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SIND WILDLIFE MANAGEMENT BOARD
MANAGEMENT PLAN

FOR
KIRTHAR NATIONAL PARK
SIND, PAKISTAN
July 1973-78

BY

COLIN W. HOLLOWAY

Ecologist, IUCN

Switzerland

AND

KHAN MUHAMMAD KHAN

Deputy Conservator of Forests, Wildlife

KARACHI (Pakistan)

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INTRODUCTION

In August 1972, the Government of the Province of Sind, Pakistan, invited the International Union for Conservation of Nature and Natural Resources to send a staff member to visit Sind for the purposes of preparing a plan for the establishment, organisation and development of the Kirthar National Park. IUCN was unable to comply with this request immediately, but on March 2nd, 1973 Dr. Colin W. Holloway of IUCN's Research and Planning Group arrived in Pakistan and spent approximately one month in the collection of data and the preparation of the plan with his Pakistani counterpart, Mr. Khan Muhammad Khan, of the Wildlife and Forest Department.

Presentation of material in the plan follows the same basic arrangement as a Forest Working Plan in that it is divided into two parts, the first of which deals with background information on which management proposals are based, and the second states the management objectives and outlines prescriptions for their attainment, followed by a summary of prescriptions and estimates of expenditure. Numerous modifications have been made to the conventional working plan arrangement, however, to meet the particular needs of this undertaking. In some respects, the document is comparable to a North American Park Master Plan, in that many of its sections deal with the basic strategy for realising objectives and may require the preparation of more detailed proposals as experience is accumulated.

The Kirthar National Park is the first in the Province of Sind and one of the first in the country as a whole. It is hoped that the implementation of this plan and the consequent establishment and organisation of the Park may serve as a pilot project for further initiatives of this sort in the Province in the future.

Acknowledgements

Many different people assisted the authors both in field work and in subsequent discussion of the plan's content. They include all the officers and members of the Sind Wildlife Management Board that the authors were privileged to meet, the Chief Conservator of Forests and many members of his staff, members of the Wildlife Watchers in the Kirthar Range, and a great variety of private individuals. They are too numerous to mention by name but their help is very gratefully acknowledged.

Special mention deserves to be made, however, of Mr. W. A. Kermani, Secretary to the Government of Sind, who organised the programme and provided much useful advice in the plan's compilation, Dr. S. M. Hasan Rizvi, member of the Sind Wildlife Management Board, who accompanied the authors on part of their field work. Mr. Hasan Ali Baloch, Section Officer, Karachi, and formerly Divisional Forest Officer, Karachi, who filled many gaps in the authors' knowledge of the study area and Mr. T.J. Roberts, an acknowledged authority on wildlife in Pakistan who provided information on the birds of the Kirthar tract. The authors are indebted to them for their assistance and cooperation.

The World Wildlife Fund (International) provided the grant that enabled Dr. Holloway to take part in this project and its support is very greatly appreciated.

LITERATURE

1. Baig, O.U. 1972. The Great Wall of Rannikot. *Outdoorman* 2, (9 & 10): 39-48.
2. Chaudhri, I.I. & Chattar, M. S. 1966. The Vegetation and Range Flora of Thar Desert. West Pakistan Forest Department: 165 pp.
3. Holmes, D.A. & Wright, J.O. 1968. The Birds of Sind: A Review Jour. of the Bombay Nat. Hist. Soc. 3 (65): 534-556 and 1 (66): 8-30.
4. Kermani, W. A. 1972. Sind sets the Pattern. *Outdoorman* 2 (9 & 10) 89-91.
5. Khan, M. K. & Baloch, H. A. 1972. Feasibility Report for Range Management in Registan, Kohistan, Ghaibidero Jagir & Takkar Area. *cyclo* 46: 70
6. Prater, S.H. 1965. The Book of Indian Animals. Bombay Nat. Hist. Soc. & Prince of Wales Mus. of W. India: 323 PP.
7. Qadri, M.A.H. 1971. Problems of Wildlife and Natural Environments & Ecology. Pak. Assoc. Advan. Sc. Lahore: 20 pp.
8. Qadri, S. A. Qureshi, S.Z. & Ahmed, M.A. 1966. A Phytosociological Survey of the Karachi University Campus. *Vegetation* 13 (6): 339-361.
9. Roberts, T.J. 1972. Ecological Disturbance in Sind. *Outdoorman* 2 (9) & 10): 33-38.
10. Shaukat, S.S & Qadri, S.A. 1971. Multivariate Analysis of the Vegetation of Calcarious Hills around Karachi. *Vegetation* 23 (3-4): 235-253.
11. Schaller, G. B. 1972. Notes on the Proposed Kirthar National Park. *cyclo* 2 pp.
12. Sorley, H.T. 1968. The Former Province of Sind (including Khairpur state). *Gazetteer of West Pakistan. Government of West Pakistan.* 809 pp.
13. Wadia, D. N. 1919. *Geology of India.* Macmillan & Co. Ltd. London 398 pp.
14. Wildlife Society. 1969 (3rd edn.). *Wildlife Management Techniques* (ed R.H Giles). Washington D. C 623 pp.

