watering places by a variety of animals. Where such natural indications exist it is easier to predict the effects of making waterholes more permanent.

b. Recommendations

It is recommended that Kodhawa Tal be deepened and enlarged to make it permanent and that two further, trial waterholes be dug and results monitored during at least three subsequent dry seasons. To facilitate this, simple machans should be built overlooking the waterholes. A fraction of 20% clay in sand is sufficient to hold water and it is fortunate that the central part of the reserve, between the Githe and Aurai Rivers, is reported (Soil Survey of Bardia Division 1971) to be overlain by clay loams of the 'Lambara' series which have more than 20% clay in a layer between about 1 and 3 feet deep. Beneath that the clay fraction is said to be slightly less than 20% but clay from the surface layer can, of course, be added for pond lining.

Two types of pond might be found practicable. One, a diversion pond alongside a straight, stable section of the Githe Khola to be filled via a ditch leading from the stream. The other, a simple excavated pond in a depression in open grass and possibly between the Patalchuli River and Lamkhola Phanta. Needless to say the pond should only be dug in areas where adequate grazing is thought to exist and preferably where a fresh bite could be maintained in the dry season by controlled burning. Selection of the site must also depend upon results of soil augering to test the substrate for permeability. In general the ponds should be deep (about 12 feet, 4m) and the approach ends should slope at about 4:1. Some constructional principles are given in Kunkle and Abel (1976) but details will be determined by the specific characteristics of the site selected. Fig 2 shows the general idea

(not to scale)

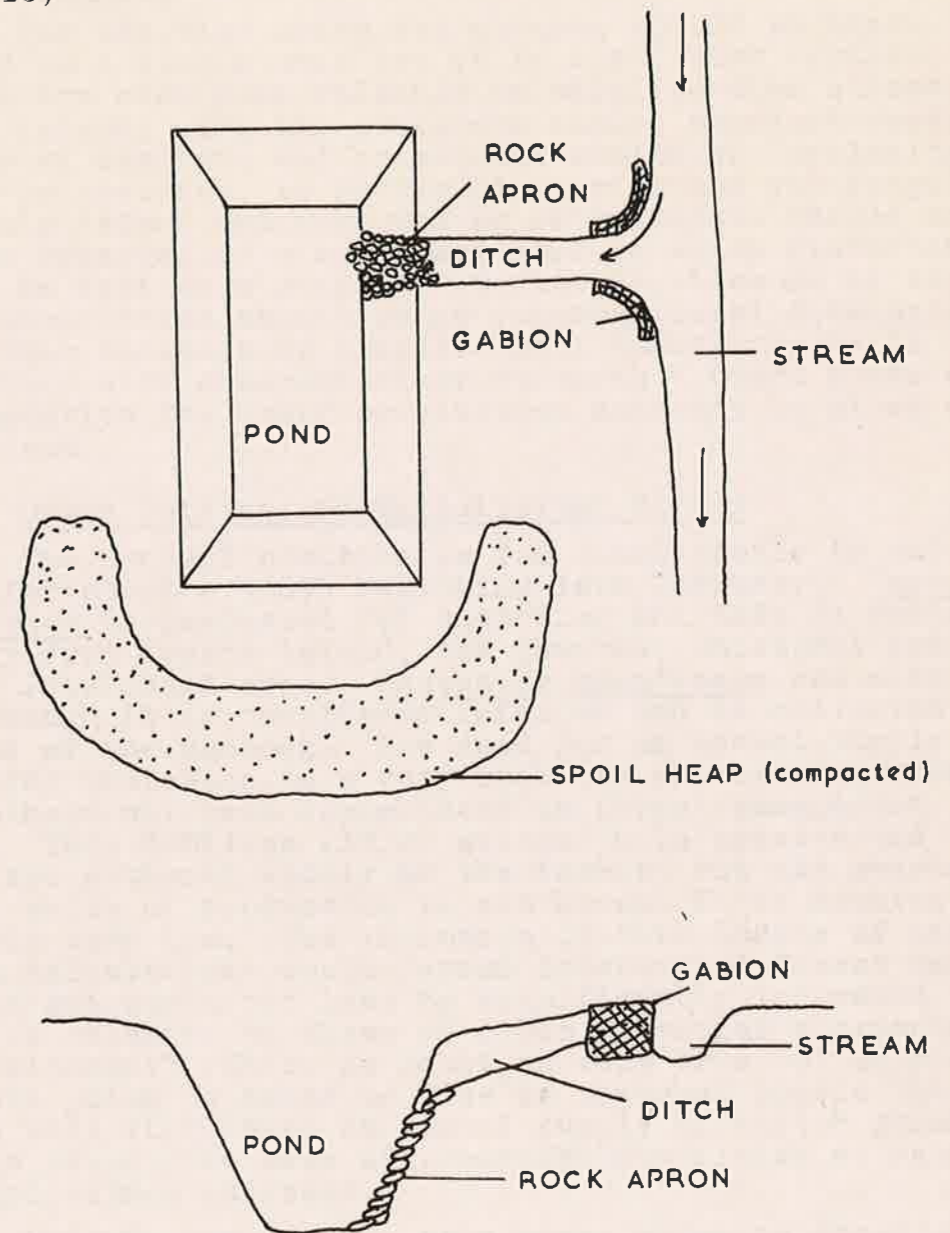


Fig. 2

Sketch showing general arrangement of a streamside diversion pond (after Kunkle and Abel 1976)

of a streamside diversion pond.

7.1.7 Zonation

For the time being the reserve should be administered as a single unit but it is clear that certain sectors are much more valuable to wildlife than others. Koraha Island, with its evergreen shade, abundant water, variety of habitats and consequent wealth of "ecological edges" or ecotones, is particularly rich and yet fragile. The whole island and surrounding watercourses should therefore be regarded as a sanctuary zone in which disturbance should be kept to a minimum. Certainly, because of its small size, there should be no constructional development other than machaans or similar small constructions in connection with observation or research. Guard posts or accommodation for staff or visitors must not be sited on the island.

7.1.8 Grass Cutting and Extralimital Forest

The present practice is for local people to cut grass for about a month beginning late February. Imperata cylindrica is preferred for thatching and this is gathered chiefly from Koraha island, the phantas, Chisapani and Lamata Patalchuli area. Saccharum spontaneum can also be used though it is considered inferior and is collected at the end of the monsoon. The need for an annual supply of grass for thatching is a very real one and its importance has perhaps not been appreciated in forest management plans. Thus McMillan (1972) writes "wild grasses and herbs are gathered widely in the forest, but the average annual value of production is not known. It is however, probably very low. The inclusion of this source of income in the calculations would favour intensified forest management but would not lead to significantly increased benefits relative to those of other potential approaches to development" This, no doubt, is very true but unless they are going to cease to live in thatched houses the people will still need an annual supply of thatch grass. And, as usual, the area of grassland diminishes as people and agriculture increase.

Outside the reserve many areas shown as grassland in forest type maps derived from 1964 air photographs are now cultivated. The reserve is consequently becoming an increasingly important source of thatching grass and it is a source which is only being maintained because it is a reserve. Yet the disturbance caused by hundreds of people harvesting grass each year should not be overlooked especially since Dinerstein has observed that chital are in the peak of the rut about mid May so that fawns will

be dropped in January - February if Schaller's (1967) estimation of gestation is correct. Grass harvest time will therefore coincide with a peak in the number of very young fawns.

The long-term plan put forward for the areas of forest south of the reserve is one of progressive clearance and increased settlement. It may be anticipated that traditional thatched houses will be replaced by more permanent buildings but this will not happen very suddenly and the long-term outlook for the grass supply problem is bleak unless additional sources of grass are considered in the overall land use plans for Bardia. It is not difficult to envisage a system of grassland rotation on some of the land released by forest clearance to the south.

