ROYAL CHITWAN NATIONAL PARK MANAGEMENT PLAN 1975 - 1979

NATIONAL PARKS AND
WILDLIFE CONSERVATION

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NATIONAL PARKS AND WILDLIFE CONSERVATION

NEPAL

ROYAL CHITWAN NATIONAL PARK

MANAGEMENT PLAN

1975 - 1979

Prepared for the
Government of Nepal

by

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UNITED NATIONS DEVELOPMENT PROGRAMME

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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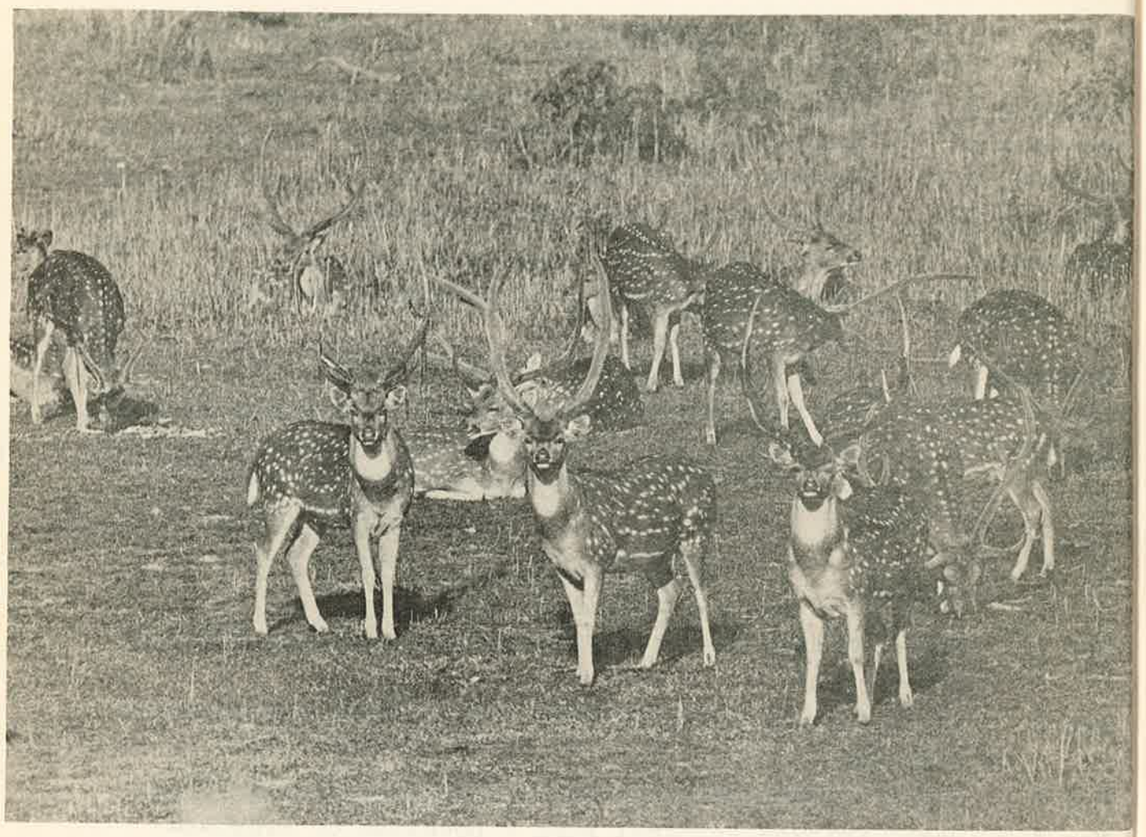
TABLE OF CONTENTS



Chital (Axis axis) Royal Chitwan National Park

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.

One of the most important specific objectives was to establish a national park in part of the Chitwan District of southern Nepal. This area was known to be rich in wildlife, had long been protected as a royal hunting reserve and more recently had been declared a sanctuary for the great one horned rhinoceros. In February 1974, in accordance with the project plan, an FAO ecologist joined the project and composed the present management plan on the bases of information supplied by project staff and other parties involved, supplemented by a personal reconnaissance of the park.

The management plan is provisional but 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, education and recreation, though the aims of estate management and other objectives are included. Proposals for realising these objectives are put forward as prescriptions for management in which the need for much more scientific data is recognised. A research programme is recommended to yield information on which more precise management policy can be based.

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 Organisation 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.

From the beginning of the project one of the main immediate objectives was the establishment of the Royal Chitwan National Park and the preparation of a plan for its subsequent management. The park is situated in the Terai region of Nepal adjacent to, and in parts contiguous with, the Indian border. It is one of the most important components of Nepal's national scheme of parks and reserves as it lies in the faunistically richest part of the country, is ecologically representative of the region and contains several species of large wild animals whose status throughout their range as a whole has become a matter of international concern.

Considerable progress has been made in the initial phases of Chitwan's development and in February 1974 an ecologist was appointed to the project with responsibility for conducting ecological surveys of selected areas and the preparation of management plans. The expert visited Chitwan during March and April 1974 and spent several weeks in the park and proposed extension areas during January to March 1975. The expert has attempted in the following pages to summarise the information presently available on Chitwan and to outline the requirements necessary for its development as a national park. Invaluable assistance and information was supplied by the project manager and regional warden and the Food and Agriculture Organisation is also indebted to the project co-manager, HMG ecologist, park warden, Tiger Tops Jungle Lodge and the scientists supported by the New York Zoological Society and Smithsonian Institution, whose works are cited in the report.

It is hoped that this first and provisional management plan will prove to be a useful compilation of current knowledge and thinking on Chitwan but it must be emphasised that both the descriptive and prescriptive parts of the plan will be subject to revision and expansion as new information comes to light. Indeed the research programme which this plan puts forward is designed to supply the facts upon which future, more detailed management plans will be based.

2. GENERAL INFORMATION

2.1 Location and Boundaries

The Royal Chitwan National Park lies in the Chitwan District of the Terai in the Narayani Zone, in approximately Long. 84° 20' E. Lat. 27° 30' N. This is roughly sixty air miles WSW of Kathmandu. The administrative district, which has its headquarters at Bharatpur, includes the lower part of the Rapti Valley and extends southwards through the Siwalik Hills to the Nepal - India border. In this region the Siwaliks form what is locally known as the Churia Hills to the east and the Someswar Hills in the west where the crest of the range marks the international boundary.

The national park itself, which covers an area of approximately 210 sq. miles (544 km²), is located in the southern part of the district between the Rapti River, which forms the northern boundary, and the Reu River, which for some distance forms the southern boundary. In the south-west the boundary follows the Someswar ridge along the Nepal - India border for several miles, and then extends northwards to include a number of large islands in the Narayani River. The eastern boundary crosses the Churia Hills from Sauraha, on the Rapti to the Amwa Khola. A formal boundary description appears in Appendix II

2.2 Description in Brief

The main axis of the park is east-west, parallel to the Rapti River which forms its northern boundary. In the west, the boundary follows the Narayani River to produce a narrow extension to the park which runs for some twelve miles to the north-east and include a number of forested river islands. In all, more than half of the park boundary is delimited by rivers so that riverine influence, including the presence of flood plains, is a major factor in the park's ecology.

From the flood plains at an elevation of 400 - 500 feet the land rises in the eastern half of the park to more than 2000 feet at the crest of the Churia Range. The Someswar Hills in the south-west of the park are only about half that height but are considerably more broken than the Churias, with steep eroded slopes cut by deep ravines.

Approximately 70% of the park, including the hills, is forested Sal (Shorea robusta) is the predominant tree species on more than half of that area. Together with other, associated species, sal forms an open canopy about 80 feet high which produces the general

impression of fairly light deciduous woodland with tall, straight trees and relatively little undergrowth. The flood plains, for much of the year, support a dense growth of elephant grass often over fifteen feet tall which persists in a less luxuriant form beneath the sal canopy.

During the three months of February to April the grass is dry and has been subject to burning. Fire reduces the old grass to blackened stalks and stimulates fresh, green growth. Where the ground is not too dry this is sustained until the onset of the rains when growth becomes prolific. In February and March the sal trees are comparatively bare and the forest floor is carpeted by fallen leaves but these too are combustible and often only a layer of ashes covers the dry earth.

Adjacent to the rivers the sal forest is commonly replaced by riverine associations. The simal tree (Bombax malabaricum) frequently predominates on old river terraces and in February and March, though the tree is leafless, its profuse scarlet flowers are strikingly attractive. At the water's edge sissoo (Dalbergia sissoo) trees up to fifty feet high, may form a colonising forest strip. This is also conspicuous during March as it bursts into leaf while most of the forest is still in winter foliage.

Clearly the park is subject to profound seasonal change and this is quite dramatically apparent in the rivers themselves. The Narayani, which within the park is a two mile wide complex of channels and islands, flows in the dry season as a series of deep, clear streams between exposed shingle beds and boulders. But during the monsoon whole islands may be carried away and tree trunks are tossed as driftwood on the swirling brown water.

Needless to say, no part of the Terai can compare scenically with the magnificence of the Himalayas but the forested hills and changing rivers do serve to make Chitwan one of the most pleasant and attractive parts of Nepal's lowlands. And, in the dry season, views of the snowclad Himalayan ranges are superb.

2.3 Access and Communications

As one might expect, access to the park is affected to a considerable extent by the season. However it is possible to visit all parts of the park throughout the year. The internal network of footpaths and dry-weather motor tracks is shown in Map I. At present there is a surfaced road, (the Rajpath) from Kathmandu to the park via Hetaura, though this is not always passable during the monsoon as it is liable to become blocked by landslides and deep fords. Hetaura can also be approached by surfaced road from Birgunj on the Indian border, and with the completion of the projected east-west highway, will be accessible from all the major centres of eastern and western Terai.

From Hetaura, the park can be entered via Tadi Bazaar and Sauraha, and from Bharatpur through Patihani to Kasra Durbar. At Sauraha and Kasra there are natural fords across the Rapti River (which at both points marks the park boundary) which can be crossed by 4x4 vehicle without difficulty during the months January to June. It is possible to cross the river om elephant-back throughout the monsoon and to travel by this method, and on foot, within the park when motoring is impracticable. However this has only been a prcatice of park staff, research workers etc and generally speaking the park is neither easily accessible nor enjoyable to visitors during the rains.

The area is served by a frequent (at present thrice weekly) scheduled air service from Kathmandu to Bharatpur. The service is able to operate, somewhat opportunely throughout the year. In addition there is a STOL strip at Rhampur which is used primarily to serve an agricultural station. North of the park boundary Meghauli has daily flights in the dry season for visitors to Tiger Tops and the strip is capable of taking medium range aircraft of the Avro-type, though it is mainly used by Twin Otter. Within the park at Jaimangala (opposite Sauraha on the south side of the Rapti) a STOL strip has been used by Pilatus Porter flying on official park business. A new STOL strip at Ghatgain near the park HQ is also being used for this purpose and it is hoped that the strip will be functional on most days throughout the year.

There is a government radio link between Bharatpur and Kathmandu and the national park has its own radio contacts within the park and with national parks headquarters ih Kathmandu.

Road Mileages

KTM - Sauraha 133 (about 8 hrs' driving)
Birganj - Sauraha 48 (approx)

Air Mileages

KTM - Bharatpur 57
KTM - Meghauli 70

2.4 History of Establishment

During the hundred years of Rana rule in Nepal the whole of the Chitwan district was jealously protected as a hunting preserve for the privileged classes. In 1952 the Rana regime fell and as mentioned later (5.1) a malaria eradication scheme was put into operation which opened up the Terai to peasant settlers from further north. The influx of settlers continued for several years

and it has been estimated that the human population of Chitwan almost trebled during the decade of the fifties.

The destruction of forest and wildlife resulting from the agricultural and poaching activities of over 100,000 people in Chitwan can be imagined and His Majesty's Government became seriously concerned about the situation. In 1959, on a Fauna Preservation Society mission to Nepal, the late E P Gee recommended the creation of a national park in Chitwan to the north of the Rapti and a rhinoceros sanctuary to the south of the river.