PART I

NATIONAL PARK AREA: ITS CURRENT STATUS, MANAGEMENT AND UTILIZATION.

1. PARK AREA.

1.1. Name and Location.

1. The area proposed for the Kirthar National Park is situated in the South West of the Province of Sind and lies between Latitudes 25° 10'N and 26° 05'N and Longitudes 67° 10'E and 67° 55'E. It comprises the South East extension of the Kirthar Mountain range, to the West of the River Indus. The Western boundary of the Park is the provincial border between Baluchistan and Sind.

2. Approximately one third of the Park area occurs in the North of Karachi Administrative District, and the remainder occurs in the South West sector of Dadu District (ref. map. Appendix I)*.

3. The Park will have a total area of approximately 1192 sq. miles.

1.2. Villages and Communications.

4. There are 93 permanent villages within the Park area that are occupied throughout the year. Their location is shown on the map in Appendix 1. A further 124 villages are temporary and are occupied for part of the year, after the rains, by migrant herdsmen. Estimates of population sizes of villages are provided in Table 3 (ref. para 42).

5. The nearest rail centre and international airport is in the city of Karachi in the south, some 12.8 miles by road from the south west extremity of the Park. The city of Hyderabad, which has a local airport, and the town of Thano Bula Khan, are 35 and 5 miles respectively, from the Park's south eastern boundary.

6. The Park has a total of 417 miles of unmetalled roads and cart tracks. Only one stretch of road, between Thano Bula Khan and Karchat (34 miles), is presently negotiable by ordinary motor vehicles. Motor travel on the remainder requires four-wheeled drive.

1.3. Legal Status.

7. The vast majority of land units that comprise the Park are owned by the Government and are classified as *Government Wasteland*. In 1965, all wasteland areas in the Karachi district of the Park and the adjacent region to the north west (Mol) were declared *Protected Forests*. These latter areas may be used by local people except for purposes specifically forbidden by the Government such as felling of trees. Individuals may lease areas of Government Wasteland for cultivation (such areas are known as *Eksala land*) or may establish rights for purposes such as stock grazing, but they can never acquire ownership of this land. The rights of local people within the Park area have never been settled.

*The map also shows the Surjani/Hothiano Game Reserve; although the latter is outside the Park. Reference to its management is made in paras 158-159 of this Plan.

9. Table I shows the areas of these different categories of land ownership and Quabuli land.

9. Table 1 shows the areas of these different categories of land ownership and use by districts in 1972.

TABLE 1 LAND OWNERSHIP AND LEASE. KIRTHAR NATIONAL PARK 1972

District	Govt. Wasteland sq miles	Protected Forests sq miles	Eksala land sq miles	Quabuli land sq miles
Karachi ..	78.20	240.59	16.42	5.44
Dadu ..	443.92	33.32	241.47	133.07

10. On October 28th 1972, the Park area (excluding a small strip of land in the South West and a block in the North East corner, to the East of Suk Nai) was declared a Wildlife Sanctuary, under the terms of the Sind Wildlife Protection Ordinance 1972. It is forbidden to enter or reside in a Sanctuary, to cultivate land, to damage or destroy vegetation, to hunt, kill or capture wild animals or to shoot in the area or within three miles of its boundaries; exotic species of animals and plants or domestic stock may not be introduced into the area, and starting fires or polluting water are prohibited. The Government is empowered, however, to permit some of these activities to be undertaken for scientific or aesthetic purposes. These regulations have not, as yet, been enforced within the Kirthar Sanctuary.

1.4. Present Administration.

11. The Park region and its people are subject to the normal law of the land and civil administration is the responsibility of the Deputy Commissioners of Karachi and Dadu districts.

12. Protection of wildlife in this area is the responsibility of the Honorary Game Warden, who resides at Kotri (between Thano Bula Khan and Hyderabad). The present occupant of this position is also the member of the Pakistan National Assembly for this area and the Chief of the Malik Tribe, to which most of the population in this region belongs. The Game Warden has two Honorary Assistant Game Wardens and a Game Inspector, who is a Government officer based in Thano Bula Khan, to aid him.

13. There is a force of 53 Wildlife Watchers (guards) presently operating wholly or partially within the boundaries of the Sanctuary and of the neighbouring Surjani/Hothiano Game Reserve. Their distribution is shown in Table 2.