For the duration of this plan it is recommended that the matter be taken up with the appropriate authorities in the Ministry of Forest and that the following phased control within the reserve be implemented:

- a. Grass cutting should be prohibited on Koraha Island after December 31st each year and should be stopped altogether there as soon as possible.
- b. The present permit system is sound and should be continued but it may cause less disturbance and also please the locals if permits are issued from Thakurdwara, Chisapani and perhaps other outposts as required instead of having everyone trek to Thakurdwara for a permit.
- c. To avoid intolerable escalation of the concession an annual limit in terms of man-days cutting/collecting should be fixed and based on present local demand or that of the next year or two. Since no carts or other transport will be allowed a man's daily load capacity will remain within predictable limits. Post monsoon harvesting of Saccharum should be included within the annual limit.
- d. Areas in which cutting is authorised should be stipulated to facilitate supervision on a 'spot check' basis. Lighting of grass fires by harvesters should be an offence.

Although grass is by far the most essential wild harvest from the reserve various herbs and fruits are also valued by the Tharu people. Again the forest development plans will destroy the supply immediately outside the reserve and the plantations will not constitute an alternative source since, at least beneath eucalypts, relatively

few plants will grow. The demand for edible plants from the reserve is therefore likely to increase. For the next few years the demand can probably be sustained since gathering is mostly done by women (who are less likely to be poaching) during the monsoon when potential damage is at a minimum. But again the Koraha sanctuary zone should be out of bounds. Any other localities could be placed out of bounds (e.g. experimental plots, intensive observation points etc) temporarily or permanently at the discretion of the warden. It is imperative therefore that permission be sought from the warden or his appointed deputy and that people do not wander in and out of the reserve at will. A consequence of this would be to prohibit foraging until a proper control has been established.

It is essential that this concession be regarded as such and not as an inalienable right. The power to terminate the concession must be retained since it may be incompatible with any future tourist enterprise and would become unacceptable if the reserve were one day upgraded to National Park status.

7.2 Management for Research

It is probable that, following the departure of the Peace Corps Volunteer ecologist, the reserve will be without a resident scientist and research will have to be continued by visiting national and expatriate workers and by non-scientist members of the reserve staff, both separately and in liaison. Unquestionably a great deal of useful data can be collected simply by keen intelligent observation. The research programme should include the following:

- a. Continuation of the meteorological and other routine recordings established by the Peace Corps ecologist.
- b. Regular wildlife counts to be conducted by vehicle and on foot along standardised routes through the reserve. Ideally three counts a year (post monsoon, mid dry season, pre monsoon) should be carried out at the same time each year for comparative purposes.
- c. Maximum use should be made of the fact that vegetational analyses have been carried out on the phantas and along transects of Koraha Island. The phantas were studied in August 1975 and the Koraha Island work was done between February and June 1976 (Dinerstein 1975, 1976). In order to monitor changes the work should be repeated at not more than five year intervals and preferably more frequently on the phantas in view of the burning recommendations. Dinerstein's techniques must be followed in order to ensure direct

- comparison but this does not of course preclude additional methods and refinements.
- d. It may be important, in future discussions on the Chisapani dam project, to be able to present the case for mahseer. At present it is not known whether the fish need to enter the gorge for breeding and if so whether they would make use of a fish ladder (and what type) or indeed if the gorge would still be suitable if the dam were built. Engineers can predict at least some of the effects of a dam but we need to evaluate the effects in terms of how they will affect the fish. Probably the fishery project would be best equipped to tackle this problem. For certain species (notably salmon) an enormous amount of research in connection with dams and fish ladders has been done in UK and elsewhere. Research on the breeding and other requirements of the mahseer will not be wasted whether the dam is built or not.
- e. It can be said with certainty that the dam will ruin the gorge for gharial though mugger may find the resulting reservoir to their liking. Nevertheless gharial might continue to occupy the Karnali downstream of Chisapani and should increase on the Babai if given proper protection. The research programme should therefore include a study of gharial distribution, nesting habits and requirements in the vicinity of the reserve; the information to be used in connection with the measures referred to in section 7.1.4
- f. Once the swamp deer report is available it will be easier to identify the specific research problems. Suffice to say here that the habitat should be evaluated as far as possible in terms of swamp deer requirements. Methods of improving the habitat for this species could then be considered and investigated. The long term aim should be not only to promote an increase in the existing remnant herd but also to acquire the knowledge necessary for a future decision on the advisability of translocating additional animals from Sukla Phanta.
- g. A Peace Corps Volunteer ecologist has recently been assigned to a short study of the remnant herds of blackbuck (*Antelope cervicapra*) in Banke district and (in tiny numbers) in Bardia, near Gularia south of the reserve. Subsequent to this study an appraisal of the phanta habitats of the reserve should be conducted to assess their suitability for this species in any future translocations.

- h. To date research on tiger has been confined to Chitwan but some comparative work in Karnali would seem to be very desirable.

7.3 Management for Education

At Thakurdwara a building equipped with simple visual aid materials should be provided so that instruction to local villagers could be presented in an interesting and appealing way. The aim should be to introduce the idea of conservation and to interpret the functions of the reserve and establish its importance in the national and international context. Both the building and some of the visual aid materials could probably be made to serve the purposes of section 7.5.3 (q.v.) It is understood that funds for this development are available from the WWF conservation coin scheme.

7.4 Estate Management

Agreements must be reached with all contractors or other agencies involved in construction of the east-west highway, dam or other works affecting the reserve to ensure that no camps, pits, quarries etc are sited within the reserve without prior consultation with the warden. In general all such disturbances should be avoided as far as possible. It ought to be possible to exclude at least all camps from the reserve. The warden must retain the right to inspect work sites and take appropriate disciplinary action against poachers or others in breach of the agreement.

Other small points may be noted as follows (certain items such as boundary demarcation, machaans and water holes have already been referred to):

- The south boundary fence which runs alongside the road should be kept clear of undergrowth and climbing plants to facilitate easy and swift inspection. It may also prove useful as a fire break.
- A fuel dump of both diesel and petrol should be established. Forty-four gallon drums could be stored at Thakurdwara and refilled as necessary at Nepalganj using the tractor and trailer for transport. It is expensive, time consuming and frustrating to have to make numerous trips to Nepalganj for fuel, especially so as the pumps there are not infrequently empty.
- The present transport comprises a 135 h.p. tractor with trailer and a Toyota Land Cruiser. A second 4x4 vehicle, preferably another Toyota so that spares will serve both, is needed. Bicycles would be useful for travel between the lowland outposts.

- d. The present system of roads is good and for the life of this plan only routine maintenance and metalling of certain sections will be required. As an ultimate aim all the roads should be metalled. A short motor road to the southern end of Koraha Island would be helpful for wildlife censusing and patrols and the regional warden has pointed out that habitat destruction would be minimal if the road were aligned along an existing cart track.
- e. A new building at Thakurdwara, originally intended for office accommodation, could be more usefully kept as a 'rest house' for visiting officials and others, including researchers. If the building is needed for office space then a further building as spare accommodation would be justified.
- f. As a result of a government policy decision all government elephants are to become the responsibility of the Wildlife and National Parks Office. Twelve elephants will eventually be assigned to Bardia District and four of them are expected in the near future. Although, in the absence of tourists, there is no need for as many as twelve, four reliable elephants could certainly be useful to the reserve. The hatisar will need to include two large elephant shelters, accommodation (barrack type) for 41 men (3 to each elephant plus 5 administrative staff), office and store. The destructive impact of all this will obviously be considerable and it is strongly recommended that the hatisar be located outside the reserve's southern boundary. Local destruction to the reserve should be kept to a minimum and the elephants should not be taken to forage in the Koraha Island sanctuary zone. Nor should that zone be used as a source of fodder although the elephants would be used there for bona fide patrols and observation work.
- g. Cattle pounds are clearly required and the regional warden has recommended that they be located at Thakurdwara, Chisapani, Lathuwa/Muthipur and Sainwar. If a guard post is established at Baghora then a cattle pound there too would be useful.
- h. The conservation interpretive centre referred to in section 7.3 should be located at Thakurdwara on, or preferably outside, the reserve boundary. The building will need to include a 'classroom', a small built-in lock-up storeroom and toilet facilities. One wall could usefully be finished as a plain surface for displays.