In 1963 Mr E P Gee again visited Chitwan on behalf of the FPS and the International Union for the Conservation of Nature. He recommended that the national park to the north of the Rapti, which had by then been declared by the Forestry Department, should be extended to include the more valuable wildlife habitat to the south of the river. The area was duly demarcated but not gazetted as a national park and it continued to be known as the rhinoceros sanctuary.

A major step forward in the development of Chitwan was the appointment, in 1963, of a government committee of enquiry to look into the legal status of the Chitwan settlers. This was followed, in 1964, by the creation of a Land Settlement Commission under the chairmanship of a deputy minister. The commission was empowered to remove illegal squatters and resettle them in specially designated areas adjacent to the Rapti Valley (Willan 1965). As a result, some 22,000 people were removed, including 4,000 who had settled in the rhino sanctuary. Unfortunately, grazing and the collection of forest produce were still allowed within the sanctuary under permits issued by the Forest Department.

In 1970 an advisor on wildlife conservation was appointed under the UNDP/FAO Technical Assistance Programme. As a matter of top priority he urged the establishment of a national park to the south of the Rapti as was originally proposed. This was approved by His Late Majesty King Mahendra in December 1970 and demarcation of the boundaries was completed in March - April 1971. Preliminary development of the park started in October 1971 with a modest budget provided by the Forest Department supplemented by a grant from the World Wildlife Fund.

In 1973 The National Parks and Wild Life Protection Act came into law and in March of that year an expatriate regional warden was appointed under the HMG/FAO/UNDP National Parks and Wildlife Conservation Project. The warden gave top priority to Chitwan and together with his Nepali counterpart, made outstanding progress in suppressing poaching, and within the limits of a fairly modest budget, in developing the park infrastructure - accommodation for wardens, guards' outposts, roads, paths, fences etc. The warden's counterpart is scheduled to take over in 1976. In

addition there are at present two assistant wardens and a force of about eighty guards under the immediate command of a senior officer. Unquestionably the legal establishment of Chitwan as a national park in 1973 has been the most important event in its history.

2.5 Bye Laws

Bye-laws for the park were confirmed under the title "Royal Chitwan National Park Rules 1974" by publication in the Nepal Gazette on March 4, 1975. In this management plan the Park Rules appear in Appendix III.

2.6 Permits

A park entry fee is payable in accordance with the Park Rules and the receipt for such fees serves as an entry permit. In addition, permits are issued, upon payment of the prescribed fees, for sport fishing, camping and for the entry of vehicles and domestic stock. This last is in the nature of a road toll for stock being herded through the park along public rights of way which are maintained by the park authorities. A schedule of fees can be found in the 'Park Rules'.

2.7 Reference Collections, Maps and Photographs

As yet there is no park museum or herbarium though a useful herbarium is maintained by the botany department of the Ministry of Forests in Kathmandu. This facility may be used by kind permission of the custodians.

Maps are not easily available and there are no maps based on up-to-date survey information except forest maps (3":1 mile) produced by the Forest Resource Survey Department of the Ministry of Forests.

One inch to the mile survey of India maps are still very useful though extraordinarily difficult to obtain. Probably the most used maps are the US Army Map Service of 1955 (1:250 000, Series U502). Sheet NG 45-1 KATHMANDU covers the Chitwan district. However this series is also largely based on the one inch survey of India series

Aerial photographs taken in 1964 are held by the Ministry of Forests Forest Resource Survey Department and cover the whole of the park area, more recent photographs (1973) are held by the Irrigation Department of the Ministry of Water and Power but these cover only the Rapti Valley and the northern portion of the park.

3. REASONS FOR ESTABLISHMENT

The plan to establish a national scheme of parks and other conservation areas is an ambitious and worthy one which needs no justification here. The value of securing both representative and unique examples of Nepal's natural riches has been clearly stated elsewhere and it is strongly apparent that without protection and proper management some of the most valuable forest and wildlife resources will be destroyed and lost forever.

Here it is necessary only to record the reasons why Chitwan was selected for development as the major conservation area of the Terai. Faunistically the Terai is the richest region of Nepal, although in contrast, the flora of the forests and grasslands tend to be dominated by few species and there is not the diversity of plant life which can be found in the Himalayas.

Most of the Terai is now settled and cultivated but because of the comparative uniformity of the natural vegetation most of the forest remnants of any appreciable size are truly representative of the natural vegetation of the whole region. The wildlife however has been destroyed differentially in terms of species and even the remaining forest patches no longer contain the large wild animals which are known to have occurred there until fairly recently. Certain species have become localised to an extreme degree and it is in this connection that Chitwan is particularly important. Not only does the park contain what is now an unusually rich variety of large mammals but it is the only locality where the great one-horned rhinoceros survives in Nepal. More important, this constitutes the second largest remaining population of the species in the world. In addition, the population of tiger in Chitwan is believed to be one of the two largest concentrations in the country and leopard are present in apparently healthy numbers. Gaur, the Indian 'bison' also occurs in the park and IUCN has stated that parks and preserves probably offer the only chance for its survival. The Gangetic dolphin and the gharial, a scarce, fish-eating crocodile, are found in the Narayani River and this may well prove to be one of the gharial's main strongholds anywhere. The marsh crocodile or mugger lives in the major rivers of the park and is often at least temporarily resident on the lakes or 'tals'.

In summary then, the chief reason for establishing the Chitwan National Park is the conservation of the indigenous Terai Fauna and in particular the conservation of the species mentioned above in their natural habitats. All these animals are included in the IUCN list of endangered species (IUCN 1968, IUCN 1974).

It should also be borne in mind that as the Terai becomes increasingly settled and cultivated so the tracts of forest,

grassland and riverside vegetation of Chitwan will assume increasing importance, not only as wildlife habitat but as examples of Terai vegetation which, in a relatively unspoiled state, will be much more exiguous than at present. Chitwan will provide opportunities for research, education and recreation which will not be easily available elsewhere and it is fortunate that the area lies within a day's drive of Kathmandu.

The proximity to the capital is also fortunate in connection with a further, subsidiary reason, for establishing the park. The foreign exchange to be derived from a healthy tourist industry has not been overlooked by HGM and others concerned in setting up the park; and consistent with the main purpose of the park as stated above, it is fully intended that Chitwan should be developed for tourism and visitors will be encouraged and assisted to appreciate the natural attractions of the park.

4. SCIENTIFIC SURVEY DATA

4.1 Climate

Chitwan's dominant climatic factor is the south-east monsoon which normally commences about mid-June and continues until late September but there is a marked increase in rainfall during May, when sporadic thunderstorms are frequent, so that in fact there are five wet months as illustrated by the histogram (fig 1). At the Rapti Agricultural Station total annual rainfall averaged for the years 1958 - 1966 was 215.6 cm and 93% of that fell during the months of May to September inclusive.

During the winter months dry northerly winds from the Himalayas and Tibetan plateau result in greatly reduced temperatures and low relative humidity. Consequently there is little cloud cover and insolation is high. As the monsoon season approaches temperatures increase and localised thunderstorms with rain and hail occur along the hills, the prevailing wind having swung to the south-west. A further change of wind direction to the south-east, brings the moisture-laden monsoon winds form the Bay of Bengal. The heavy, monsoon rains are by no means continuous however and in 1973 at Sauraha within the park, Laurie (personal communication) recorded 15, 15 and 12 dry days respectively for the three wettest months ie July, August and September.

Temperatures normally reach a maximum in May - June, becoming slightly less during the monsoon and progressively lower until December - January when frost is occasionally experienced at night (table 1).

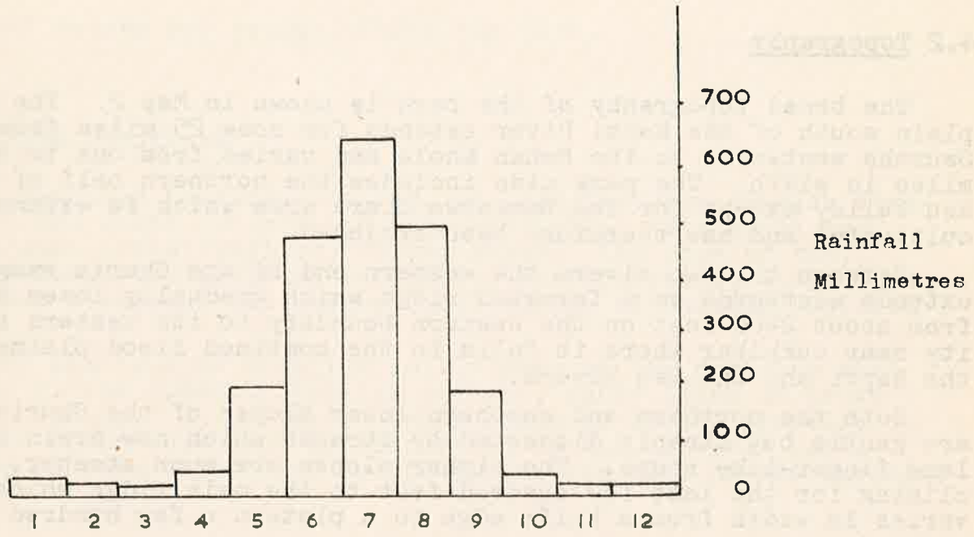


Fig. 1 Annual Rainfall Averaged for the years 1958-1966
Rapti Agricultural Station, Chitwan

	JAN	FEB	MCH	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Mean Max	25.1	29.3	32.9	37.4	37.9	36.1	35.2	34.6	35.0	31.1	27.0	23.1
Mean Min	7.7	11.2	17.3	22.5	25.1	25.5	25.4	25.3	23.4	17.4	11.6	7.2
Max	31.2	36.1	40.0	44.5	45.6	42.8	41.1	40.0	41.1	36.7	31.2	30.6
Min	0.0	3.9	6.1	15.5	15.5	21.1	23.3	21.1	15.7	10.0	3.3	1.1

Table 1 Temperatures (centigrade) recorded at Rapti Agricultural Station, Chitwan: 1958-1966

4.2 Topography

The broad topography of the park is shown in Map 2. The flood plain south of the Rapti River extends for some 25 miles from Sauraha westwards to the Mohan Khola and varies from one to three miles in width. The park also includes the northern half of the Reu Valley except for the Bankatwa Simra area which is extensively cultivated and has therefore been excluded.

Between the two rivers the western end of the Churia range extends westwards as a forested ridge which gradually loses height from about 2400 feet on the eastern boundary to its western extremity near Sukhibar where it falls to the combined flood plains of the Rapti and the Reu Rivers.

Both the northern and southern lower slopes of the Churias are gentle but steeply dissected by streams which now drain between long finger-like spurs. The higher slopes are much steeper, inclining for the last few hundred feet to the main ridge which varies in width from a knife edge to a plateau a few hundred feet across.

The section of the Someswar range in the southwest of the park is an extremely broken mountain mass; a complex of deep ravines and steep, eroded slopes. Except for a narrow, saw-backed ridge, which rises to nearly 1700 feet and for a few miles marks the border with India, the section of the Someswars within the park lies below 1500 feet.

4.3 Drainage and the Hydrobiological Regime

From the watershed of the Churia ridge numerous permanent and seasonal streams flow northwards into the Rapti and southwards into the Reu. In the south-west of the park, where the Nepal-India border follows the crest of the Someswar Range, a number of similar clear streams flow throughout the year northwards into the Reu.

. Drainage in the park is generally quite good and permanent standing water is almost entirely confined to small lakes or tals which are to be found throughout the park. During the monsoon however, extensive areas of the tall-grass flood plains become waterlogged or inundated.

As has been mentioned, both the Rapti and its tributary, the Reu, flow westwards and become confluent before entering the Narayani. This last is the third largest river in Nepal and during the dry season its several channels maintain a total flow of some

200 cubic metres per second within the park.

4.4 Geology and Soils

Geologically the area consists of late Tertiary Siwalik formtions in the south (Churia and Someswar Hills) with Rapti and Chitwan duns (inner vallays) to the north. The core of the Siwaliks consists mainly of sandstone, conglomerates, quartzites, shales and micaceous sandstones (Soil Survey of Chitwan Division 1968).

There has been no detailed soil survey of the park but the alluvial plains commonly consist of deep, sandy loams of brown or grey colours. On the hills sandy loams or eroded gravelly loams are often very dark in colour and in the steepest parts outcrops of parent material frequently occupy much of the surface.