TABLE 2 DISTRIBUTORS WILDLIFE WATCHERS—KIRTHAR NATIONAL PARK 1972

Guard Beat (Operational area)	Base	No. of Watchers
Karchat (kirthar) Mountain	Karchat	1
	Bachel Rind	3
	Amiro Gabol	3
	Gabol	3
	Lutufali Gabol	1
	Taung	1
Jatteng Mountain	Jalalani	1
	Burfat	2
Ranikot	Ranikot	1
Hothiana Mountain	Basran Shop	1
	Saed Khan	2
Eri Mountain	Mochija	1
	Chemo Khoso	3
Halar Pass	Wahi	2
Sumbak Mountain	Shedo Khoso	1
	Ladao Khaskheli	3
	Dadu Muhammad Khoso	5
Surjani Mountain	Thano Ahmed Khan	5
	Somar Sunahro	2
	Bhal	1
Easer Pass	Gul Muhammad Shodo	2
Loyach	Quadirbux Lalani	2
Mol	Mol	2
Dunbar Mountain	Taung	1
Murri Mongthar Range	M. Hassan Buro	4
Total		53

14. The location of the Wildlife Watchers' bases is shown on the map in Appendix I.

2. PHYSIOGRAPHY, CLIMATE, GEOLOGY, VEGETATION AND WILDLIFE.

2.1. Topography.

15. The Park tract consists of a number of north-south hill ranges separated by relatively wide, undulating valleys. The elevation of the area as a whole generally decreases from north to south. The highest altitude within the Park occurs on Karchat Mountain (strictly the south eastern extremity of the Kirthar Range proper) at 3294 feet a.s.l., and the lowest altitude is at the Hab Dam, at the south west extremity of the Park at approximately 230 feet a.s.l.

16. Drainage in the north and central sectors of the Park follows a south westerly direction *via* the Baran Nadi to the Indus river and thence to the Arabian Sea, the west central region drains due south *via* the Malir river to the ocean, and the drainage of the south western sector follows a south westerly course *via* the Hab river to the sea. There are no perennial rivers in the Park.

2.2. Climate.

17. There are no meteorological stations within the Park area. Some meteorological data are available from the station that was established in Thanu Bula Khan from March 1955 to September 1959, but even these figures are incomplete. What figures are available show considerable similarity to the amount and distribution of rainfall at Karachi Airport (12 miles north east of the City) during the same period, higher maximum and minimum temperatures, much higher wind speeds and lower humidity. In the absence of more precise information, this section will confine itself largely to comment on the main climatic features of the region as a whole.

18. There are four climatic seasons: (1) winter season—December to March (2) summer season—April to June (3) monsoon season—July to September, and (4) autumn season—October to November. The average annual rainfall is in the region of 6-8 inches but amounts may fluctuate very considerably from one year to the next. It falls principally in July and August. Figures for Karachi Airport suggest that at least one year in ten is a drought year with rainfalls of one inch or less. Examination of rainfall data for a wide variety of stations within the Province has shown that there has been no persistent trend in rainfall for the past 70 years. Temperatures are often extreme, being very hot in summer and relatively cold in winter. Mean maximum daily temperatures in Thanu Bula Khan in 1955-59 exceeded 100°F during most of the summer months. Relative humidity is lowest in the summer and highest during the monsoons. Wind speeds are generally high and are dry and desiccating for much of the year, except in July and August.

2.3. Geology and Soils; Water Development.

19. The principal geological formations within the area are calcareous; limestone generally predominates in the hill ranges and recent calcareous deposits

are common in the valleys. Sandy limestones, shales, sandy shales and sandstones also occur throughout the range, particularly in the south west and lower foothills of the main hill features. Grey sandstones occur together with limestone in the north east.

20. The main geological series represented are *Gaj*, *Braihu* and *Ranikot*. Some stages of these formations are remarkably rich in fossils of Foramina, Lamellibranchs, Echnoids, Gastropods and others. The Geology Department of the University of Sind has undertaken research on this subject.

21. The soils of the region contain fragments of rocky material, much of which is limestone. Surface soils contain about 90% sand and 10% clay. There has been considerable soil erosion on the hill flanks and exposed plateaus on the plains and hill tops, but in the valleys and depressions protected from wind or running water there are still good depths of soil. Sand dunes are virtually absent in the Park.

22. Sufficient wells have been dug in the Kirthar area to suggest that underground water can be tapped at economic depths over much of the region, but its quality depends on the geological formation in which it occurs. In general terms, water in limestone formations is often brackish except where rock fissures are large enough to permit quick passage of the water, or where the limestone is fairly pure as frequently occurs in the *Gaj* or *Nari* series and decomposition of the rock is slow. Sandstones normally provide fresh water. Underground water supplies to the east of Karchat mountain where one of the new tourist centres (ref. para 137) may be sited, are likely to be fresh.