- i. An airstrip would certainly be useful and in the long term will be essential if tourism is to be catered for. Baghora Phanta should be examined in this connection, with the assistance of the UN pilot, and if suitable a STOL strip should be built to serve Thakurdwara. A STOL strip at Chisapani would also be useful and will become necessary should it be decided to move reserve headquarters there as a consequence of the east west highway. This however will be dependent upon the removal of the village.

7.5 Responsibilities, Administration and Wardening

7.5.1 The Administrative Body

Conservation in Nepal is the responsibility of the Ministry of Forest and in particular its National Parks and Wildlife Conservation Office. Technical assistance is to be provided under the HMG/UNDP/FAO National Parks and Wildlife Conservation Project until 1979.

7.5.2 Administrative Organization in the Field

On matters of reserve administration the chain of command should devolve from the warden, through the officer in charge of the guards to the N C Os in charge of each guard post since the guards are directly responsible to their immediate military superior. The military guard force and civilian staff are fundamentally separate units but it is most desirable that the overall responsibility for the reserve be understood at the outset and it is essential that there be a good working relationship with maximum liaison between the warden and the guard commander. Recognising the need for overall responsibility of the warden, the project manager, in consultation with HMG and military officers, has drawn up a summary of the duties and responsibilities of senior field personnel. This appears in Appendix VI. Clearly, it is desirable that the warden be a man of considerable experience and maturity and where trainee or inexperienced men are appointed they must obviously be of the highest calibre.

The initial distribution of the guards is to be as follows: Thakurdwara (HQ), Lathuwa/Muthipur, Chisapani, Danwatal and Sainwar

This seems a satisfactory deployment initially but later a sixth post near the mouth of the Paltal Chuli River will be necessary if stock encroachment and poaching is to be adequately controlled. Guard posts are also proposed at Sukarmala and Banspani though a site for the latter has yet to be located. For the purpose of poaching control

five or six men to an outpost would suffice as it does in other parts of the world where poaching is a far more serious problem. Since the guard force is in sections of 13 men however they can only be split into groups of 6 and 7. This is tolerable but can still cause problems. For example in the writer's opinion it would be an advantage to have a small guard post at Telpani (instead of Banspani) to cover the much-used point of exit and entry but it would not be worth establishing a full outpost at both Telpani and Danwatal.

The current proposal to keep guards in full sections is unfortunate since it leaves the choice of having fewer outposts or turning the reserve into something resembling a military establishment. The requirements of military organization and wildlife conservation clearly need to be reconciled here.

7.5.3 Training and Qualifications of Field Personnel

The personnel requirements at Karnali are essentially similar to those in the national parks and other reserves and a training programme has been outlined in previous management plans. It bears repeating however that even the best military personnel will still need instruction and orientation in the non-military aspects of their duties. In particular the subjects listed below will need to be added to a basic military training:

1. The concept and philosophy of wildlife conservation in general and in the national context.
2. Conservation legislation in Nepal, especially the provisions of the regulations for the Terai. Boundaries of the Karnali Wildlife Reserve.
3. Court procedure and the proper exercise of legal powers.
4. Natural history of the reserve. Basic principles of ecology and conservation.
5. Proper conduct and relationship with visitors to the reserve.
6. Guard post duties and reporting.

It will not be practicable to organize a complete training programme for men who, because of transfers, military redeployments etc, may join a guard force after it has been trained. Consequently as much as possible of the training programme should be in written and otherwise recorded form (tapes, diagrams, slides and other visual aid materials). New recruits could then receive at

least a thorough briefing by the warden or other appointed officer in addition to acquiring on the job training by working with more experienced guards. The conservation education officer ought to be able to assist in the preparation of a simple training manual and visual aid materials.

7.5.4 Staff Discipline, Welfare and Equipment

Administrative matters concerning army and government personnel are covered in the respective regulations. The guard force's field dress and equipment will also be issued and maintained according to military custom. It is also most desirable in all parks and reserves that non-military officers should wear uniform with shoulder titles and cap badge. In the Terai uniform could be a standardised bush jacket and slacks with Nepalese cap. This would not only present a smart appearance but would be good for morale and should generally raise the image of non-military officers. Designations (Warden, Assistant Warden) could usefully be shown beneath the shoulder title.

7.6 Reports and Records

Regular radio contact between the reserve and head office in Kathmandu already exists. A log book is maintained. Written reports, as in the parks, should include:

1. Outpost reports prepared by each outpost NCO. These should be brief monthly statements of activities at the outpost (observations of wildlife, encounters with poachers etc) to be submitted through the guard commander to the warden.
2. Warden's monthly report to Kathmandu as at present. This will eventually include information from the outpost reports as the warden deems appropriate.
3. Scientific reports. The submission of two copies of all reports should be a condition of conducting any scientific study in the reserve. At least a final report should be produced and quarterly progress reports where appropriate.

Appendix ITime Schedule and Finance

Most of the essential infrastructure already exists. The relatively small capital expenditure proposed for the next five years is set out below. The list of recurrent expenditure is necessarily incomplete as certain items have yet to be determined in the government budget.

<u>Capital Expenditure Over 5 Years:</u>	<u>Costs As Of August '76</u> (Estimated)	
<u>Item</u>	<u>Time</u>	<u>N.C. Rupees</u>
1. Resettlement of approximately 110 villagers from Chisapani	Soonest	300 000 (approx)
2. Improvement of boundary demarcation in north-west, south west and eastern sections of reserve	1976/77	3 000
3. Extension of motor track in southern part of Koraha Island	1976/77	2 000
4. Construction of sixth guard post north of Baghora Phanta	1977/78	25 000 *
5. Establishment of fuel store for vehicles (fuel bought from recurrent budget funds)	1977	1 000
6. Provision of tools etc for routine basic servicing of vehicles	1977	500
7. Provision of second 4x4 vehicle (Already available from project fleet)	1977	
8. Construction of interpretive centre at Thakurdwara	1977/78	186 750 **
9. Construction of 5 cattle pounds	1977/78	12 500
10. Construction of two new water-holes with adjacent machaans/		

*WWF Funds might be available. **Funds expected from the WWF Conservation Coin Scheme

10. adjacent machaans/ Enlarging of Kodhawa tal	1977/78	22 000
11. Preparation of STOL strip at Baghora	1977/78	10 000
12. Supply of ten bicycles	1977/78	8 000
13. Construction of Hatisar to include 2 elephant sheds, accommodation for 41 staff (including 5 administrative) office and store	1977/78	173 000 ***

Total estimated capital expenditure over five years excluding equipment and other initial costs incurred in installing military guard force

743 750

*** Additional funds to be allocated by government

Recurrent Expenditure (per annum)

<u>Item</u>	<u>N.C. Rupees</u>
1. Staff Salaries and Allowances (based on prevailing government rates)	57 478
a. <u>Civilian</u>	
Total salaries based on basic salary for establishment comprising warden, assistant warden, Khardar, senior game scout, four game scouts, two drivers and peon	24 150
Total allowances additional to salary	5 200
<u>Per diem</u> and travel allowances	4 000
b. <u>Military</u>	
Total salaries (based on basic salaries for 41 man force)	
Total ration allowance	
Medical expenses	
Travel and <u>per diem</u> expenses	Not yet available

2. Porterage and transport of Equipment	8 000
3. Medical supplies	1 500
4. Office stationery etc.	1 750
5. Maintenance of buildings, airstrip, roads and fence	Not distributed
6. Maintenance of vehicles	3 000
7. Petrol and lubricants	8 500
8. Hatisar	Not allocated *

Total annual
recurrent

* Additional funds to be made
available by government

Appendix II

Boundary description of the Royal Karnali Wildlife Reserve
(unofficial translation from Nepal Gazette Part 3 Section 25
Falgen 25-2032 8 March 1976)

East The east bank of the Babai River

South 1. The forest road starting from the bank of the Babai River; through Bargada, Sainwar, Dumreini, Singbhani, Ranipur, Karmela, Balati, Amreini, Nuthipur, Bankhet, Mohanpur, Padhanpur; along the bank of the Gabrela up to Betaini

2. From Betaini, along the boundary of the forest from Forest Demarcation Pillar No 1 to No 28

3. From pillar No 28, along the Koraha River to the Girwa River thence to a point where the branch of the Girwa comes to Mohanghat

4. Thence along the Girwa River to Munalghat

West Along the western bank of the Girwa River to Chisapani at the office of the Chisapani Dam Project

North From the Karnali River at Chisapani, along the west of the main Churia Ridge to the Babai River.