4.5 Vegetation

Map 3 shows that about 63% of the park vegetation is predominantly sal forest, 19% is under grassland, 6.5% may be described as riverine forest and 2% is sal with Pinus roxburghii. A provisional check-list of plants occurring within the park appears in Appendix VII.

4.5.1 Sal and Hill forest

Sal (Shorea robusta) is a straight-boled deciduous tree exceptionally attatining 150 feet but usually growing to about 80 feet. The sprays of white flowers and the new leaves appear in March and although most of the old leaves have been shed by then the tree is never entirely leafless. Sal frequently grows in almost pure stands or with relatively few associated tree species, notably Terminalia species and others such as Anogeissus, Dillenia, Bauhinia and Dalbergia latifolia. Throughout extensive areas of the park forest undergrowth is scant and the grass Themeda caudata grows prolifically on the forest floor and in clearings where it reaches fifteen to twenty feet in height.

On the hills, scattered Phoenix palms are conspicuous among the very light undergrowth and on the upper, drier ridges of the Churias, the chir or longleaf pine (Pinus roxburghii) occurs in tongues extending down into the sal. The more moist slopes of

the upper valleys and ravines of the Someswars and the Churia support bamboo species which in favourable localities are thicket forming.

4.5.2 Khair-sissoo and Riverine Vegetation

Khair (Acacia catechu) and sissoo (Dalbergia sissoo) associations dominate the banks of the Rapti and Narayani on recent alluvium. Khair, a moderately large thorn tree, may be found far from water but sissoo reaching 60 feet and bearing vivid green leaves, is almost entirely confined to riverine situations. In the park the khair-sissoo association may be very heavily dominated by one species or the other and there is frequently a dense undergrowth of Pogostemon plectroides and a variety of small, shade-loving herbs and grass. Dense beds of tall Saccharum grass frequently grow adjacent to the forest strip on wet ground.

The khair-sissoo association is a colonising vegetation type which, if successful in stabilising the riverside gravel will ultimately produce conditions more favourable to other species, notably Bombax malabaricum, the simal tree. Thus, simal and other rather loosely associated species, especially Trewia nudiflora, may represent a later stage in the riverine forest succession and appear as a recognisably distinct forest strip between the khair-sissoo and the sal. Callicarpa macrophylla and Phyllanthus emblica are common understorey shrubs in this situation.

4.5.3 Grasslands

Within the park Laurie (Ecology and Behaviour of the Indian Rhinoceros 1973 & 1974 unpublished progress reports) has distinguished a number of major types of grass cover which may be summarised as follows:

i. Themeda caudata forming a tall grass cover beneath the sal canopy and growing up to 20 feet high in clearings.

ii. Short grass communities of the forest shade. These grow in the absence of Themeda, in shadier parts of the forest and also beneath the tall cover of Themeda. Species include Setaria pallida fusca, Paspalidium flavidum, Chrysopogon aciculatus and Digitaria setigera.

iii. Saccharum - Phragmites - Themeda Associations - growing as a dense bed up to 20 feet high with the dominant species varying in different localities, shorter grasses grow beneath the tall cover. Saccharum spontaneum is one of the first species to invade riverside sand and may form pure stands in this situation.

iv. During the monsoon a fall of water level in the Rapti exposes silt beds in which grass seeds will germinate within a few days. Laurie records a "lush grass growth within eight days of a fall of the water level". As would be expected, short grasses are involved which grow and flower swiftly during the monsoon. Species include Cynodon dactylon, Eragrostis japonica, Brachiaria ramosa and Andropogon spp.

v. In areas occupied by villages prior to their evacuation in 1964 Imperata cylindrica (Thatching grass) grows together with taller Saccharum species. Dabadghao and Shankarnarayan (1973) state that in a mixed grass cover of Imperata, Saccharum and Phragmites, Imperata cylindrica is the species best able to survive (albeit in an impoverished form) a regime of continued burning in moist situations. This could be interpreted as being in agreement with Laurie's observation on the prevalence of Imperata on old village sites. It could also indicate that the predominance of Imperata persists for at least a decade after the heavy burning and grazing regime has been relaxed. Other interpretations are possible, of course.

vi. The tall, dense grass stands along streams and around lakes commonly include Arundo donax, Saccharum spp and sedges (Cyperus spp). Such stands are recognisably distinct from the Saccharum - Phragmites associations on other moist areas.

4.6 Fauna

Present knowledge of the occurrence and status of some of the animals most important from a management and tourist point of view, is briefly summarised in the following pages. Provisional check-lists of mammals, birds and other vertebrates are given in Appendix IV, V and VI but it will be apparent that much basic information remains to be discovered about the vertebrate fauna of the park and virtually nothing is known of the invertebrates.

4.6.1 Mammals

Rhesus Monkey (Macaca mulatta)

The resus macaque is the common "village monkey" of Nepal and northern India. They are thickset animals with tails much shorter than the head and body. Males weigh up to about 22 lb (10 kg), females are much smaller. Coat colour is mid-brown, reddish on the loins and rump.

At Chitwan large troops of rhesus live along the major rivers, spending the nights in the trees of the riverine forest and foraging, mainly on the ground, during the day. They include insects

and other animal food in their diet but subsist mainly on ground vegetation and are unquestionably a pest in the vicinity of growing crops. The ease with which rhesus take to a scavenging existence around towns and villages has led to a large proportion of them becoming infected with human intestinal and respiratory diseases. This situation has been exacerbated in northern India by the selection of 'clean' monkeys for medical research. During the decade of the sixties hundreds of thousands of rhesus monkeys were exported as experimental animals, mostly from Uttar Pradesh. Seen in this context the rhesus populations of Chitwan National Park may contain behaviourally and physically 'uncontaminated' monkeys which are less common than is generally supposed.

Common Langur (Presbytis entellus)

In contrast to the macaques, langurs are long-limbed, long-tailed arboreal monkeys and are strictly vegetarian. (In fact, to one familiar with Africa the rhesus and langurs in Nepal appear as the complete ecological counterparts of baboons and colobus monkeys). Head and body of the common langur measure about 24 - 30 inches (60 - 75 cm) and the tail is 36 inches (90 cm) or more. Specimens from the Himalayas (they ascend to more than 11,000 ft. 3,400 m.) tend to be larger and have a more luxuriant coat than animals of peninsular India. Coat colour varies too but at Chitwan and elsewhere in Nepal it is a smoky brown rather like that of a Siamese cat. Face, hands and feet are black and in striking contrast to the face the fur of the head is white.

In troops of about twenty animals langurs are distributed throughout the sal and riverine forests of Chitwan. They do descend to the ground, especially along rocky watercourses and they are often to be seen on the precipitous escarpments of the Someswar Hills. It seems likely that in such country they will be preyed upon significantly by leopards. Like other monkeys langurs are diurnal and normally spend the night in the tree-tops.

In northern India a marked breeding season has been noted with births reaching a peak in April - May.

Sloth Bear (Melursus ursinus)

A medium-sized bear wighing about 200 lb, the sloth bear is a black, shaggy coated animal with a whitish V-shaped breast patch. The muzzle which appears disproportionately large, is also usually whitish as are the claws. The sloth bear is more often detected by its diggings and droppings than by actual sightings. Yet it is not uncommon in the park and because of its basic diet of termites and other insects, supplemented by wild fruits and honey, it travels extensively and is well-distributed. It may be encountered high in the Churias and Someswars as well as on the flood plains. Though generally nocturnal, sloth bears are frequently seen in daylight and at Sauraha in March 1975 at least three adult bears were present and a fourth, carrying two cubs on her back, was seen near Dumaria about five miles further west.

Sloth bears are inquisitive animals and will follow human scent. The writer, having been tracked to a tree, was sniffed at by an adult bear rearing on hindlegs. Females with cubs will attack without provocation and because of the apparently poor senses of sight and hearing, these bears are easily startled by man in cover and may then attack before fleeing. Little is really known of the habits, requirements and numbers of sloth bears in Chitwan but provided adequate cover is available they are clearly able to exploit a very wide variety of habitats and it is doubtful whether any specific management policies will be required or even practicable in the interests of this species. The maintenance of habitat diversity as prescribed in 6.1 should suit the sloth bear admirably.

Leopard (Panthera pardus)

Leopards are notoriously adaptable, able to occupy a wide variety of habitats and include a correspondingly wide variety of prey species in their diets. They are widespread within the park but, as would be expected, they appear to be most numerous in the lower, ecologically richer regions. During the period December 15th 1974 to April 15th 1975 at least six leopards were known to be moving within an area of 10 km^2 in the northeast corner of the park (Sunquist M E and Tamang K M, Smithsonian Tiger Ecology Project Unpublished Progress Reports). During the same period a leopard was also regularly visiting baits at the Tiger Tops Jungle Lodge and two other adult individuals were seen on the road at midday near Kasra Durbar, the park headquarters. Nine leopards were therefore seen in what amounts to a very small proportion of the park in terms of area surveyed.

Tiger (Panthera tigris)

The Smithsonian tiger study referred to above is producing valuable data on the behaviour and population characteristics of this species. Through radio telemetry studies it has been revealed, for example, that four tigers (adult male, adult tigress, 2 sub-adult males) commonly use an area of 40 km^2 in the north-east corner of the park. At least three other tigers (tigress with young and a male tiger) also make use of the area though less regularly.

The maximum recorded straight line distance travelled by a tiger over a 24 hour period was 5.2 km. In general it appears that the tigers move independently but maintain occasional contacts when using the same areas. At the opposite end of the park four other tigers regularly visited baits at the tented camp during 1974 and at least two other tigers were frequently

to be seen near the Tiger Tops Jungle Lodge. Again, these areas are ecologically rich and even without baiting it would be misleading to apply any conclusions about tiger densities to the park as a whole.

It has proved difficult to obtain data on tiger prey. Kills are usually hidden in long grass and even when a tiger is located in the immediate vicinity of a kill it may still be difficult to discover the remains of the meal. One sambar stag wearing a collar and transmitter was killed by a tiger at the end of January 1974.

Gangetic Dolphin (Platanista gangetica)

This freshwater dolphin, blackish in colour and about 8 feet (2.4 m) long, occurs in the Ganges, Brahmaputra, Indus and their main tributaries in the lower reaches. During the monsoon Platanista is said to descend to the tidal limits and so displays a migratory tendency.

It is seen but infrequently within the park, notably near the Rarayani-Rapti confluence. Local reports as to its former abundance are conflicting but there is some reason to believe that it has become less common during recent years. Possibly the Narayani barrage at Tribenighat on the Indian - Nepal border is preventing the migration of dolphins. The intensive fishing of the Rapti and Narayani Rivers (see 5.2.1)is probably a serious factor in depleting the dolphins' food supply.

It would be extremely interesting to know whether dolphins are to be observed in greater numbers in the vicinity of the barrage at any particular time of the year. But even if the barrage is periodically lifted to permit migration and fishing is brought under control within the park, the dolphins' migratory habits will still make it impossible for Chitwan to afford the species the protection it requires. The effectiveness of any management policy directed towards this species and operating only within the park must necessarily be limited.

Great One-Horned Rhinoceros (Rhinoceros unicornis)

Laurie has discovered that the total rhino population of Nepal is about 250 - 300 all within the districts of Nawalpur and Chitwan. The majority of these rhino are resident or seasonally resident within the park. The greatest concentration occur around Sauraha in the northeast corner where it is not unusual to see ten or fifteen individuals in a day's observation from selected vantage points near wallows or the river. Laurie has found that rhino both graze and browse on a wide variety of plants but show a preference for young, lush grasses and cultivated crops adjacent to the park. The density of rhino within the park boundary is highest during January to May when the tall grasses are producing new growth after burning. It seems clear that rhino require both dense cover and fresh new growth stimulated by burning. Management will plainly have to include a patch burning programme designed to produce fresh regrowth from January onwards while maintaining adequate forest and long grass cover in the same general areas. (See 7.1.4 and 7.2.C)

Rhino are by no means distributed evenly throughout the park and although the greatest concentration is around Sauraha there is also a heavy density in the vicinity of Devi Tal. This agrees with the findings of Pelinck and Upreti (A Census of Rhinoceros in Chitwan National Park unpublished report 1972) who in 1972 discovered the second largest concentration to be in the Surung - Sukhibar - Khoria Mohan area.