2.4. Vegetation:

23. There is evidence from geological and archeological sources to suggest that until about 500 B.C. this geographical region was fairly humid and carried tropical forest. As a result of geophysical changes, however, the zone is now an arid one and the dominant vegetation within the Park is composed of open communities of deciduous, xerophytic trees and shrubs. A varying proportion of the ground cover is perennial and, in the rains, there is normally profuse regeneration of summer annuals whose seeds germinate in June and, after flowering and seeding, the plants die back usually by November. Perennial grasses and shrubs shed their leaves and enter the dormant season soon afterwards. Some tree species with particularly deep roots *e.g.*, *Acacia Jacquemontii* and *Gymnosporia montana* may obtain sufficient water to grow even in the dry season.

24. Extensive botanical collections have been made within the Park and its environs, notably by the University of Karachi, but no comprehensive list of species for this particular tract has, as yet, been compiled. Appendix 2 provides a list of the principal trees, shrubs, grasses and herbs in the Park and has been compiled by Mr. Hassan A. Baloch. It is not a complete list of the species present.

25. In common with arid regions in general, species variety is not wide, although ecological requirements of individual species may vary appreciably. Some species, such as *Commiphora mukul* occur virtually throughout the area in deep sandy soils in the valleys to shallow rock fissures on the mountain tops, whilst

others, such as *Acacia arabica* are largely confined to deep soils in valley depressions. Other species such as *Salvadora oleoides* occupy an intermediate position, occurring over a wide range of altitudes but being largely restricted to deeper soils.

26. Characteristic ecological communities and plant succession series can be identified and are of considerable importance to future management of the Park as indicators of environmental pressure, site potential and the scope for future habitat manipulation. Phytosociological studies of plant communities in the vicinity of Karachi suggest that vegetation types in the region are closely correlated with soil texture, physiographic features, soil depth and soil chemical factors. Soil depth alone can often control community development; deeper soils are normally occupied by climax or near climax communities and ecological succession is often delayed on shallow soils. Examples of seral stages that occur within the Park are: (a) *Acacia arabica*—*Indigofera oblongifolia*—*Zizyphus nummularia*, which is regarded as a post-climax, closed community that frequently occurs on mesic sites such as seasonally flooded depressions in which the soil moisture regime is better than those occupied by climax dominants. The soils are usually fine textured, of medium depth and with high field capacity. (b) *Capparis decidua*—*Prosopis spicigera*—*Commiphora mukul* is regarded as a climax community and occurs on sites with deep sandy soils, weak structure and rather low Calcium, Magnesium and carbonate content at the surface. (c) *Euphorbia caudicifolia*—*Grewia tenax*—*Acacia senegal* is a sub-climax community associated with shallow loamy soils, with low field capacity and rather high Potassium and low carbonate content.

27. Whilst recognising the significance of physiographic and edaphic factors on plant succession in the region, the fact remains that, at present, biotic factors (principally man and his domestic stock) are exercising a major influence on the vegetation through cultivation, grazing and tree felling. Ecological succession is being retarded and often reversed and, in many areas, perennial vegetative cover has been lost completely (ref. paras 46—53).

2.5. Wildlife:

28. This section will be confined to consideration of vertebrate species, although the conservation and study of all forms of fauna and flora are of concern to the Park authorities. Knowledge of the species and distribution of animals in the Park region is probably poorer than for plants; no comprehensive lists of species are available. Birds are reasonably well known but information on mammals is incomplete and very little data apparently exists on amphibians, reptiles and fishes.

29. Appendix 3 provides a list of some of the mammals believed to occur in the Park at the present time. The Sind wild goat (*Capra hircus blythi*) is the only species on which any intensive ecological studies have been undertaken to date. Counts of the animal in the National Park and Surjani/Hothiano Game Reserve areas in 1970-71 suggested a total population of about 1200, of which by far the largest population (approximately 500) occurred on Karchat Mountain. The wild goat presently occurs on all the main hill features of the Park and Reserve except

Dunbar and Murri Mongthar in the west. The last wild goats on Murri Mongthar are believed to have been exterminated by poachers in 1964.