The compass bearings of the boundary have been certified and a copy is kept at the office of the Chief Conservator of Forest, the National Parks and Wildlife Conservation Office, The Royal Karnali Wildlife Reserve Office and the office of the Bardia Conservator

Appendix III

Preliminary Check List of Mammals of Royal Karnali Wildlife Reserve (Based on the records of E. Dinerstein)

CHIROPTERA

Scotophilus heathi
(common in buildings,
Thakurdwara) Common yellow bat

PRIMATES

Macaca mulatta Rhesus macaque
Presbytis entellus
(see text) Common langur

CARNIVORA

Canis aureus
(common) Common jackal
Melursus ursinus Sloth bear
Lutra perspicillata Smooth Indian Otter
Viverra zibetha Large Indian civet
Viverricula Indica Small Indian civet
Herpestes edwardsi Common mongoose
Herpestes auropunctatus Small Indian mongoose
Hyaena hyaena
(recorded within reserve but
possibly not resident) Striped hyaena
Felis chaus Jungle cat
Panthera pardus
(see text) Leopard
Panthera tigris
(see text) Tiger

CETACEA

Platanista gangetica Gangetic dolphin
(Few in Karnali River downstream of
gorge not resident within reserve)

PROBOSCIDAE

Elephas maximus Elephant
(see text)

ARTIODACTYLA

Sus scrofa Wild boar
(common)
Cervus duvauceli Swamp deer
(see text)

Cervus unicolor Sambar
(hill sal forest; not
plentiful but tracks
frequently encountered)

Axis axis Chital
(see text)

Axis porcinus Hog deer
(small numbers, mostly on phantas
of south west)

Muntiacus muntjak Barking deer
(common)

Nemorhaedus goral Goral
(few only, churias)

RODENTIA

Funambulus pennanti Five striped palm squirrel
Petaurista petaurista Large flying squirrel
Hystrix indica Indian porcupine

LAGOMORPHA

Lepus nigricollis Indian hare

Appendix IV

Preliminary Check List Of Birds Of Royal Karnali Wildlife Reserve

(Based on the records of M Levine, E Dinerstein, E W Balson and the writer)

PHALACROCORIDAE

Phalacrocorax carbo Cormorant
Anhinga rufa Darter

ARDEIDAE

Egretta garzetta Little egret
Egretta alba Large egret
Ixobrychus cinnamomeus Chestnut bittern
Ardeola grayii Paddy bird

CICONIIDAE

Ciconia nigra Black stork
Ciconia episcopus White necked stork
Leptoptilos javanicus Lesser adjutant stork

GRUIDAE

Grus antigone Sarus crane

THRESKIORNITHIDAE

Pseudibis papillosa Black ibis

ANATIDAE

Anser anser Greylag goose

Anser indicus
Tadorna ferruginea
Anas acuta
Mergus merganser

Bar headed goose
Ruddy shelduck
Pintail
Common merganser

ACCIPITRIDAE

Elanus caeruleus
Milvus migrans
Accipter badius
Ichthyophaga nana

Black winged kite
Pariah kite
Shikra
Himalayan grey headed
fishing eagle
Black vulture
White backed vulture
Scavenger vulture
Marsh harrier
Pied harrier
White eyed buzzard
Crested serpent eagle
Osprey

Torgos calvus
Gyps bengalensis
Neophron percnopterus
Circus aeruginosus
Circus melanoleucos
Butastur teesa
Spilornis cheela
Pandion haliaetus

FALCONIDAE

Falco tinnunculus

Kestrel

PHASIANIDAE

Francolinus pondicerianus
Francolinus francolinus
Gallus gallus
Pavo cristatus

Grey partridge
Black partridge
Red junglefowl
Peafowl

TURNICIDAE

Turnix suscitator

Common bustard quail

RALLIDAE

Amaurornis phoenicura White breasted waterhen
Gallinula chloropus Waterhen

OTIDIDAE

Eupodotis bengalensis Bengal florican

CHARADRIIDAE

Vanellus indicus Red wattled lapwing
Vanellus spinosus Spurwinged lapwing
Tringa nebularia Greenshank
Tringa hypoleucos Common sandpiper

BURHINIDAE

Burhinus oedienemus Stone curlew

GLAREOLIDAE

Glareola lactea Small pratincole

LARIDAE

Larus brunnicephalus Brown headed gull
Sterna aurantia Indian river tern

COLUMBIDAE

Treron phoenicoptera Bengal green pigeon
Streptopelia decaocte Ring dove
Streptopelia tranquebarica Red turtle dove
Streptopelia chinesis Spotted dove
Chalcophaps indica Emerald dove

PSITTACIDAE

Psittacula eupatria Large Indian parakeet
Psittacula krameri Rose ringed parakeet
Psittacula cyanocephala Blossom headed parakeet
Psittacula himalayana Slaty headed parakeet

CUCULIDAE

Cuculus varius Common hawk cuckoo
Cuculus micropterus Indian cuckoo
Rhopodytes tristis Large green billed
 malkoha
Taccocua leschenaultii Sirkeer cuckoo
Centropus sinensis Crow pheasant
Eudynamys scolopacea Koel cuckoo

STRIGIDAE

Otus bakkamoena Collared scops owl
Bubo zeylonensis Brown fish owl
Glaucidium radiatum Jungle owlet
Athene brama Spotted owlet

CAPRIMULGIDAE

Caprimulgus indicus Jungle nightjar
Caprimulgus macrurus Long tailed nightjar
Caprimulgus asiaticus Indian nightjar

APODIDAE

Apus affinis House swift

ALCEDINIDAE

<u>Ceryle rudis</u>	Lesser pied kingfisher
<u>Alcedo atthis</u>	Common kingfisher
<u>Pelargopsis capensis</u>	Stork billed kingfisher
<u>Halcyon smyrnensis</u>	White breasted kingfisher

MEROPIBAE

<u>Merops orientalis</u>	Green bee eater
<u>Merops leschenaulti</u>	Chestnut headed bee eater
<u>Merops philippinus</u>	Blue tailed bee eater
<u>Nyctyornis athertoni</u>	Blue bearded bee eater

CORACIIDAE

<u>Coracias benghalensis</u>	Indian roller
<u>Eurystomus orientalis</u>	Broad billed roller

UPUPIDAE

<u>Upupa epops</u>	Hoopoe
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BUCEROTIDAE

<u>Toclus birostris</u>	Grey hornbill
<u>Anthracoceros malabaricus</u>	Indian pied hornbill

CAPITONIDAE

<u>Megalaima lineata</u>	Lineated barbet
<u>Megalaima haemacephala</u>	Crimson breasted barbet

PICIDAE

<u>Dinopium benghalense</u>	Lesser golden backed woodpecker
<u>Dendrocopos nanus</u>	Brown crowned pigmy woodpecker
<u>Micropternus brachyurus</u>	Brown woodpecker
<u>Mulleripicus pulverulentus</u>	Large slaty woodpecker