Generally speaking rhinos may be encountered throughout the lowlands and flood plains of the park except that few signs, and then probably only from transient individuals, have been seen in the Reu Valley.

Wild Boar (Sus scrofa)

Ancestor of domestic pigs this species ranges from Europe, through North Africa to Central Asia.

Wild boar are blackish in general colour with long coarse hair and a dorsal crest of black bristles. The boars are reported to grow to 36 inches (90 cm) at the shoulder and to exceed 500 lb (230 kg) in weight (Prater). Such big boars are not often seen at Chitwan however, perhaps partly because adult males tend to be solitary for much of the year. Yet the species is common in the park and may be seen at any time of the day, though most frequently in the early mornings and evenings. They are most often seen in sounders of one or more boars, several sows and young.

Notably omnivorous, wild boar are also notorious crop raiders and within the park they are most in evidence on and around the flood plains and adjacent to cultivated land in the northeast, although they do extend into the hills where spoor can easily be found along the watercourses.

Wild boar are thought to breed throughout the year and the age-spread of the young animals at Chitwan appears to support this view, though there may well be one or two breeding peaks in the year. They are prolific but authorities differ as to the average size of litter; it is probably not less than six.

Barking Deer (Muntiacus muntjak)

The smallest deer within the park, barking deer or muntjac males are said to reach 30 inches (75 cm) at the shoulder and to weigh up to 50 lb (23 kg) (Prater) but the average seems to be

about two feet (60 cm) at the shoulder with a weight of about 35 lb (16 kg). Muntjac are usually seen running with a furtive gait, head down, and this does tend to make them look smaller than they really are.

Coat colour throughout the year is a deep chestnut red. Antlers are short (usually 2 - 4 ins; 5 - 10 cm) but are set upon hair-covered pedicels which make the antlers appear twice as long in the field. The antlers comprise a straight beam and a short tine. The pedicels continue as bony ridges down the face of the male.

At Chitwan muntjac are probably most often seen in pairs though solitary individuals and trios are common. They appear to be mainly browsing deer (wild specimens in England, where they were introduced over 70 years ago, eat a very wide variety of vegetation including dried, fallen leaves from certain trees) and are widely distributed within the park. Their presence is often revealed by their barking call which both sexes produce. The bark quite like that of a dog is said to be uttered during the rut and it is certainly commonly used as an alarm call.

Because of their small size, secretive habits and very adaptable feeding habits muntjac are successful little deer and one might expect to encounter even more evidence of them than is the case. It would be surprising if they did not feature prominently in the diet of leopards.

Hog Deer (Axis porcinus)

Although related most closely to cheetal, hog deer resemble muntjac in general appearance. The two types are of fairly comparable size and the male also bears antlers on long, hair-covered pedicels. Furthermore the characteristic crouching gait of hog deer is often to be seen in muntjac and both may raise their tails to flash the white underside when fleeing. Not surprisingly the two species are quite often confused by inexperienced observers at Chitwan when, as is usual, a solitary deer or doe with fawn bolts across the path.

The antlers of the male hog deer have a forked beam and a brow tine and are considerably longer than those of muntjac (commonly about 12 - 15 inches, 30 - 38 cm). The winter coat is generally a greyish-brown but in India, at least, the summer pelage is reported to become chestnut with white spots which may be faint and inconspicuous.

Presumably hog deer are very predominantly grazers; their distribution within the park certainly supports this view. In the flood-plain grasslands of Janeli, Khoria Mohan and Sauraha they are abundant though normally seen only as solitories or in very small groups. They also occur in the lower sal and river-

ine forests but are not to be seen on the hills.

Chital (Axis axis)

Much smaller than the sambar, chital measure about three feet (90 cm) at the shoulder and adult males are said to weigh up to 190 lb (85 kg). Throughout the year the coat is a light rufous-brown richly spotted with white. The throat, chest, insides of thighs and lower limbs are entirely white. Antlers, like those of sambar, consist of a forked beam and brow tine. The Chitwan chital produce some very fine heads and a good chital stag is surely the most handsome of deer.

At Sauraha, in February 1975 an aggregation of 60 chital was seen of which 19 were adult stags all in velvet. An adult female was leading the group. Rutting began at Sauraha about mid-March that year though west of the park, near Dumikibas, an adult stag was still in velvet on March 20th.

The sixty animals mentioned above was an unusually large group which were returning together from foraging. Chital are mostly seen in much smaller herds of usually less than a dozen individuals; as such they are the most commonly observed mammals within the park. Almost certainly the group sizes show some seasonal change but as is the case with most animals at Chitwan, no systematic observations have been recorded.

Chital are very predominantly grazers and supplement their diet with browse and fruits. They are at home in the flood-plain grasslands and in the riverine and lower sal forests where grass is plentiful. The forest edge in the vicinity of a river meets all their requirements of cover, shade, food and water. Chital movements and distribution can certainly be influenced by the availability of grass shoots and hence by grass burning. A policy of converting some patches of sal to more open grassland, i.e. creating glades and maintaining them by controlled burning, may well prove to directly benefit chital as well as some other ungulates in the park. Chital are almost certainly a major prey-species of tiger and at Kanha Park in India Schaller (1967) found that 52% of tiger droppings examined contained chital remains.

Sambar (Cervus unicolor)

A big deer, with record stags weighing more than 700 lb (318 kg), the sambar in winter coat is greyish-brown, lighter or more reddish in summer. The antlers are thick and heavy and consist of a forked main beam and a brow tine. At Chitwan sambar do not appear to carry very large antlers.

Sambar are usually seen in very small groups or as solitary males. They eat a wide variety of plants but, like gaur, favour young grass shoots when available. Within the park sambar inhabit

virtually all forest and grassland from the tops of the hills to the river banks. Because they are secretive however they are see less frequently than one might expect and despite its size the sambar will be a difficult species to census. This is not to say that sambar are rarely seen at all; indeed during the hot months preceeding the monsoon, at least, they visit wallows fairly regularly in the late afternoons and can easily be watched and photographed from a tree-hide.

At Chitwan peak rutting appears to take place during November and one fawn with very occasional twins seems to be the rule.

The sambar is probably an important prey species of tiger and it would not be surprising if it were relatively more important in the hilly, broken country within and outside the park where bo species are known to co-exist and chital are scarce or absent.

Gaur (Bos gaurus)

Looking rather like a bison an adult bull gaur may weigh 2000 (909 kg) or more and stand some 6 feet (183 cm) at the shoulder. The short coat is black except for white lower limbs and a greyis boss between the horns. Cows and young bulls are dark brown, cal light brown. Both sexes carry sweeping, inward-curving horns, a dewlap and dorsal ridge though these features are best developed adult bulls.

A shy, elusive animal the gaur has its strongholds in the Chu and, more particularly, the Someswars. During recent years it ha been seen more frequently and it is not clear whether numbers are increasing or the gaur is beginning to appreciate, as it were, th protection now afforded it within the park. Hopefully both facto are operating. It is of course, possible that the recent sightin are a result of increased observation and reporting but this seem unlikely to be the full explanation.

In early 1975 gaur were being encountered with unusual regula ity along the Surung River near Tiger Tops Jungle Lodge. In Apri of that year a solitary adult bull was seen about four miles west of Sauraha near the main motor track. A few weeks later a herd o about 20 gaur was observed from the air a little further south towards the Churias.

Gaur are grazers and browsers. In India they are known to ea bamboo shoots, and leaves of sal, Phoenix, Terminalia, Bauhinea and other trees and shrubs which are common in the hills of the Chitwan Park. Almost certainly grass will be favoured when fresh green growth is available. In the Someswars a bull gaur was observed feeding on the tall grasses which border the inummerable gullies and watercourses and the bull west of Sauraha was grazing on fresh Saccharum shoots following the burn. The tall grass pla with tree cover at the base of the hills ought to be very attractive to these wild cattle during the early months of the year and

it is to be hoped that with a programme of patch burning and the established prevention of poaching gaur will make increasing use of this habitat.

Gaur are mainly active at night and the most likely behaviour to be expected is an increasing tendency for herds and solitary bulls to descend from the forested slopes in the evening and return, after a night's grazing, an hour or so after sunrise.

4.6.2 Other Vertebrates

Birds

The Chitwan check list contains over 250 species of birds, many of them quite common residents. It is perhaps worth mentioning two of them which, more than any other, are remarked upon by visitors and which are invariably associated with a visit to the park.

Peafowl (Pavo cristatus) are common in and around the park. As the emblem of Lord Krishna they are protected by the Hindu religion and held in special esteem. Feeding mainly on seeds and other vegetable matter they frequent the sal and riverine forest but often emerge onto river banks and forest tracks to feed. The well-known display of the male is usually performed in a clearing in the sal before his assembled harem of two to five hens. Breeding is mostly during the summer months (many cocks were displaying in March 1975) and each hen lays and incubates a clutch of about 3 - 5 eggs. Red jungle fowl (Gallus gallus) have fairly similar general habits to peafowl and are seen, usually in pairs, along the roads through the forest; indeed it has been pointed out that the distribution of red jungle fowl coincides almost exactly with that of the sal tree. In appearance the cock bird looks like a small barnyard red cock - practically indistinguishable from the English game bantam. It is generally accepted that the red jungle fowl is the chief ancester of all domestic poultry. The keeping of domestic fowls spread rapidly during the first millenium B C but the initial domestication of Gallus was probably earlier than that. In the park red jungle fowl have been observed following sloth bears - presumably in order to feed at the bears' diggings. It is not known whether this behaviour is widespread or whether it is only of local occurrence.

Reptiles and Fishes

Marsh Crocodile or Mugger (Crocodylus palustris)

This is now considered by IUCN to be a threatened species having been "exterminated in most areas of its range" in India and become "relatively rare" in Iran and "near extinction" in Pakistan (Crocodiles: IUCN 1971). It is a blunt-nosed crocodile averaging about 10 feet (3m+) but reaching about 13 feet (4m) as a maximum.

In Chitwan they frequent the major rivers and also the tals within the park.

Gharial or Gavial (Gavialis gangeticus)

Even more seriously endangered than the mugger, the gharial is reported to be "extremely rare" in India and "near extinction" in Pakistan (op.cit.). There are no records of its having been bred in captivity nor are there any very closely related species; the gharial is the only living member of the family Gavialidae. This unique crocodilian averages about 14 - 15 feet (4.5 m) and has been recorded to reach 22 feet (6.75 m). A distinctive feature is the very long, narrow snout. At Chitwan they occur on the Narayani and, during the monsoon at least, on the Rapti, but they do not appear in the tals within the park. Depletion of food supply (fish) and especially disturbance of habitat and nesting sites during the breeding season are undoubtedly factors involved in the decline of both types of crocodile in Chitwan. An ecological study is urgently required (see 7.2.f).

Fishes have not been studied but the mahseer or 'Indian salmon' (Barbus tor) a premier sport fish, occurs in the Rapti and Narayani but is scarce. The jalkapoor (Barilius spp) growing to about a foot in length is more plentiful and is widely used as a food fish throughout the Terai.

5. LAND USE AND DEVELOPMENT IN AND AROUND CHITWAN NATIONAL PARK

5.1 Historical

Prior to 1952; i.e. during the period of Rana rule, Chitwan was used exclusively as a hunting reserve, and judging by the quality of the sport, the game animals must have been very effectively protected between organised hunts. The hunting was arranged on a lavish scale for special occasions such as the visits of foreign dignitaries. Hundreds of elephants and beaters were assembled to drive and encircle the game, particularly tiger and rhinoceros which were the most sought-after quarry. In 1911 in what is now the National Park, a shoot organised for H M King George V produced a bag of 39 tiger, 18 rhino and 4 bear in additon to lesser game. In 1921 H R H the Prince of Wales and his party shot 17 tiger, 10 rhino, 2 leopard and 2 bear. Yet it is unlikely that such slaughter caused any lasting damage to the wildlife population since these large shoots were held only at infrequent intervals and there was evidently such an abundance of game that stocks would be well able to recover.