30. In autumn 1972, Dr. George Schaller of the New York Zoological Society began an etho-ecological study of the wild goats during breeding and parturition (September/October and March, respectively) on Karchat mountain. His preliminary findings have drawn attention to the importance of grass over shrub forage to the wild goats during these periods and consequent competition with domestic goats whose preferences are similar. Wild goats were not observed to drink at pools during these periods. The sex ratio was at parity and a good proportion of adult males had large horns. Reproductive success was good in 1971 but poor in 1972 and in 1973, probably as a result of drought and nutritious green forage. A few leopard (*Panthera pardus saxicola*) were present and were taking wild goats, which the latter population can easily sustain.

31. The urial or wild sheep (*Ovis orientalis blandfordi*) was censused in July 1971 on the Murri Mongthar mountain ranges, when approximately 70 animals were recorded. The urial also occurs in small numbers on Karchat, Dunbar and Kambhu mountains. The only other wild, hoofed animal present is the gazelle (*Gazella gazella*) which occurs in relatively low numbers on the plains and hill flanks of the Park and occasionally frequents the mountain tops. The species has received special protection by the wildlife watchers within an area of some 7-8 square miles in the south west corner of Kambhu mountain.

32. There is still a good variety of predators in the Park, but numbers of some of the larger species, such as leopard and wolf (*Canis lupus pallipes*) are certainly low. The caracal (*Felis caracal*) may already be extinct in the Park. Rodents are well represented and there is at least one species of bat (probably the greater mouse tailed bat *Rhinopoma microphyllum*) in the numerous caves in the hills.

33. Mr. T. J. Roberts has provided a list of birds identified by him within the Park area as a result of several visits in the winter. It is shown in Appendix 4 and is acknowledged to be incomplete. The more spectacular species are marked with an asterisk.

34. Over 400 species of birds, the majority of which are winter visitors, have been recorded in Sind Province, which is of considerable ornithological interest as it lies on the border between the Oriental and Palaearctic regions. During the authors' visit to the Park area in March, however, relatively few species were seen except in the vicinity of springs, villages and cultivated areas.

35. There are a number of species of raptors in the area and, it is likely that the lammergeyer or bearded vulture (*Gypaetus barbatus*) occurs in the higher reaches of the Park. The houbara bustard (*Chlamydotis undulata macqueenii*) has been a regular visitor to the valleys in the past although recent sightings are understood to have been few. In addition to the game birds listed, the chukor (*Alectoris graeca*) is believed to occur here although it is said to be fairly rare.

36. Among amphibians, frogs and toads are not well represented in the Province as a whole, but the water skipper (*Rana cyanophlyctis*) was seen in pools within the Park from Dunbar to Ranikot.

37. Reptiles in the area are probably relatively numerous. The Sind crocodile (*Crocodylus palustris*) is almost certainly extinct within the stretch of the Hab river that borders the Park, but it may still occur within the upper reaches of the catchment in Baluchistan. The species is said to travel long distances overland to reach suitable water, but the possibilities of it returning to the lower Hab as a result of the Hab dam project (ref. para 54) are remote. Freshwater turtles (*Trionycidae*) very probably occur in the Hab River and the starred tortoise (*Testudo elegans*) occurs in the Hab valley. In addition to the more common geckos (*Geckonidae*) that are associated with villages and gardens. Dunster-ville's gecko (*Stenodactylus orientalis*) may occur in the Park, as may the "bloodsucker" or garden lizard (*Calotes versicolor*) and the spiny-tailed lizard (*Uromastix hardwickii*). The red throated agma (*Agma rubigularis*) is said to be not uncommon at the base of the Kirthar foothills. The large monitor lizards could be present, particularly the desert monitor (*Varanus griseus*) and the barred monitor. (*Varanus flevescens*). The three-toed skink (*Mabuia macularia*) has been recorded on the banks of the Baran river.

38. Forty-three species of snakes have been recorded in Sind and Khairpur but information on their occurrence in the Park region is generally lacking. The rock python (*python molurus*) and three species of rat snakes (*Zamenis spp*) have been recorded within the Park area. It is certain that *Echis carinata*, the saw-scaled viper, occurs in the Kirthar; also the royal rat snake (*Spalerosophis arena-reus*) and the Sind Krait (*Bungareus sindanus*).

39. All rivers within the Park are seasonal but few of the larger rivers ever dry up completely and deep pools of water usually collect at bends and depressions in the river bed, in which fish and other aquatic life survive the dry season. At least a dozen species, principally of the carp family have been identified from the Kirthar Range nais (many of which occur outside the Park boundaries). Further investigation into the subject will be required.