PITTIDAE

<u>Pitta brachyura</u>	Indian pitta
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ALAUDIDAE

<u>Galerida cristata</u>	Crested lark
<u>Eremipterix grisea</u>	Ashy crowned finch lark

HIRUNDIDAE

<u>Riparia paludicola</u>	Plain sand martin
<u>Hirundo rustica</u>	Common swallow

LANIDAE

<u>Lanius excubitor</u>	Grey shrike
<u>Lanius schach</u>	Rufous backed shrike

ORIOOLIDAE

<u>Oriolus oriolus</u>	Golden oriole
<u>Oriolus xanthornus</u>	Black headed oriole

DICRURIDAE

<u>Dicrurus adsimilis</u>	Black drongo
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Dicrurus leucophaeus
Dicrurus caerulescens
Dicrurus hottentottus
Dicrurus paradiseus

STURNIDAE

Sturnus contra
Acridotheres tristis
Acridotheres fuscus

CORVIDAE

Dendrocitta vagabunda
Corvus macrorhynchos
Corvus splendens
Cissa erythrorhyncha

CAMPEPHAGIDAE

Coracina novaehollandiae
Pericrocotus flammeus
Pericrocotus cinnamomeus

IRENIDAE

Aegithina tiphia

PYCNONOTIDAE

Pycnonotus melanicterus
Pycnonotus jocosus
Pycnonotus leucogenys
Pycnonotus cafer

Ashy drongo
 White bellied drongo
 Hair crested drongo
 Greater racket-tailed
 drongo

Pied myna
 Common myna
 Jungle myna

Indian tree pie
 Jungle crow
 House crow
 Red billed blue magpie

Large cuckoo-shrike
 Scarlet minivet
 Small minivet

Common iora

Black headed yellow
 bulbul
 Red whiskered bulbul
 White cheeked bulbul
 Red vented bulbul

Hypsipetes madagascariensis
Chloropsis aurifrons

MUSCICAPIDAE

Chrysomma sinensis
Turoides striatus
Muscicapa thalassina
Culicicapa ceylonensis
Terpsiphone paradisi
Orthotomus sutorius
Copsychus saularis
Copsychus malabaricus
Saxicola caprata
Saxicoloides fulicata
Turdus ruficollis
Myiophoneus caeruleus

Black bulbul
 Golden fronted leaf
 bird

Yellow eyed babbler
 Jungle babbler
 Verditer flycatcher
 Grey headed flycatcher
 Paradise flycatcher
 Tailor bird
 Magpie robin
 Shama
 Pied bush chat
 Indian robin
 Black throated thrush
 Whistling thrush

PARIDAE

Parus major

Grey tit

SITTIDAE

Sitta castanea

Chestnut bellied
 nuthatch

MOTACILLIDAE

Motacilla flava
Motacilla caspica
Motacilla alba
Motacilla maderaspatensis

Yellow wagtail
 Grey wagtail
 White wagtail
 Large pied wagtail

NECTARINIIDAE

Nectarinia asiatica
Aethopyga siparaja

Purple sunbird
 Scarlet breasted
 sunbird

ZOSTEROPIDAE

Zosterops palpebrosa

White eye

PLOCEIDAE

Passer domesticus
Ploceus philippinus
Lonchura punctulata

House sparrow
 Baya weaver
 Spotted munia

EMBERIZIDAE

Melophus lathami

Crested bunting

Appendix V

Preliminary Check List Of Plants of the Royal Karnali Wildlife Reserve. (From the records of E. Dinerstein)

For convenience genera are listed in alphabetical order

Reeds, Rushes and SedgesFamily

Cyperus aristatus

Cyperaceae

C. brevifolius

C. cyperoides

C. difformis

C. esculentus

C. globosus

C. iria

C. kyllingia

C. mersuri

C. rotundus

Fimbristylis dichotoma

Typha elephantina

Typhaceae

Grasses

Graminae

Arundo donax

Apluda mutica

Brachiaria sp

Chrysopogon aciculatus

Coix lacryma-jobi

Cynodon dactylon

Dactyloctenium aegypticum

Dendrocalamus strictus

Digitaria sp

Echinochloa colonum
Echinochloa sp.
Elusine indica
Eragrostis coerctata
E. unioloides
Erianthus ravennae
Imperata cylindrica
Ischaemum angustifolium
Oryza sativa
Panicum miliarie
Panicum sp.
Paspalum distichum
P. scrobiculatum
Pseudopogonatherum contortum
Saccharum benghalense
S. spontaneum
Setaria glauca
Setaria pallida-fusca
Sporobolus diander
Themeda sp.
Thysanolaena maxima
Tritictum arvense
Vetiveria zyzanoides
Zea mays

Herbs (Forbs)

<u>Ageratum conyzoides</u>	Compositae
<u>Aresema sp</u>	Araceae
<u>Argemone mexicana</u>	Papaveraceae
<u>Artemesia vulgaris</u>	Compositae
<u>Asparagus racemosa</u>	Liliaceae
<u>Biophytum sensitivum</u>	Oxalidaceae

<u>Cannabis sativa</u>	Cannabiaceae
<u>Cassia occidentalis</u>	Leguminosae
<u>Cassia tora</u>	Leguminosae
<u>Chenopodium ambrosioides</u>	Chenopodiaceae
<u>Cirsium sp</u>	Compositae
<u>Commelina sp</u>	Commelinaceae
<u>Cyanotis sp</u>	Commelinaceae
<u>Cynoglossum wallichii</u>	Boraginaceae
<u>Desmodium sp</u>	Leguminosae
<u>Elopantus spander</u>	Compositae
<u>Euphorbia acutis</u>	Euphorbiaceae
<u>Euphorbia hirta</u>	Euphorbiaceae
<u>Globba ramosa</u>	Zingiberaceae
<u>Gnaphalium luteo-album</u>	Compositae
<u>Leucas cephaloides</u>	Verbenaceae
<u>Majus sp</u>	Scrophulariaceae
<u>Moghania bracteata</u>	Leguminosae
<u>Myosotis sp</u>	Boraginaceae
<u>Oxalis corniculata</u>	Oxalidaceae
<u>Plectranthus sp</u>	Labiatae
<u>Polygonum barbatum</u>	Polygonaceae
<u>P. plebujum</u>	Polygonaceae
<u>Scoparia dulcis</u>	Scrophulariaceae
<u>Sida acuta</u>	Malvaceae
<u>Sida rhomboida</u>	Malvaceae
<u>Solanum indicum</u>	Solanaceae
<u>Urena lobata</u>	Malvaceae

Shrubs

<u>Adhatoda vasica</u>	Euphorbiaceae
<u>Argyrea roxburghii</u>	Convolvulaceae
<u>Caesalpinia bonducella</u>	Leguminosae
<u>Caesalpinia separia</u>	Leguminosae

<u>Callicarpa macrophylla</u>	Verbenaceae
<u>Callotropis gigantea</u>	Asclepiadaceae
<u>Cannabis sativa</u>	Urticaceae
<u>Clerodendron infortunatum</u>	Verbenaceae
<u>Colebrookia oppositifolia</u>	Labiatae
<u>Grewia sp</u>	Tiliaceae
<u>Indigofera pulchella</u>	Leguminosae
<u>Leea robusta</u>	Vitaceae
<u>Moghania strobilifera</u>	Leguminosae
<u>Phoenix acaulis</u>	Arecaceae
<u>Pogostemon plectanthroides</u>	Labiatae
<u>Taxarix indica</u>	Tamaricaceae
<u>Thespesia lampas</u>	Malvaceae
<u>Woodfordia fruticosa</u>	Lythraceae
<u>Ziziphus mauritanica</u>	Rhamnaceae
<u>Ziziphus rugosa</u>	Rhamnaceae