It is also unlikely that the native Tharu people of Chitwan caused intolerable damage to game populations at that time since although they are traditionally cultivators and also practice hunting and trapping, their methods were primitive, and more important, their numbers were small.

Following the fall of the Ranas, land hungry settlers from the hills migrated into Chitwan and began clearing forest for cultivation on an unprecedented scale. But the area was still malarious and this presented a serious deterrent to newcomers, unaccustomed to the malady. In 1954 a massive malaria eradication programme was started as part of the US AID financed, Rapti Valley multi-purpose project and by 1960 the whole area was malaria free. This, together with the opening-up of roads, accelerated the influx of settlers and the spread of cultivation such that the Rapti Valley, north of the river, is now more than 80% cultivated.

The present human population of Chitwan District is about 180,000 and at the present rate of increase, can be expected to double within the next twenty years or so. The corresponding decline in wildlife numbers has been dramatic and it is estimated that the rhino population is now only a quarter of that which existed twenty years ago.

5.2 Current Land Use Factors

5.2.1 Activities of Local People

There are no longer any hamlets or settlements within the park boundary but certain activities of the villagers continue to have a significant impact on the ecology of the park and pose serious management problems. In some localities, notably the north-eastern corner of the park, both grazing of stock and cultivation are practiced hard against the park boundary. Stock is grazed, by accident and deliberately, within the park. Cattle thus caught are impounded and a fine must be paid to secure their release. Gathering of fuel wood and forest produce for feeding stock is also prohibited but is conducted illicitly. Forest produce for human consumption such as fruits and shoots, is also gathered without authorisation, though guard patrols stop these activities as far as possible. On a much larger scale is the seasonal cutting of grass (Imperata cylindrica) for thatching. This has been permitted subject to certain conditions but additional, unauthorised cutting, is also being discovered. Canes (dried stalks of Saccharum) and poles are collected for building materials for the walls of huts. Burning of grass to improve grazing near the park inevitably results in some uncontrolled burning within the park boundaries.

Fishing in the rivers bordering the park is highly intensive and totally indiscriminate since a variety of traps, nets and lines are used and even finger-sized immature fish are taken. Small

crustaceans are also gathered. Poaching of game within the park has been brought under control but as fields are cultivated in such close proximity to the park there are innumerable cases of crop damage and destruction caused by game animals. A rhino fence near Sauraha has only been partially effective and crop raiding is likely to become an increasingly serious management problem.

In summary then, the activities of the local populace are still in the main, traditional rural practices but because of the explosive increase in the human population and the concomitant destruction of natural vegetation outside the park, the park is no longer just another area of sal forest and grassland, but has become the only source of supply of certain forest products for miles around. The demand for the sort of products mentioned above has been quite suddenly multiplied while the supply has been drastically reduced.

Chitwan National Park therefore is not to be protected from a long-established and harmonious pattern of land use but from demands of a new and far more destructive order of magnitude.

5.2.2 Public Rights of Way

There are four public rights of way through the park. In the east a short track runs from Sauraha to Jaimangala, crossing the Rapti. It continues as a footpath to Amwa. In the centre of the park two rights of way run north-south from Ghargain to Dhoba and from Dhruba to Bhankata, distances of some seven and four miles respectively. In the west a seasonal route fords the Narayani and crosses Bhandarjhola Island from east to west.

In the case of the Ghatgain - Dhoba and Dhruba - Bhankatta sections within the park, the thoroughfares are maintained by park funds and labour and a small toll charge is made for their use in accordance with the park bye-laws.

5.2.3 Commercial Forestry

The Timber Corporation of Nepal (TCN) was established in 1960 as a government corporation with two (later three) sawmills at Hetaura financed by US AID. All the loggable forest remaining in the Rapti watershed was set aside as TCN Forest Reserve as a source of timber for the corporation and its sawmills. No commercial logging operations have been conducted within what is now the national park and of course the park is now safe from this form of exploitation. Logging is carried out on the northern slopes of the Churia near the eastern boundary of the park but TCN have been requested to leave a one-mile strip of forest between their logging areas and the park boundary as a buffer zone. It is important that this should be respected.

5.2.4 Tourism

The only tourist facilities are at present organised by Tiger Tops (Pvt Ltd) private company which holds a 160 acre concession area within the park. Tourist activities are mainly centred around the timber-built Tiger Tops Jungle Lodge the design of which was inspired by the world-famous Tree Tops in Kenya's Aberdare mountains. The lodge, which has 44 beds, was first opened to the public in 1965 and has maintained a high occupancy rate throughout each dry season despite fairly high charges (in the region of US $70 per night. Full board). Tourist activities include game viewing from elephant back and from hides overlooking tiger or leopard baits. Sport fishing is permitted in the Rapti and Narayani Rivers. Most park visitors are guests of Tiger Tops and they arrive by air at Meghauli and are then transported to the Jungle Lodge on elephant back.

In 1973 a 15-bed tented camp was opened by Tiger Tops on the banks of the Rapti River, just outside the western boundary of the park. Visitors arrive at the Jungle Lodge in the usual manner and are thereafter transported to the tented camp by jeep or boat. In terms of the occupancy rate the camp has also been most successful and, of course, is less expensive than the lodge; the basic charge being US $22 a night, full board.

As at the lodge, tourist activities outside the immediate vicinity of the accommodation, are directed entirely towards the enjoyment of Chitwan's natural attractions and no totally 'artificial' recreational facilities are provided. During the 1973/74 season tigers were seen at baits near the camp almost nightly and as an additional attraction short conducted nature walks have been organised each day. Visitors to the camp are able to swim in a large natural pool of the river.

During the last tourist season (September 1973 - June 1974) Tiger Tops catered for a total of almost 4,000 visitors, most of whom stayed for only one night at Chitwan.

Without doubt the park could easily accommodate more visitors if the facilities were available. At present only a small portion of the park is being used by tourists and although this is scenically the most attractive part of the park there are good wildlife concentrations elsewhere. Another tented camp with about 20 beds has therefore been proposed, to be located at Sauraha just outside the eastern boundary of the park. Tenders for the camp-site concession have been invited.

5.2.5 Rearch

No specific research facilities have been provided in the park but assistance has been extended to two visiting research workers supported by external funds. In December 1972 Mr Andrew Laurie

began a two-year study of the great one-horned rhinoceros and is currently based at Sauraha, just outside the park. Laurie's work is supported by the New York Zoological Society and was extended for a third year. Under the auspices of the Smithsonian Institute Dr J Seidensticker (since replaced by Mr M E Sunquist) and Mr Kirt Man Tamang began a study of the tiger in November 1973. This team is also based at Sauraha but both studies are being conducted inside and outside the park. The research has necessitated virtually no interference with park habitat and Laurie's work, which is already yielding invaluable information, has been almost entirely observational. The Smithsonian team has, without mishap, attached radio transmitter collars to five tigers, three leopards and several deer in connection with radio-telemetry studies.

5.2.6 Wardening and Park Development To Date

The park headquarters have been established at Kasra Durbar, an old Rana hunting lodge which has been completely renovated to serve as headquarters, temporary living accommodation for the regional warden and warden, stores and armoury. Nearby a brick-built regional warden's house has been completed and six guards' quarters have been built and are in use.

More than thirty miles of internal road have been completed and some twenty miles of inspecion paths. Sub-headquarters are being established at Sauraha in the east, and Koria Mohan in the west where assistant wardens' quarters have been built. Guard posts have been located at each of the sub-headquarters and also at Pair Khola, Bhawanipur and Bhankatta.

Five cattle pounds have been built in different locations throughout the park and with financial aid from World Wildlife Fund, ten miles of rhino fence and ditch have been constructed on the park's eastern boundary.

The internal road system, airstrips, outposts and other buildings are shown on Map I.

The present system of wardening is somewhat anachronistic in that the entire guard force consists of some 80 forest guards under the immediate command of a guard captain who is responsible to a colonel of the Forest Territorial Service based at Tikoli, north of the park. The force however, is in effect, on secondment to the national park and operates under the direction of the regional and park wardens. There is thus a system of dual responsibility and control.

The undesirability of the arrangement has long been recognized and attempts have been made to secure ultimate autonomy for national park staff. The security laws cause difficult problems in this connection however and it now seems likely that the forest guards will be replaced by military personnel.

6. AIMS OF MANAGEMENT

The whole business of park management is open to question and there are different schools of thought on the subject. Some would argue that within a national park nature should be allowed to take its course and man should not interfere; but within a park, what is nature's course? For practical purposes (let alone philosophical ones) it is impossible always to know where human activities and their effects cease to be natural processes. Many "natural" events in parks are induced by man from outside: water regimes are altered, animal diseases are spread from domestic stock, animals movements both in and out of the park are influenced etc. In the most long-term view man is part of nature and will always be so as long as he exists but it is a proven fact that without protection from destructive humanity many other forms of life are unable to survive.

So national parks are established and the first step in deliberate, well-meaning interference is taken in order to protect wild life and wild places. Boundaries are laid down which, no matter how carefully they are selected, almost inevitably divide some natural systems even if others are left intact. Moreover, the boundaries must be fixed at one point in time and circumstances change. A few years of unexpected weather conditions, for example can completely disrupt what appeared to be a stable or self-perpetuating ecosystem. Under entirely natural conditions such an event would most likely be of local significance only - the flooding of a valley, the drying-up of a lake or the local extermination of a species by an epizootic. But if such an event threatens a national park which happens to be the only remaining refuge of a species it becomes a major catastrophe. Some natural, biological cycles operate on a time scale of hundreds of years but parks have to survive on the human time scale.

The fact is that national parks are established by man for his own reason and in this sense they are not part of the natural scene at all. Furthermore, only man knows what the reasons for establishment are and man alone, through management, can attempt to ensure that the purposes of the park are fulfilled. Of course it could be a deliberate policy to set up a park with express intention of doing nothing more than protecting it from certain forms of exploitation and waiting to see what happened. This would be a positive enough approach provided that it was realised that the 'natural' events which occur may not be independent of human activities outside the park and that the significance of the events may be far more serious than it would be in the absence of human influence elsewhere.

It all depends what the park is for and in the case of Chitwan the purposes of the park have been stated (3). It must be expected that some active management of the resources will become necessary if the park is to continue to serve these purposes effectively.

On the other hand the more we interfere with natural systems the more mistakes we are likely to make and by rejecting the pure view of non-interference for Chitwan the writer most certainly do not advocate the reckless pursuit of empirical management. This would be an even faster road to disaster.

We are left then, in a position of caution; preferring to let natural processes take their course but being prepared to intervene if it appears necessary in order to prevent changes which are incompatible with the purposes of the park. Obviously the more information we have about the ecology of the park, the more successful management is likely to be. Research is vitally important in connection with park management and the subject will be treated in more detail later. It follows logically that the main objectives of management will derive directly from the reasons for establishing the park and this must remain a guiding principle; without it, future management programmes will have not common purpose and policy disputes are likely to become endless and insoluble. This has happened all too often in national parks where firm objectives have never been stated.

In the case of Chitwan an additional point needs to be stressed. Of all the parks and reserves so far proposed in Nepal only Chitwan can meet strict international criteria of a national park and for some years to come it is likely to remain Nepal's only national park approaching such a standard. More important, at Chitwan a very high degree of protection is essential if the park is to fulfill its functions. Every possible effort should be made therefore to maintain the park so as to continue to meet the most stringent international criteria as recorded by IUCN and the UN List of National Parks and Equivalent Reserves (IUCN 1974). Unquestionably the park is worthy of the effort and Nepal may be justly proud of a Royal Chitwan National Park which is administered so as to meet the world's highest standards.

The main objectives of management may be briefly stated as follows:

6.1 Conservation and Relationship with Local Residents

a. To protect the park in accordance with the National Parks and Wildlife Conservation Regulations and the Royal Chitwan National Park Rules.

b. To maintain the diversity of habitats within the park. This is not to preclude habitat manipulation where research findings indicate that this is feasible and in the interests of management objectives. However no habitat represented should be reduced in extent to such a degree that its continued existence within the park is jeopardized.

c. To conserve all indigenous fauna at present extant within the park and if possible to promote an increase in the numbers of wild animals, especially tiger, gaur, gharial and rhino. Such an increase in numbers must not conflict with 'b' above and should not be encouraged if the long-term survival of the animals is thereby jeopardised. Indeed, if it should be satisfactorily demonstrated scientifically that a species has increased beyond the carrying capacity of the park, appropriate steps should be taken to reduce the population to a safe level.