3. HISTORY—HUMAN POPULATION AND LAND USE: WILDLIFE PROTECTION.

3.1. Human Population and Land Utilization.

40. The authors have little data on the early history of the Park area and its people. The presence, age and numbers of tombs at Taung suggest that the area has supported a permanent human population for at least a few hundred years. Equally, the wildness and aridity of the tract suggests that this population was never very large. There is, apparently, no evidence of any substantial change in the size of the human population of the region in recent decades, although the increase in irrigated cultivation in the Park area has probably raised the carrying capacity of some villages. On the other hand, it is certain that the vegetation of the area could not have sustained the present grazing pressure (ref. paras 46--47) for a long period and it seems likely that livestock populations, or stock pressure from outside the area, have risen quite markedly within the recent past. The rise could be attributed to the increase in irrigated areas in the Indus valley (since

the 1930's) and increased availability of grazing during the dry season, to improved veterinary care, and to the substantial increases in financial returns from dairy products over the past decade.

41. The human population of the region is almost entirely dependent upon its livestock, shifting cultivation and some cottage industries (principally embroidery). During the winter and summer months, however, the area's vegetation cannot support vast herds of livestock and so a sizeable proportion of the stock are moved out of the area, very largely to Government land including reserved forests, in the Indus valley, with effect from December/January. When the monsoon starts, however, not only does the resident livestock return but also sizeable herds of stock and their herdsmen and families from outside, to occupy temporary villages and utilize what grazing exists (ref. Table 3, para 42 and Table 4, para 47). Most of these temporary immigrants have no ties with the area at all, but a small proportion (perhaps 20%) may claim some "rights" through tradition or family connection with the resident population. The number of animal immigrants varies with the rainfall and consequent growth of vegetation.

42. The total, permanent human population of the Park area is estimated to be approximately 10,500; in an average year, this population is temporarily increased from about July/August to November/December by some 3,000 migrants to 13,500. Table 4 (ref. para 47) provides details of the equivalent increase in livestock for this period. Table 3 gives estimates of total human population sizes of permanent and temporary villages within the Park, by districts:

TABLE 3. ESTIMATED HUMAN POPULATION SIZES OF PERMANENT AND TEMPORARY VILLAGES BY DISTRICTS. KIRTHAR NATIONAL PARK 1972

District	Villages	POPULATION SIZE			
		0—50	51—100	101—200	201—300
Karachi ..	Permanent	7	8	3	2
	Temporary	29	..	..	..
Dadu ..	Permanent	23	37	9	4
	Temporary	95	..	..	..

43. The six largest villages are Khar and Kand Jhang, in Karachi district, and Karchat, Taung, Bachani and Bailithap in Dadu district (ref. map. Appendix I).

3.2. Land Management

44. Recognition of the continuing deterioration of range lands in this region led to the formulation of a government scheme for soil and vegetation conservation in 1957. It was concerned with conventional soil conservation operations and afforestation, but no work was undertaken within the actual Park area and the scheme was terminated in 1962. A revised scheme of range management was prepared and launched in 1965 and was aimed at better utilization of natural forage, the production of supplemental livestock feed for use during drought periods, development of water points, control of disease and selective stock breeding. It was unsuccessful for a number of reasons, including lack of funds, labour and mechanical equipment, the failure to settle local peoples' rights before the scheme was implemented and to win the peoples' cooperation, and particularly erratic rainfall during the scheme's operation. It was terminated in 1970 and, in 1972, a further range management scheme was devised that seeks to rectify most of the faults in the previous programme. The feasibility study and report on this subject were completed in June 1972, and the scheme is to be launched in July 1973.

3.3 Wildlife Protection

45. The Sind Wild Birds and Wild Animals Protection Act 1940 represented an early attempt to restrict the decline of wildlife and, from this date, a force of game guards (rakhas) was employed in the Khirthar region and was apparently paid privately by the families that owned land on the principal mountains in the tract. It is possible that a private force of guards may have been operating in the area even before the Act. In 1955 the Provincial Government created the post of Hon Chief Game Warden, with two paid Game Wardens for Upper and Lower Sind and 104 Honorary Game Wardens. At that time there were some 15-20 guards in the Khirthar. This staff was expanded when the provinces were absorbed into the Central Government in 1957. The Game Department was amalgamated with the Forest Service during 1966-67 but it was clearly not effective for some of the worst poaching in the Park area occurred in the 1960's (ref. para 56). In 1970, protection within the area was reorganised, most of the tract was declared a Game Reserve, and no further hunting licences were issued, a Divisional Forest Officer was made responsible for the area and its wildlife, cooperation of the local people was sought and a series of wildlife counts was initiated. Murri Mongthar was declared a Wildlife Sanctuary in 1971. In 1972, responsibility for wildlife protection was transferred to the Honorary Game Warden with the present staff and organisation as outlined in paras 12-14, and most of the region was declared a Wildlife Sanctuary.