Trees and Woody Climbers

<u>Acacia catechu</u>	Leguminosae
<u>Acacia pennata</u>	Leguminosae
<u>Adina cordifolia</u>	Rubiaceae
<u>Aegle marmelos</u>	Rutaceae
<u>Albizia lebbek</u>	Leguminosae
<u>Alstonia scholaris</u>	Apocynaceae
<u>Anogeissus latifolia</u>	Combretaceae
<u>Bassia butyracea</u>	Sapotaceae
<u>Bassia latifolia</u>	Sapotaceae
<u>Bauhinia malabarica</u>	Leguminosae
<u>Bauhinia racemosa</u>	Leguminosae
<u>Bauhinia vahlii</u>	Leguminosae
<u>Bauhinia variegata</u>	Leguminosae
<u>Bombax malabaricum</u>	Bombacaceae

<u>Bridelia retusa</u>	Euphorbiaceae
<u>Buchanania latifolia</u>	Anacardiaceae
<u>Butea frondosa</u>	Leguminosae
<u>Calamus tenuis</u>	Palmae
<u>Careya arborea</u>	Myrtaceae
<u>Casearia tomentosa</u>	Samydaceae
<u>Cassia fistula</u>	Leguminosae
<u>Cedrela toona</u>	Meliaceae
<u>Dalbergia sissoo</u>	Leguminosae
<u>Dillenia pentagyna</u>	Dilleniaceae
<u>Ehretia laevis</u>	Boraginaceae
<u>Emblica officinalis</u>	Euphorbiaceae
<u>Eugenia jambolina</u>	Myrtaceae
<u>Eugenia operculata</u>	Myrtaceae
<u>Ficus benghalensis</u>	Moraceae
<u>F. glomerulata</u>	Moraceae
<u>F. religiosa</u>	Moraceae
<u>Gardenia turgida</u>	Rubiaceae
<u>Garuga pimata</u>	Rubiaceae
<u>Holarrhena antidysenterica</u>	Apocynaceae
<u>Hymenictyon excelsum</u>	Rubiaceae
<u>Lagerstroemia parviflora</u>	Lythraceae
<u>Macaranga indica</u>	Anacardiaceae
<u>Mallotus philippinensis</u>	Euphorbiaceae
<u>Mangifera indica</u>	Anacardiaceae
<u>Millettia auriculata</u>	Leguminosae
<u>Mitragyna parviflora</u>	Rubiaceae
<u>Murraya koenigii</u>	Rutaceae
<u>Musa sapientum</u>	Musaceae
<u>Ougenia dalbergoides</u>	Leguminosae
<u>Pinus roxburghii</u>	Pinaceae
<u>Randia dumetorum</u>	Rubiaceae

Schleichera trijuga
Semecarpus anacardium
Shorea robusta
Smilax proliferata
Spatholobus roxburghii
Sterculia villosa
Terminalia belerica
T. chebula
T. tomentosa
Trewia nudiflora

Sapindaceae
Anacardiaceae
Dipterocarpaceae
Smilacaceae
Leguminosae
Sterculiaceae
Combretaceae
Combretaceae
Combretaceae
Euphorbiaceae

Appendix VI

Duties and Responsibilities of Senior Park Staff

(Prepared by Project Manager and senior Government Staff of the National Parks and Wildlife Conservation Office)

The Park Warden is the senior officer in the park and as such he is in overall charge of the park. He is entirely responsible for all matters relating to the proper management and control of the park. He is answerable to the Chief of the National Parks and Wildlife Office for the proper conduct of all park staff and the day to day management and control assisted by his Assistant Warden and the senior officers in command of the guards' antipoaching operations.

Policy Matters

All matters of policy, relating to management and law enforcement and the routine day to day running of the park which falls within the scope of the field staff for the park should be resolved by the Warden, any matters of policy which are considered to be beyond his powers should be referred to the Chief of the National Parks and Wildlife Office at headquarters.

Law Enforcement

The Warden as the senior officer in the park is responsible for the armed guards assisted by the officer in command of the guards; who is the senior member of the uniformed force but who must accept orders from the Warden when major decisions or policy matters are to be decided, relating to the operation and control of the force, and the disposition and deployment of personnel inside the park will be carried out in consultation with the senior officer. The Warden under the national parks legislation will have the powers of a public prosecutor and will deal with certain offenders according to the law.

Administration

The Warden's duties include the administration of the park and he will be personally responsible for all administrative matters assisted by his staff over whom he will act in a supervisory capacity, these duties include, as appropriate:

Office Routine

- a) Preparation and submission of reports as directed.
- b) Routine correspondence
- c) Accounts and finance including preparation of estimates and the control of expenditure, collection of park dues

- and fees, muster rolls and payment of staff.
- d) Preparation of standing orders laying down the duties of the various members of the staff.

Stores and Equipment

- a) Accounting and control of stores and equipment, general stores, tentage, uniform, clothing etc.
Motor transport stores, petrol, oil, lubricants.
Medical supplies, office stationery and rations.
- b) Purchase and supply.

Staff

- a) Employment of staff.
b) Payment of staff.
c) Leave
d) Conditions of service
e) Discipline
f) Maintenance of staff records

Welfare

- a) The Warden should organise recreation and sport
b) Canteen and recreation centre if possible

Transport and River Craft

- a) Standing orders relating to the use of vehicles should be issued by the Warden and strictly enforced.
b) The Warden is responsible for the control and maintenance of transport also machinery and river craft.

Maintenance Installations

Maintenance of roads and tracks, installations and buildings.

Medical and Hygiene

- a) As and when necessary he will organise medical attention for park staff requiring assistance outside the park HQ.
b) He must insist on a high standard of hygiene in all park dwellings which must include refuse pits and latrines, and the clearance of litter.

Communications

- a) Supervision of radio network, ensuring radios are properly used and maintained.
b) Organisation and supervision of regular calls and proper radio procedures.
c) Training of radio operators.
d) Maintenance of radio log book.

Airfields

- a) Construction of airfields. Carrying out regular checks for any dangerous obstructions and maintaining the strip in good condition.

Game Management (as appropriate)

- a) Maintaining records of game observations
b) Cooperate and assist in work undertaken by scientists working in the park, who have been approved by the Chief of the Wildlife Office of HMG.
c) Regular game counts
d) Supervision and implementation of burning programmes and other management practices as laid down in the management plan and as directed.
e) Ditching and fencing
f) Investigation and animal post mortem procedures when necessary.
g) Control of grazing, grass cutting, encroachment and other irregularities as specified in the regulations.

Development and Planning

- a) Preparation of development plans as directed by the Chief of the National Parks and Wildlife Office
b) Building of tracks, roads and other developments as directed.

Public Relations and Tourism

- a) Maintaining contact with the local authorities and keeping them informed of park affairs and developments.
b) Maintaining friendly relationships with the local inhabitants.
c) Providing HQ by means of the monthly report with interesting information for use by the press and other publicity media.
d) Contact with visiting tourists.
e) Regular meetings with the local panchayat, other authorities and individuals

Training

- a) The organisation of training programmes and refresher courses for the park guards and guides in cooperation with the senior officer in charge of the guard force.
b) Supervision of all training programmes

Conservation Education Interpretation

- a) Interpretation planning
b) Preparation of exhibits for interpretative purposes
c) Museum and information centre
d) Providing information for the visitors
e) Park handbook and maps

Senior Officer in Charge of the Guards Force

The Senior officer in charge of the guard force is responsible to the Warden of the park for proper management, control, discipline and performance of the guard force. He will

consult with the Park Warden on all matters concerning the force and decisions relating to the training on park matters and deployment and operations of the force will be jointly discussed, but the final responsibility rests with the Senior Commander on all aspects of control and protection as specified in the Act and Regulations.