Notwithstanding anything above, special attention should be given to -

d. Maintaining all areas of permanent standing water i.e. tals.

e. Protecting the forest cover of the Churia and Someswar Hills and guarding against erosion and reduction of stream flow during the dry season.

f. To maintain good relations and a spirit of cooperation with local communities and with concessionaires operating within the park.

6.2 Research

To facilitate and encourage research with priority given to:

a. Establishment of a simple monitoring system to keep meteorological records and record long-term changes in the major vegetation types.

b. Surveys necessary for the production of inventories and indices of relative abundance of the (taxonomically) higher plants and animals.

c. Specific investigations into practical problems of park management or fields of research likely to be of practical value. This is not to deny the value of 'pure' research but in the inevitable competition for funds and facilities those studies are to be preferred which appear most likely to serve the immediate needs of management.

6.3 Education

Without doubt visitors in Chitwan will be better able to appreciate the attractions of the park if they know and understand something of what they see. Tourism and education are linked in this way, and fortunately so, for an educated public will better serve the interests of the park. The objective therefore should be to encourage visitors in an appreciation of natural history and to interest and inform the public in all aspects of the natural history of the park; special attention to be given to local residents, students and schoolchildren.

6.4 Recreation

The objectives of educational and recreational planning inevitably overlap. Management should seek to:

a. Encourage and facilitate the enjoyment of wildlife viewing and photography in surroundings which are not disturbed more than is necessary. And in accordance with this, make suitable provision for visitors so as to minimise the environmental impact of approved recreational pursuits and to studiously avoid developments and recreational activities which will conflict with this objective.
Without abandoning the objective, some exceptions will clearly need to be made (e.g. swimming pool) in the immediate vicinity of approved accommodation. However new accommodation should in any case be located immediately outside the park, or if need be, in the periphery.

b. To establish proper controls over sport fishing within the park so that not only fish stocks but also waterside vegetation are adequately protected.

6.5 Estate Management

Planning and construction of roads, bridges, administrative buildings etc. will be influenced by a number of considerations and constraints, not least, financial ones. Here, however, it is not inappropriate to stress as under 4. a, above, that all such structural development should be unobtrusive as far as possible and should be planned so as to have the least impact on environment and scenery. The park administration should have the power to restrict any development by concessionnaires which conflict with this principle.

6.6 Extension of the Park

In view of the outstanding importance of the Chitwan National Park and in consideration of the valuable wildlife habitat, as yet not settled by man, which still remains outside the park to the east and west, it is considered that the expansion of the park should become a major objective.

Detailed recommendations for extending the park eastwards and westwards are given in the Supplement - "Royal Chitwan National Park: Proposed Extensions and Adjacent Reserves" - at the end of this plan.

7. PRESCRIPTIONS FOR MANAGEMENT

7.1 Management for Conservation

It would be foolish to attempt to lay down a detailed management programme for conservation in the absence of so much basic information. But much can be done with the knowledge we have, and hopefully, an overall policy of protection will cause no ecological problems within the next few years. The conservation programme should include the following:

7.1.1 Sanctuary Zones

Retention of sanctuary zones in which all the major habitat types are represented and can be kept free of visitor disturbance. Since the park is relatively small, it will not be feasible, except in the case of sal forest, to keep more than a few square miles in this category. The park road system should therefore be planned so that it will be possible to close off additional areas, if the need arises, without leaving long cul-de-sacs and causing inconvenience to visitors.

7.1.2 Poaching Control

The admirable progress achieved in suppressing poaching should, of course, be maintained and if possible extended so as to offer more protection to fish in those stretches of river within the park. The banks of the Rapti and Narayani, where they form park boundaries ought, if at all possible, be protected even from disturbance by fishermen, herdsmen and stock although such disturbance may be unavoidable on the opposite bank of the river. This is vitally important in the interests of basking and nesting crocodiles.

7.1.3 Crop Protection and Relations with Local Residents

The problem of crop damage and the local demand for forest produce will inevitably become linked in the minds of the local populace. It can not be expected that local farmers will continue to accept heavy damage to crops by wild animals from the park, while at the same time accepting that the collection of forest produce is totally prohibited.

It is obviously a sensible policy to maintain good relations with the local people as far as possible and one solution which has been suggested to this difficult problem is to relax the rules restricting gathering in the forest in return for tolerance and cooperation from neighbouring farmers. Apart from its being contrary to the national park concept, this policy, in the opinion of the writer, would be inviting more and worse problems in the future. It could be argued that the limited collection of thatch grass, fuel wood, reeds or herbs will do no harm ecologically. But this is only one factor, another more important factor is that it is not possible

to allow the harvesting of forest produce by the local populace without incurring intolerable disturbance to the park and opening the flood gates to an ever-increasing demand from more and more people for less and less restrictions on when and what they may harvest. The supervision of the collecting will be time-consuming and costly in terms of man power, yet without supervision trees will be ringed in order to ensure a better harvest of dead wood for the future and restrictions will not be adhered to. The noisy succession of people and bullock-carts piled with grass or firewoo and far from the established tracks will offer irresistable opportunities for concealing poaching and other unauthorized activities. The progress already made at Chitwan in establishing the principle of a national park as an inviolate area will be lost. And ultimately the problem of crop damage will still have to be faced.

The present policy of permitting thatch-grass cutting should therefore be phased out if possible, as was originally intended, and should certainly not be further extended. Cooperation with local farmers should not consist of eroding the status of the park but of actively assisting in protecting crops.

Fencing, though of doubtful efficacy and high cost, should not be dismissed until all available methods have been tried experimentally. Scaring devices must be tried and of course any opportunity to acquire land which would serve as a buffer zone between crops and park should be siezed. The establishment of local coordinating committee to provide official contact between park authorities and local people has been suggested, it is an excellen idea, and should be pursued.

Ultimately, Chitwan District residents must become involved in the park financially. A proportion of the profits from the park should be presented, with appropriate publicity, to the village panchayats. Only this, together with a suitable conservation education programme for the area, will ensure continued interest and support for the park at the local level. It is unfortunate that under existing legislation there is no provision for sharing park proceeds with local panchayats. It is recommended that the Act be amended to facilitate this.

7.1.4 Grass Burning

Fire is an important and established factor in the ecology of the park. Accidental and unauthorised burning will be impossible to eliminate entirely and on present evidence there is no reason to abandon deliberate burning; indeed this would appear to be positively disadvantageous for the rhino, deer and consequently also for tiger. The tall Sacharum, Phragmites, Imperata and Themada grasses are course and evidently unpalatable except when young. The main value of old, unburnt stands is for cover not food. But both cover and grazing are needed in close proximity.

The little evidence there is indicates that a severe grazing and burning regime under moist conditions reduces the tall grass stands to a shorter grass cover in which Imperata survives in an impoverished form and other, more palatable, perennials are favoured as the water table is lowered and the succession shifts towards a generally dryer type of grassland (Dabaghao and Shankarnarayan 1973). Although primary production (in terms of weight of grass per unit area) may be lower, the carrying capacity for herbivores may be higher as a result of a greater proportion of the grass being edible for more months of the year. The problem will be to hold the pasture in the desired stage of succession and especially to avoid further degeneration in favour of annual species. The elimination of over-grazing will prevent concomitant damage from trampling and alteration of the soil structure, and will simplify the experimental burning programme.

Only the experimental programme can reveal the most beneficial grass-burning regime and until results are available only a few directives can be laid down.

i There should be no deliberate burning on the Churia and Someswar slopes.

ii There should be no deliberate burning of riverine and waterside vegetation.

iii In general burning on the flat land should be concentrated on the open grassland or beneath tall sal with little undergrowth. The aim should be to leave forest undergrowth for cover and to burn, say 50% of the open grassland in patches of a few hectares. For aesthetic reasons and to make use of the ecotone or 'ecological edge' effect and attempt should be made to burn alongside game-viewing tracks in sections of a few hundred yards on alternate sides. It is recognised however, that in practice, this may be difficult and not always possible to do.

iv In view of the heavy dewfall and mist which often forms at lower levels during winter, it may be possible to predict when grass fires are likely to go out at night. If so this could be a very useful aid to controlled burning. It will be even better if these conditions prevail reasonably early in the dry season, for on balance it is probably better (in the absence of experimental data) to aim for an earlier, cooler burn rather than a late, hot fire. A possible disadvantage of early burns is that they kill off standing grass before all nutrients have been translocated to the roots for storage during the dormant season. However, late burns will pose a greater threat to trees, will be more difficult to control and may affect soil structure to a greater extent.

Fire ecology is obviously a complex subject and predictions based on findings elsewhere can rarely be made with much confidence. The importance of initiating an experimental programme cannot be over-emphasised.

7.2 Management for Research

At present the only research in the park is being conducted by visiting scientists supported by external funds and who are primarily responsible to outside organisations. From the point of view of management, a great deal of useful information can emerge during the course of autecological studies as the present research workers have demonstrated. But naturally, visiting scientists will always wish to pursue research studies which, within a reasonably short time are likely to yield results suitable for a thesis or publication which will further the worker's career. The routine recording of data from different branches of ecology and the relatively long-term, broad-based investigations into park management problems can not be the main responsibility of any but a resident staff ecologist and a national park research unit. If accommodation is provided there should be no difficulty in obtaining an ecelogist under a bilateral aid agreement. He would be responsible for training Nepali counterparts, and within the limits of his time, would be available to undertake or initiate field studies in other areas besides Chitwan.

The management programme for research should therefore include the following:

a. Provision of living accommodation and basic laboratory facilities for a resident staff ecologist. The accommodation should preferably be an adequate family house since an experienced scientist should be recruited and it must be accepted that he may have a family. He would be responsible for training a suitably qualified Nepali counterpart. The laboratory need only be a modest building of about 25 ft x 12 ft. One end should be sectioned off as a store room and fitted with shelves and a cupboard for the herbarium. The main room should have a bench running the length of one wall and be fitted with two deep wash basins (standard lab. fittings). If possible the bench should run below a row of north-facing windows. The wall opposite the bench should have wide shelves, book shelves and a cupboard. A couple of heavy tables, lab. stools and a filing cabinet would complete the essential fittings. It is not essential that the lab. be wired for electricity but it would be useful and could be done at very little extra cost if the lab. were located close to the ecologist's house. Another desirable asset would then be a mapping table with ground glass top and a light bulb beneath. A list of apparatus for basic ecological research is given in Appendix VIII. Necessary photographic processing could initially be handled by the Conservation Education Section to avoid expensive duplication of facilities.

b. Establishment, as early as possible, of a simple monitoring system for the park. Meteorological records should be kept and permanent transects laid down in each major habitat type to record long-term changes in vegetation and soil. Regular game counts should be introduced although estimates of numbers will not be very valid without intensive study. Nevertheless, indices of relative abundance will be useful to indicate trends.

c. An experimental burning scheme to consist of a series of plots less than o.25 hectares each, set up in the open Saccharum - Phragmites - Imperata and in the tall grass cover beneath the sal canopy. The experimental design should include control plots and the treatments should include early/late burning and annual /biennial burning. Parameters to be measured should include species composition, species frequency, percentage bare ground, soil litter and humus content. On plots below trees regeneration must also be recorded.
If the resources and expertise are available for long-term experiments of greater sophistication, the effects of mowing and grazing interactions should also be incorporated into the programme.
Two or three patches of decadent or otherwise less healthy sal forest, each of a few hectares, should be cleared and an attempt made to maintain them as open grassland by burning. It would be instructive to monitor the usage of these 'artificial' glades by ungulates. If the experiment were successful i.e. the glades were easily maintained and did serve to attract deer or other animals, a useful management technique would be proven.

d. Maintenance of records of confirmed observations of animal feeding (species involved), watering, wallowing, etc. and seasonal events such as calving and rutting.

e. Encouragement of, and cooperation with visiting scientists wishing to work on approved projects.

f. Autecological Studies

By the time the staff ecologist has been recruited and the Chitwan Research Unit is functioning smoothly, new management problems of an ecological nature will probably have arisen. The research programmes of the staff ecologist and his counterpart will need to remain flexible, since in cooperation with the warden, the research unit will need to be able to tackle problems as they arise. However, if no visiting scientist has studied the gharial by then the staff ecologist should investigate its breeding biology and habitat requirements as a high priority. There will already be a substantial body of data on the rhino and the tiger and there are reasons to believe that (unlike Platanista) the gharial will respond most favourably to specific conservation measures within the park. If nesting sites can be located on river banks within the park the possibility of affording them extra protection during the breeding season should be explored. A crocodile study should also include experiments, preferably using small numbers of eggs

collected from outside the park, designed to reveal a reliable method of translocating and hatching clutches of eggs which would otherwise be impossible to protect. This may well involve a period of protection and feeding of youngsters after hatching. A study of the mugger might well be conducted concurrently with the gharial work.
Research into the feasibility of reintroducing wild buffalo into Chitwan from Kosi Tappu should also have high priority.