4. UTILIZATION OF THE PARK AREA

4.1 Domestic Stock Grazing.

46. Stock grazing is the most widespread form of land use in the region and is, ultimately, the most important to the people and far reaching in its effects on the environment. Reference has been made to the intensity of grazing pressure (ref. para 27) and the grazing pattern (ref. para 41). In 1971/72, range forage production was calculated for the Kohistan tract, of which the Park area is a part, by clipping samples of palatable shrubs and grasses on a wide range

of sites after the rains and assuming 50% utilization by stock. The animal units that the range could support were then compared with the units actually present. The calculation showed that in Kohistan, after the monsoon, the vegetation could support 115,501 animal units for 6 months but that 401,893 units were actually present i.e. nearly four times the stocking that the area could carry and still maintain its productivity. The authors' visits to the area have confirmed that perennial vegetation is being replaced by annual grasses and herbs, and that shrub regeneration is inhibited. Even the development of large trees is being stunted by the graziers who commonly lop the upper branches to provide browse for stock in the dry season.

47. Table 4 provides details of the numbers and types of domesticated stock in the Park area, after the monsoon in 1971 and prior to the monsoon in 1972, by districts. The post-monsoon figures include migrant livestock of people normally resident in the area and others from outside (ref. para 41). It is not possible to provide data on the exact proportions of the two.

TABLE 4 NUMBERS AND TYPES OF DOMESTIC STOCK. POST MONSOON 1971 AND PRE-MONSOON 1972 — KIRTHAR NATIONAL PARK.

District	Period	DOMESTIC STOCK						
		Cows	Buffalo	Sheep	Goats	Camels	Donkeys	Horses
Karachi ..	post-monsoon 1971 ..	15,334	271	21,297	30,956	2,222	1,071	135
	pre-monsoon 1972 ..	4,685	90	6,988	19,530	1,046	318	29
Dadu	post-monsoon 1971	12,415	317	56,200	55,227	3,509	409	91
	pre-monsoon 1972	6,543	73	21,311	24,911	2,001	75	17

48. A summary of the range management programme that is to be initiated in July 1973 (ref. para 44) is provided in Part II of this plan (ref. para 99).

4.2 Cultivation.

49. Cultivation is infinitely more destructive to the natural biotope than stock grazing; although it affects a more limited area, the amount of land involved is still very considerable (ref. Table 5, para 51).

50. Two types of cultivation may be distinguished: **temporary or dry cultivation** in which the crops are dependent upon rainfall and the plot is usually abandoned after some years and replaced by another cleared area, and **permanent or irrigated cultivation**, in which crops are irrigated and the soil fertilised so that

the area can be maintained almost indefinitely. For temporary cultivation, the land is cleared and an earth dyke is constructed on the lower side of the land to aid moisture retention during the rains. The soil is worked before the monsoon, seeds are sown with the first shower of rain, and the crop is harvested two or three months later, depending on the rainfall. Although it is a shifting cultivation system, land is normally maintained as a cultivated block for as long as possible until soil fertility is exhausted, or the dyke falls into disrepair. The principal crop grown is sorghum. Permanent cultivation is usually irrigated from tube wells and the water drawn by diesel pump or Persian wheels (operated by bullocks or camels). The wells cost, on average, approximately Rs. 15,000 to construct and, within the Park area, they have all been financed by local capital. Karchat is the only area where spring water is used, partially, to irrigate cultivation. Sorghum, millet and wheat are the principal crops and two rotations a year are possible with the addition of fertiliser. Cotton has been grown in some areas.

51. The area under permanent cultivation is unlikely to show any substantial change from one year to the next, but temporary cultivation may change considerably as a result of good or poor rainfall and the abandonment of old plots and the clearing of new ones. Table 5 shows the total area of **Quabuli** (privately owned) and **Eksala land** (leased from the Government) in 1972, and may be regarded as the maximum area which would have been available for cultivation in that year.

TABLE 5 MAXIMUM AREA AVAILABLE FOR CULTIVATION (TEMPORARY AND PERMANENT) KHIRTHAR NATIONAL PARK 1972

District	Cultivation Status					Area (sq miles)
Karachi	..	Temporary	..	..	..	21.75
		permanent	..	..	..	0.13
Dadu	..	Temporary	..	..	..	374.23
		permanent	..	..	..	0.31

4.3 Timber Cutting.

52. Tree felling and extraction of wood, principally for sale in Karachi as fuel, is currently the third serious threat to the renewable resources of the Park. The authors saw areas (in Murri Mongthar) where not only trees have been felled but the exploiters had returned and dug out the stumps; in other places, they were shown large tracts of low scrub that eye witnesses confirmed had been areas carrying good stands of trees five years ago. There is evidence to suggest that at least part of this exploitation has been carried out with the connivance of local people, and that theft of timber on the present scale is a problem of comparatively recent origin.