Operations (as and where appropriate)

- a) The Guard Officer will be responsible for the day to day activities of the guards.
- b) He will be responsible for the discipline and training of the guards.
- c) The planning organisation and implementation of the patrol programme and patrol reports.
- d) He will carry out regular visits of inspection to the park guard posts.
- e) He will maintain an up to date roster of guard post staff so that a plan can be drawn up to move guards at regular intervals from one post to another on rotation.
- f) He will maintain contact with forest guards operating outside the park in order to coordinate patrol activities.
- g) He will ensure that all the guards under his command are familiar with their duties including a knowledge of the park legislation and court procedure.
- h) He will be responsible for dealing with prisoners, their safe custody and transfer from the park to the local authorities, the preparation of case evidence for their prosecution in court.
- i) He will be responsible for the overall planning of antipoaching operations.
- j) He will control the illegal practice of grazing, felling of timber, encroachment of park lands and other offences prohibited by the Act and incursion by the local villagers, and ensure that the only movement in the park is confined to recognised legal routes in accordance with the law.
- k) He will control all illegal activities such as fishing and the collection of firewood and forest produce, as laid down in the regulations.
- l) He will supervise the cutting of grass in areas set aside for this purpose and ensure the villagers comply with the conditions laid down by the Park Warden for the removal of grass.
- m) With the aid of the guards he will assist the Park Warden in management programmes, game counts, burning programmes as required.
- n) He will also assist in dealing with tourists by being helpful and courteous.
- o) He will make regular checks on the boundary beacons

and markers.

- p) Ensuring the boundaries are clearly marked and are not being interfered with.
- q) He will arrange to provide to the Warden or his assistant guards when needed on park duties.
- r) He will instruct all his men to obey reasonable commands given by the Warden or his deputy.

The senior officer will assist the Warden in the management of the park, he will at all times comply with the Warden's instructions to the best of his ability. He will command the guard force in the best interest of the National Park and be willing at all times to tackle any of the manifold duties which occur in the park.

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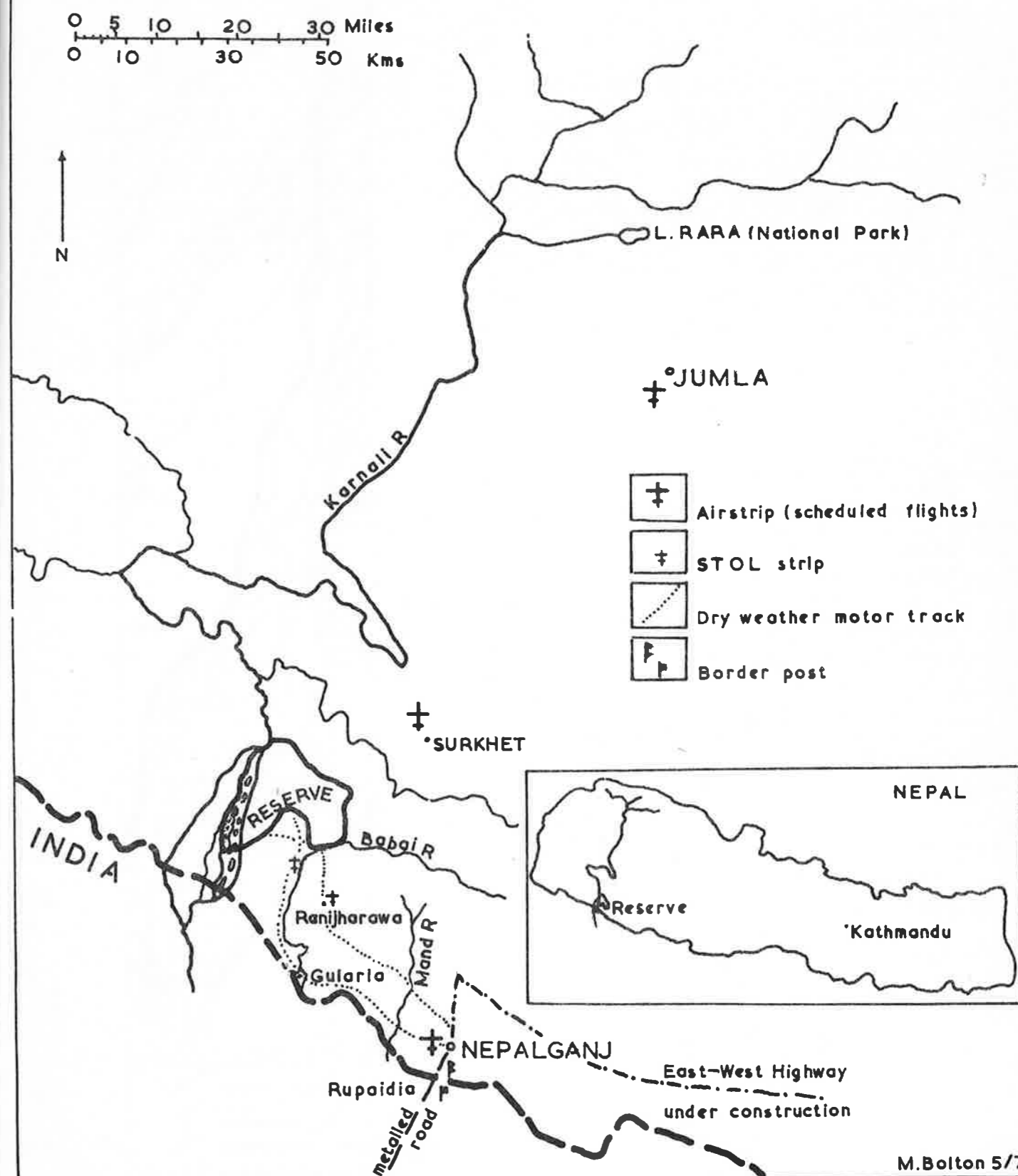
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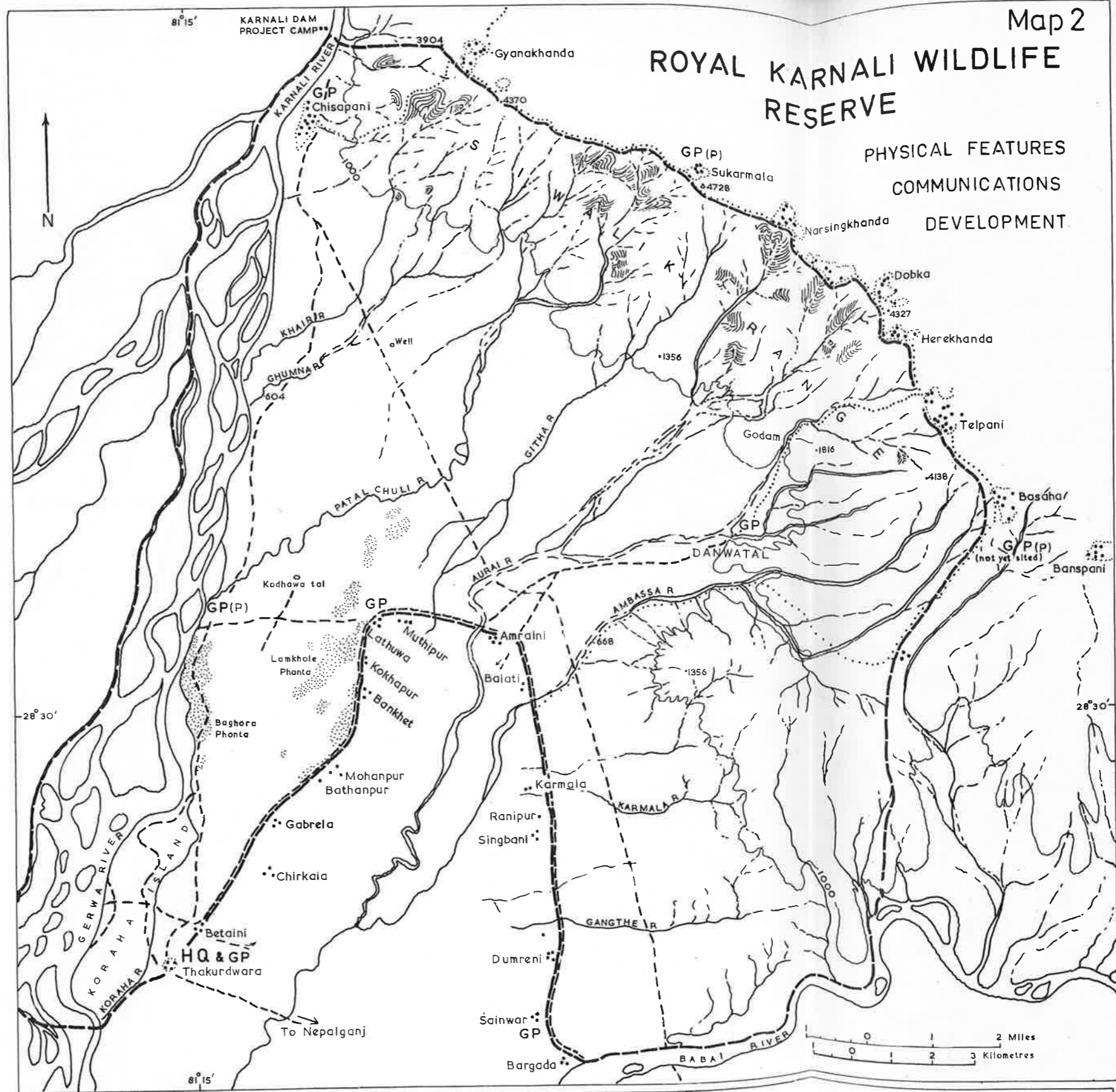
ROYAL KARNALI WILDLIFE RESERVE GENERAL LOCATION AND ACCESS