7.3 Management for Education

7.3.1 Conservation Education Centre

The Conservation Education Section of the National Parks and Wildlife Project has drawn up an outline plan for a Conservation Education Centre to be located at Chitwan. The proposed centre would accommodate and cater for up to fifty persons. The idea is sound, ambitious and the suggested locality near Sauraha, appears to be eminently suitable.

It must be stressed however that such a centre with several buildings, generator, buses and numbers of people will inevitably cause a good deal of local disturbance. Experience has repeatedly shown that for a given number of beds in a visitor accommodation approximately twice that number of people will be involved altogether. It may thus be expected that about 100 people will be present, or coming and going in the vicinity of the centre. If the plan materialises the centre should certainly be located outside the park boundary. Because of the very high cost of establishing the centre, funds will have to be sought from bilateral or other aid sources.

In the immediate future the education programme could include the following:

7.3.2 Nature Trails

Nature trails are guided walks with printed information on items of interest to be seen along the way. They are essentially do-it yourself guided nature tours. The written information is in the form of a brochure which should be made available as cheaply as possible, though some charge should be made since free handouts are usually to be seen as litter within minutes of being handed out! The brochure would normally require about 2000-3000 words of explanatory text and a small map. It may or may not be illustrated but simple line drawings can be much more useful than words in describing some features - especially plants.

Nature trails can be arranged to any degree of formality. A formal trail would be marked with numbered points (a small number on a tree or post) and the brochure would point out exactly what can be seen at each point. A less formal trail would merely indicate what could be seen along the trail between one point and

the next and a totally informal trail would merely describe what a competent observer might find by wandering at will in a particular area.

It is recommended that at Chitwan formal trails of not more than two miles (one mile might be enough) should be set up near the centres of accommodation. One serious problem at Chitwan is the danger from sloth bears and rhino to people on foot. Yet organised tours with armed guards would destroy the main attraction of a nature trail - the freedom to walk at will and so escape for a time from being organised and herded. Nature trails will clearly have to be set up at the discretion of the warden who will be best able to assess the risk in different localities. Because of this hazard, and because the park's visitors must be restricted to authorised paths and roads, totally informal trails would not be appropriate. But a longer, semi-formal type might be feasible on the Someswars where a footpath is planned to enable Tiger Tops visitors to walk to the Golden Pool - an attractive waterfall and pool on the Surung Khola.

In the writer's experience much more could be done to educate visitors during motor tours of national parks. A motoring nature trail would of course be much longer, but the principle of using a brochure to describe in detail the features of interest at different points along the road could still be effective. In some places visitors could be permitted to leave their cars to examine wayside features on foot. Such a scheme would add to the interest of any park tour but at Chitwan, where game is difficult to see from the road, some demonstration and explanation of vegetation, geology and even such features as termite mounds could add significantly to visitor education and enjoyment.

7.3.3 Display Units

Public display units have already been proposed by the Project's Conservation Education Section and Chitwan will need to be publicised in Kathmandu and elsewhere.

Within the park, display boards with captioned photographs and suitable news items could usefully be maintained at the Tiger Tops Jungle Lodge and at the tented camps of Tiger Tops and any other concessionnaires.

7.3.4 Museum

It is not recommended that any great expense be incurred in creating a park museum at this stage of development. But if a room can be spared at park headquarters it would certainly be worthwhile to build up and exhibit a collection of museum specimens which come to hand and need no great skill to display. This could then form the basis of a more ambitious museum to be planned in a few years' time.

7.3.5 Publications

In addition to nature-trail guides certain other publications are required:

i National Park Handbook

An attractively-produced handbook which would provide a general summary of the natural history (including climate, geology, etc.) of the park in authoritive but readable form. It should be illustrated and should enable the visitor to get more out of his stay at Chitwan besides having the appeal of a book to be taken home. The more common or interesting animals and plants should be described and routes and places of particular interest could be recommended and indicated on a map. A bird check list should also be included. The handbook should sell at about Rs20 per copy.

ii Information Brochure

This should be a simple, fold-out brochure in Nepali giving summary information on the flora and fauna with a brief description and drawing of each of the large animals. There should also be a map and or a synopsis of the more important bye-laws. The brochure should be made available very cheaply, though a small charge must be made.

iii Park Map

A park map showing topography, vegetation types, roads and places of special interest is in preparation. It is intended that the map shall be made available to visitors at about Rs5/-

iv Bird Check List

A check list of birds appears in Appendix V. The list should also indicate whether each bird is resident or of seasonal occurrence (migratory status can be indicated by symbols) and whether common, frequent, or rare within the park. Breeding season should also be stated and rare birds (i.e. throughout their range) should be indicated. When this information, or the bulk of it is available, the check list should be published separately (besides being included in the Park Handbook) and sold to visitors at about Rs1/- per copy.

7.3.6 Conservation Education Extension Service

The Conservation Education Section has already formed plans for this most important service in the Chitwan District outside the park. Local residents must be informed so as to be able to appreciate the various values of the park. In connection with financial returns they must be led to understand that profits to the nation may be far in excess of any monies accruing directly to the park.

7.4 Management for Recreation

As was mentioned earlier, educational and recreational activities are not always to be distinguished. The following however may be listed under this heading; the aim being to offer visitors a variety of activities in order to encourage them to extend their stay beyond a single night which is the norm at present.

7.4.1 Visitor Accommodation

In addition to the Tiger Tops Jungle Lodge and the two tented camps to be operated by Tiger Tops (or Tiger Tops and one other concessionnaire) there will be a need for approved camping sites for those visitors who prefer to bring their own camping equipment and cater for themselves. Two sites should be set aside, one near each end of the park, e.g. Sauraha and Khoria Mohan. Attractive sites should be selected with shade from trees but outstanding beauty spots should not be spoiled.

Each camp site should be provided with litter bunkers and properly constructed latrines (deep pit type as at park HQ). Firewood should be supplied by the park and the park staff should be responsible for rubbish disposal and general upkeep of the sites. These approved sites should be the only places where camping is permitted and a modest charge should be made - say Rs5/- per night for their use.

7.4.2 Machaans and Hides

Stoutly constructed machaans should be positioned overlooking wallows or mineral licks. These should be accessible to within a short distance by car, thereafter to be approached on foot while vehicles are left on a small, cleared car park. It should be possible to drive to the car park (which need only accommodate two or three vehicles) and from there to be able to see whether or not the machaan is occupied without disturbing game at the wallow or lick. The climb to the machaan should not be such that only the most agile visitors are able to get there. Where necessary, steps should be built. Unquestionably, observing from a well-placed machaan is the best way to see and photograph the wildlife of Chitwan.

Hides for bird photography might be worth while on selected parts of the river and the tals. If so, these could be built to accommodate up to six photographers at a time and a simple, covered approach should be provided.

7.4.3 Fishing

Angling, subject to certain conditions, has already been made permissable under the Park Rules, though in principle, it is in conflict with the general ethics of a national park. Sport fishing is, after all, merely the wounding or killing of animals for

pleasure. In practice however, angling need do no harm, either to fish stocks or the aquatic ecosystems involved. In the main, the population dynamics of fish are not paralleled by terrestrial vertebrates and to prohibit fishing altogether in a park bordered by rivers and where the demand is tolerable, seems to be an unnecessarily strict interpretation of the national park concept. At present the rivers bordering the park are so heavily fished with small-mesh nets and even explosives that the sport if scarcely worthwhile but with protection, fish stocks will build up and if the mahseer can be afforded adequate protection fishing for this species could become a popular attraction.

There should be no fishing in the vicinity of bird-watching spots or machaans, or where vegetation has to be chopped or trampled down in order to gain access to the water. Fishing should also be prohibited, at least during the next few years, on tals and tributaries within the park. Along the main rivers where fishing is permissible it might be more appropriate and practicable to indicate, with tastfully-designed notice boards, either those stretches approved or those where fishing is prohibited. A statement on the fishing license would inform the anglers where they may go and what notices to look for. Needless to say, only rod and line fishing should be permitted, and the privilege should be extended only to bona fide park visitors and staff and the right to prohibit fishing at any time must be retained.

7.4.4 Boat Trips

Launch trips on the Narayani might be worthwnile, possibly in conjunction with a small overnight camp on Bhandarjhola island. Canoe trips down the Rapti from Sauraha to Meghauli or the Rapti - Narayani confluence would occupy most of the day and would be a new and exciting experience for most visitors. The party could either spend the night at the Sauraha tented camp or return by vehicle the same night to the Jungle Lodge or other tented accommodation.

7.4.5 Elephant Treks

In addition to the elephant ride from Meghauli airstrip to the Jungle Lodge (which is the usual arrangement for newly-arrived Tiger Tops visitors) a more exciting trek might be organised, say, from Sauraha, along the Churia ridge with the night being spent in a Jungle camp. Unfortunately, at present, there is little game to be seen on the Churia ridge and the precise route would need to be planned so as to make the most of what scenic and wildlife attractions there are.

7.4.6 Miscellaneous

A few trained English speaking Nepali guides with a good knowledge of local natural history should be available to accompany

visitors; a reasonable charge of say Rs15 or 20 a day being made for their services. The warden and assistant warden should be prepared to give occasional talks to groups of visitors on the national park and conservation problems.

Record books should be kept at the accommodation centres where visitors may write down what wildlife and incidents they have seen during the day. Properly bound, these books could be kept on the bookshelf in the lounge at the jungle lodge and the education centre, and would form an interesting and useful collection after a few seasons. Postcards showing wildlife and scenery of the park should be on sale at all the accommodation centres.

7.5 Estate Management

7.5.1 Access Roads

With the development of the national park, and the opening up of the east-west highway, increasing numbers of visitors will want to travel to Chitwan by road as part of a regular tour circuit e.g. Kathmandu-Hetaura-Chitwan-Lumbini-Pokhara. The provision of all-weather access roads therefore becomes essential at least to Sauraha and also from Bharatpur via Patihani to Kasra Durbar. The road to Sauraha at present runs from Tadi Bazaar but it may prove best to re-route it from a point east of Tadi Bazaar and so avoid having to ford a major tributary of the Rapti River. The crossing of the Rapti itself, however, will remain a serious problem.

7.5.2 Internal Roads, Paths and Bridges

The following proposals for development within the park are based on the regional warden's development programme for the period 1975/76 to 1979/80

i New Roads

Amwa to Bhankata	18 miles	
Bhimli to Meghauli airstrip	5 "	To be surfaced with gravel to all-weather standards using river deposits.
Sauraha to Bagmara	2 "	
Kasra to Ghatgain	2 "	
Sukhibar to Bhankatta	5 "	

ii Improvement of Public Rights of Way

Ghatgain to Dhoba	5 miles
Bhankatta to Dadreni	5 "

iii Inspection Paths

Someswar Hills	20 miles	A semi-formal nature trail could probably be included within the Someswar section
Churia Ridge to various Guard posts	10 "	
Bhandarjhola Island	5 "	

iv Tracks

Game-viewing motorable tracks from present road system to selected tals and game viewing areas	This could be done in conjunction with recommendations under 7.4.2
20 miles	

v Airfield Development

Bagmara, Meghauli and Ghatgain to be provided with small waiting room (or shelter) and toilet facilities.

vi Bridges

All bridges should be brought up to all-weather standards and a bridge, pontoon ferry or causeway will ultimately need to be provided at Sauraha or Kasra across the Rapti. This will be a major undertaking but is clearly essential for access to the park by road. The problem will need to be studied by a civil engineer before a firm recommendation can be made; on present information it appears that a concrete causeway would be most effective but the cost is likely to be prohibitive.

In the meantime it is important that visitors arriving at the park without a 4x4 vehicle should have the opportunity of using elephant transport and possibly hiring a park vehicle when this can be arranged.

7.5.3 Buildings

House and laboratory for the staff ecologist have already been referred to as has the museum, Conservation Education Centre and camp sites. The following additional buildings have been listed in the regional warden's development programme and a site plan has been prepared for park headquarters.

Kasra Durbar: Park HQ

5 senior staff quarters
2 guard officers' quarters
Accommodation for 30 junior staff
School building
Canteen
Ration store

General store
Garage extension
Carpenter's shop
Dispensary
Power house
Hatisar (elephant encampment)
Boat house
Gaol for 4 prisoners

An effort should be made to keep buildings within the park to an essential minimum and to avoid over-development. At the same time it is desirable that the park should be, at least potentially, self-contained as there may be periods when, unavoidably, the park guards are unpopular with local villagers. It is fortunate therefore that Kasra Durbar is located near the park boundary. Development of park headquarters at the periphery of the park was thus facilitated from the start and the impact of development need not be unnecessarily severe.

Sauraha District HQ

Accommodation for assistant warden
Accommodation for 12 junior staff
Office and store
Garage, petrol and oil store

Khoria Mohan District HQ

Office and store
Goal for 4 prisoners
Hatisar for 2 elephants

Guard Posts

All guard posts should be brought up to the present accepted permanent standard using local materials as far as possible, although one temporary (seasonal) outpost could be maintained on Bandarjhola Island. At posts where animal pounds have been established additional accommodation for cattle guards should be provided.

7.5.4 Transport

i Vehicles. The vehicle pool will need to include 3 Landrover pick-up or similar type of vehicle for use by the warden, assistant warden and officer in charge of guards. A 3-ton truck is needed for general transport purposes and a tractor is required, equipped with trailor, blade terracer and grass cutter attachment.

Two new Landrovers are already in use at Chitwan, and the tractor and attachments are on order.

ii Elephants. Government-owned elephants are currently kept at a hatisar at Sauraha. The animals are under-utilised and are indeed idle for much of their time. Two hatisars for two elephants each have been proposed at Kasra and Khoria Mohan. Full use could be made of both for tourist transport and wet season patrols. It is recommended that selected animals be released from the government hatisar for use by the park.

iii Bicycles. While bicycles are of limited use they are relatively inexpensive and would be worthwhile for messengers travelling between district headquarters and those outposts situated in the lowlands. It is recommended that 15 bicycles should be supplied for use at park headquarters, district headquarters and outposts as appropriate.

7.6 Responsibilities, Administration and Wardening

7.6.1 The Administrative Body

At present, conservation in Nepal is the responsibility of the HMG/FAO/UNDP National Parks and Wildlife Conservation Project, the government agency being the Ministry of Forests. United Nations participation in the project is scheduled to terminate in 1978 after which it is anticipated that total responsibility will be transferred to the Wildlife Section of the Forestry Department of the Ministry of Forests. It is to be hoped that this section will be up-graded to full departmental status under a departmental chief who will be directly responsible to the Minister of Forests.

In the field the park warden will be responsible to the sectional or departmental chief and will in turn head the chain of command of the entire guard force of the park and associated reserves and zones to which he is assigned.

7.6.2 Administrative Organisation in the Field

The present unsatisfactory system of dual control in the field has been referred to (4.2.6) and it is much to be hoped that the straightforward scheme outlined above can be effected as soon as possible. In Chitwan the chain of command should devolve from the warden (or in his absence the senior assistant warden), through the officer in charge of the guards, subedars or jamedars (roughly the equivalent of captain and lieutenant respectively) in charge of each of the administrative divisions, to the NCOs in charge of each guard post. This must be so irrespective of whether the guards are seconded military men or recruited civilians.

Park headquarters have been estblished at Kasra Durbar with district headquarters at Sauraha and Khoria Mohan. It is proposed that a third district with headquarters at Bhankatta would divide the park into four effective administrative divisions under direct control of park headquarters and with responsibilities to be

delegated by the warden.

Divisional control of the outposts would be as follows:

Kasra Durbar (Park HQ)

Outposts under direct control should include Ghatgain, Janeli, Dumaria, Sughibar, Bhimli and Surung.

Sauraha District

Initially outposts would include Sauraha, Bhawanipur and Paire Khola. Eventually responsibility may be extended to include posts in a proposed hunting reserve east of the park boundary.

Khoria Mohan District

This western division would command the outposts at Khoria Mohan, Bagmara, Chumka and the Narayani Islands. It may eventually extend responsibility to outposts in the eastern sectors of the Narayani Wildlife Reserve.

Bhankatta District

Outposts under control of this district headquarters would be Bhankatta, Bote Simra, Babai and Amwa.

The guard strength at each outpost should be no greater than is absolutely necessary and it should in no case be necessary to exeed one NCO and four guards. Posts with a full compliment of men could, with advantage, include one or two indigenous Tharu people and a few suitable men should be recruited for training as soon as possible These people could be especially useful as scouts and interpretors and could be a valuable source of local information. In any case it is desirable that the park should provide employment for local people. If need be, illiterate personnel could be recruited as scouts even though they could not complete a guard's training. The deployment of the guard force must be at the discretion of the warden in consultation with the subedar (or jamedar) in charge of each district.

In addition to the permanent outposts it is recommended that a mobile anti-poaching patrol force of about 20 men be based on Kasra Durbar. There will also be four men stationed at the entrance gates to bring the total guard force to some 130 men including seven senior officers and twenty-five havildars (roughly equivalent to sergeant). This is a very large number for a park of only 210 square miles but it is probably justified by the incentive to poachers created by the high price of rhino horn and by the numerous problems caused by the close proximity of agricultural settlements. Great care will have to be taken therefore to ensure that the environmental impact of essential buildings and personnel is minimal. Many of the outposts will, of course, be located in the

periphery of the park. There should be daily radio contact between Kathmandu headquarters and park headquarters, and between the latter and divisional headquarters and mobile patrols.

7.6.3 Training and Qualifications of Field Personnel

Inevitably there is an element of the military in a body of uniformed, armed guards and a smart military image is a good thing. But drill, musketry and military skills make up only a part of the training of a good park guard and a disproportionate emphasis on martial matters is to be avoided; the aim is to produce personnel suited to national parks, not the armed forces. If military personnel are employed a thorough training will still be necessary.

It is recommended that a training centre be set up at Kasra Durbar. The proposed staff quarters together with the existing Durbar building will be adequate accommodation. The regional warden has already outlined an eminently suitable syllabus for a two month period of training and it may be an advantage to split this into two separate courses of one month for groups of about 20 men. The training programme should include the following:

1. The concept and philosophy of national parks; in general and in the national context.
2. Weapon training
3. Drill and physical training
4. National park legislation in Nepal; Chitwan bye-laws and boundaries.
5. Court procedure and proper excercise of legal powers
6. Field-craft and patrol techniques
7. Natural history (a short field course in Himalayan natural history will also have to be organised in one of the mountain parks)
8. Conduct and duties of a wildlife guide
9. Map reading, use of compass and binoculars
10. Operation and maintenance of radio sets
11. Guard post duties and report writing

7.6.4 Staff Discipline and Welfare

Conduct of guards should be clearly laid down in standing orders together with a recognised system of penalties for disciplinary offences; this could range from stoppage of pay to dismissal. In general, standards of discipline and personal turn-out should be comparable to those expected from other armed, uniformed bodies such as police or army. A scheme of incentives to encourage effort and devotion to duty is essential to high morale and efficiency

among field staff. The scheme could make provision for accelarated promotion for outstanding work, additional paid leave, proficiency badges for success in training and an extra allowance for fluency in English.

There should, of course, be strict attention to staff rights and privileges and all staff should have the opportunity, upon formal request, to discuss grievances and personal problems with officers.

All guard posts should be visited by an officer at frequent but irregular intervals and, in the interests of morale and guard experience, guards should not normally remain in the same post for more than about six months. Transfer of guards between parks should not be practiced to the extent of causing domestic hardship. It has been a policy of the park to permit guards to be accompanied by families at the outposts. Military personnel however may be subject to military ruling on this point.

There must be provision for adequate medical attention by arrangement with a local clinic and possibly through regular visits by a doctor to park headquarters. Provision must be made for proper compensation to families in case of death or injury to park staff in the course of duty.

7.6.5 Equipment, Uniforms and Supplies

i. Purchasing and Supply

Major items of equipment should be indented at the headquarters office in Kathmandu. Head office should then order locally or from overseas as appropriate. Park staff rations should be obtained through local contractors on an annual tender basis. Heavy building materials such as timber which can be obtained locally should be bought on local purchase order signed by the warden, copies of which should be sent to head office in Kathmandu for information. A petrol pump and bulk storage facilities are already scheduled to be installed at Sauraha when the access road has been brought to all-weather standards.

All stores and equipment should be taken on ledger charge and issued against signed vouchers, a record of all receipts and issues being maintained by the storeman.

Clothing and personal equipment should be supplied to staff on a scale of issue to be laid down by the warden; a suggested scheme is given in table III.

In the case of clothing it may be most practicable to supply one complete outfit initially, and thereafter to pay an adequate clothing allowance from which replacement items must be purchased.

ii. Firearms

For security reasons, and because of legal restrictions, firearms cannot be procured and issued along with other equipment. At present some old SMLE .303 military rifles are in use but these weapons are unsatisfactory and there are reports of rifles and or ammunition having fallen into the hands of poachers and thereafter being used for killing rhino.

It has been suggested that Greener single shot 12-bore shotguns specially produced for riot police and similar security forces should be used. These guns, effective up to about 100 metres, robust and equipped with slings, fire special ammunition which will not be obtainable by poachers, and would not in any case be effective against rhino. For park guards operating in forest and long grass they should be ideal and would be very effective in self-defence against sloth-bears, the most dangerous large animals in the park.

Shotguns and ammunition should be issued on an individual basis to guards of the rank of havildar and below. Ultimately each man should have his own weapon as it is difficult to hold a man entirely responsible for his gun and ammunition if he is compelled to share it with others at the guard post. For further economy and security in weapons, guards of the scout grade need not be armed. For personal defence, wardens and other senior officers should be authorised to carry pistols.

The above remarks rest on the assumption that the national park will be free to recruit staff from civilian applicants. If military personnel are supplied they will presumably be equipped by the army but a more suitable weapon than the .303 rifle will need to be supplied and the foregoing recommendations are still applicable.

7.7 Reports and Records

It has been mentioned that there should be daily radio contact between head office in Kathmandu and Park headquarters and also between the latter and divisional headquarters and mobile patrols. The content of radio messages should be briefly noted against the date and time in the radio log book as is at present being practiced at head office and park headquarters.

In addition the system of routine reporting in writing should be expanded as the training and organisation of field staff proceeds. Reports, which should always be concise; should include:

i. Warden's monthly reports to head office in Kathmandu. These, as at present, will include brief summaries of the more important current issues under a range of headings as the warden deems appropriate.

ii. Divisional reports to park headquarters. Monthly reports to include a summary of information received from the outposts in addition to reports on divisional headquarters activities.

iii. Outposts reports prepared by each outpost NCO. Brief monthly statements of activities at the outpost (encounters with poachers, observations of breaches of bye-laws, unusual observations of wildlife etc.) to be submitted to divisional headquarters.

iv. Scientific reports and records. The staff ecologist should prepare detailed research proposals annually and should submit quarterly progress reports as well as final reports with copies to both head office and park headquarters. Visiting scientists will, of course, need to have research proposals approved by head office and park headquarters before being granted any privileges within the park. Thereafter quarterly progress reports must be submitted with copies to head office, park headquarters and the staff ecologist. Similarly, at least three copies of the final report and any subsequent publications must be made available.