0 5 10 20 30 Miles
0 10 30 50 Kms



ROYAL KARNALI WILDLIFE RESERVE

PHYSICAL FEATURES
COMMUNICATIONS
DEVELOPMENT



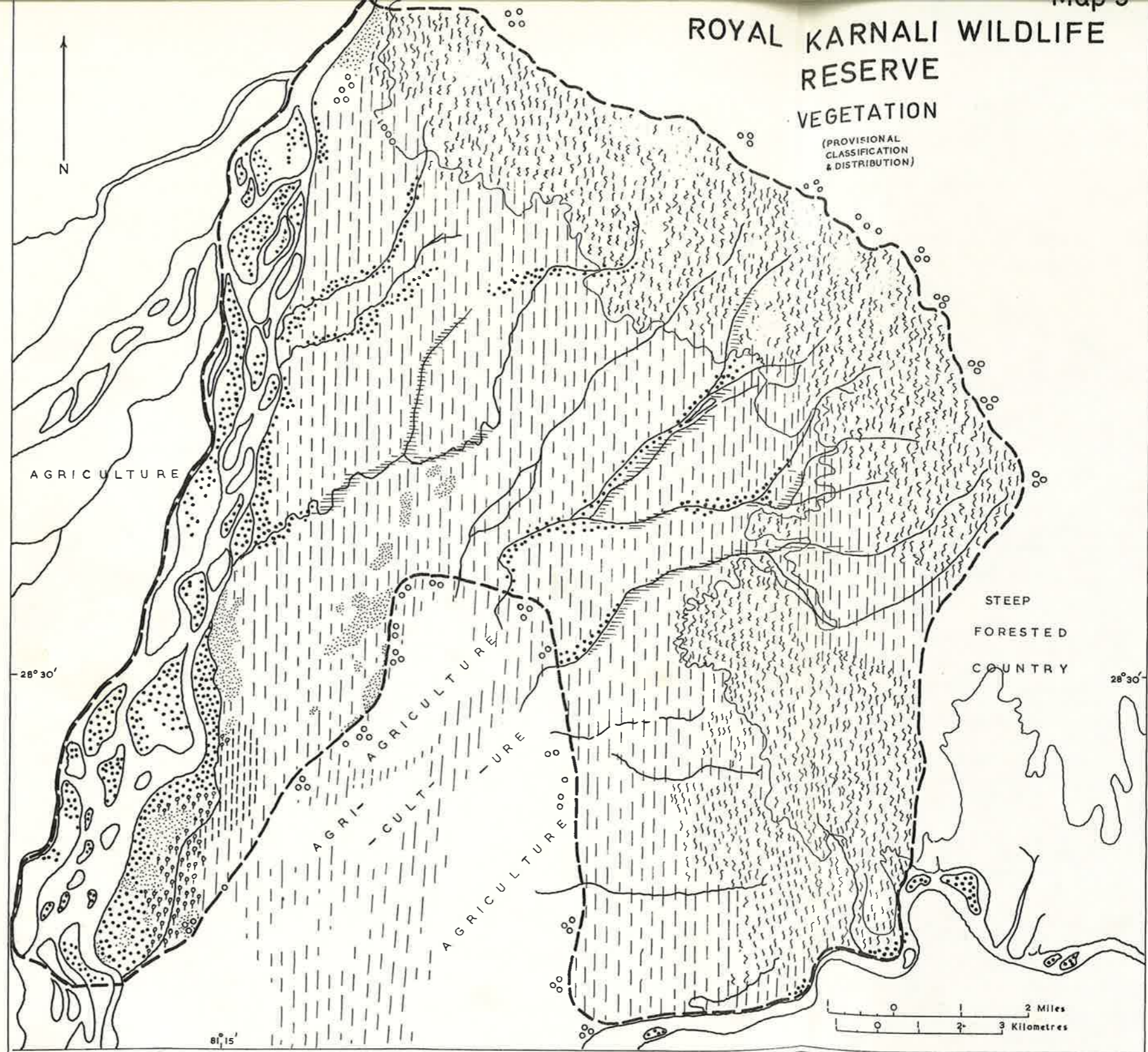
- RESERVE BOUNDARY
- SEASONAL STREAM
- MAJOR STREAM GENERALLY CONTAINING WATER
- WIDE SECTIONS OF SEASONAL STREAM
- MOTOR TRACK
- IMPORTANT FOOTPATH
- SETTLEMENT
- GP (P) PROPOSED (see text)
- ROCKY SECTIONS/CLIFFS
- SPOT HEIGHTS IN FEET
- 1000 FOOT CONTOUR APPROXIMATE

Drawing and compilation M. Bolton April 76
 Based on One Inch Survey of India Series north of 28° 30' N. South of this latitude based on other map sources including 1:100,000 Forest Development Project land use maps supplemented by local information.

ROYAL KARNALI WILDLIFE RESERVE

VEGETATION

(PROVISIONAL CLASSIFICATION & DISTRIBUTION)



	HILL SAL FOREST		GRASSLAND AND/OR SIMAL 'SAVANNA' (SEE DECIDUOUS RIVERINE FOREST)	<p>NB FLOOD PLAIN GRASSLAND (LARGELY SEASONAL) NOT SHOWN BUT OCCURS GENERALLY ON NON-FORESTED PARTS OF ISLANDS AND SPORADICALLY ALONG BANK OF GIRWA</p>	<p>SOURCES</p> <p>ONE INCH SURVEY OF INDIA SERIES (sheet 62 H6 1965)</p> <p>FOREST DEVELOPMENT PROJECT FOREST TYPE MAPS (Based on 1964 air photos)</p> <p>DINERSTEIN E. 1976</p> <p>FIELD OBSERVATIONS</p> <p>Drawing and compilation M Bolton 7/1976</p>
	SAL FOREST		EVERGREEN RIVERINE FOREST		
	SAL FOREST (WETTER TYPE WITH BUCHANANIA ETC)		UNDETERMINED RIVERINE FOREST		
	KHAIR-SISSOO		SETTLEMENTS		
See text for explanation of terms					