53. The Chief Conservator of Forests has issued an extremely strong directive to ensure that this illegal exploitation is halted immediately, and action on the subject is already being taken. It is clear from discussions with Wildlife

Watchers that they were unaware that their duties require them to protect wildlife habitat as well as wildlife and this misconception needs rectification throughout the Park area.

4.4 Water Storage.

54. A large construction programme is presently being undertaken at the south west corner of the Park's boundary, to dam the Hab river, which forms part of the Park border. The dam is three miles long and will be structurally complete by June 1976. Water will be retained permanently up to 13 miles above the dam and have a total surface area of 38 square miles. The depth of water at the dam will be 80 feet. When operational, the dam will supply 96 million gallons of water daily to Karachi (for domestic and industrial use) and also be used to irrigate 21,000 acres of agricultural land in Baluchistan and 1,000 acres in Sind province, below the dam. There are proposals to stock the impounded water with fish. The total catchment area of the dam will be 3,100 square miles and the preparation and implementation of regulations for its protection will be the responsibility of the Provincial Forest Departments concerned.

55. The authors could obtain no details of proposals that have apparently been mooted to construct a luxury hotel at the dam site and to use irrigation water from the dam to provide a green/recreational belt for the city of Karachi.

4.5 Hunting.

56. Hunting has been a significant factor in the depletion of wildlife in the region and has been responsible for the local extermination of some large mammals in certain sectors of the Park (ref. para 29). There are three principal sources of hunters. First, there is the business or professional man from Karachi. During the 1960's this group was probably the most destructive, but their activities now appear to be under control. Secondly, there is the local poacher. As a generalisation, local people within the area appear to lack any marked hunting tradition, although numerous individuals have acted as guides and assistants to hunters from Karachi. There are some notable exceptions, the individual who shot 12 Urial late in 1969 at Murri Mongthar was a local man. At present, the effect of local hunting is probably small although there has been at least one record of a wild goat killed by local poachers within the past few months. Thirdly, there has been spasmodic poaching by groups of raiders from Baluchistan, who occasionally enter the Province bent on banditry but may take a few wild goats on their return. Three wild goats were killed by such a group in August 1971.

4.6 Visitors/Tourists.

57. Although the Murri Mongthar area probably receives a trickle of Sunday visitors from Karachi at certain times of the year, the Park area as a whole has had few local or overseas visitors. Few people know of the wildlife and scenic attractions of the area and those that do are probably deterred by difficulty of access and the present degree of human disturbance in the area. The fortress at Ranikot in the north east, however, has had a number of visitors following a T.V. series on the area. It can be approached from the east on a good earth bound

road but, even so, the last eighteen miles require a four-wheeled drive vehicle to negotiate them. No facilities (notice boards, guides etc.) are presently provided for archaeological sites in the Park area.

4.7 Research.

58. Reference has already been made to research in progress on the wild goat (ref. para 30), to the Forest Department's wildlife counts (ref. paras 29 and 45) and the studies in the area by the Universities of Karachi and of Sind (ref. paras 20 and 24). The Vice-Chancellors of both Universities have expressed keen interest in cooperating in future research work in the Park.

4.8 Other Uses.

59. There are a number of small stone quarries on Kambhu (1), Dunbar (2) and the Mol area (2 or 3). Work in the quarries is intermittent; stone is used for local building purposes and occasionally for sale. The quarry at Kambhu may have already closed as the stone is not of good quality.

60. Honey hunting is occasionally undertaken by local people and may involve smoking out the bees and destroying individual trees in the process. There is insufficient vegetation in the region at present for it to constitute a fire hazard. Signalling between one group of persons and another in this area is often done by setting fire to dormant shrubs and vegetative litter.

61. Palm fronds and grass are sometimes cut in the hill valleys for thatching for local buildings.

62. Exploration for natural gas has taken place in the Park area. It is understood that borings within the Park boundary were unsuccessful, the nearest commercial bore hole has been set up south of Thano Ahmad Khan and no further exploration or work in the Park is envisaged.

PART II

FUTURE MANAGEMENT OF THE PARK

I. OBJECTS OF MANAGEMENT.

1.1 Statement of Objectives.

63. The objects of management for the Khirthar National Park are:—

- (i) To conserve natural fauna, flora and scenic features of the area in perpetuity.
- (ii) To promote regulated use of the natural resources and historic cultural sites of the Park for educational, aesthetic, recreational and scientific purposes.

1.2 Strategy for Attainment of Objectives

64. At the present time, the main requirement for realising the first objective is to eliminate, redirect or restrict commercial exploitation of the Park's renewable resources. The means of effecting these changes and the speed with which they can be accomplished will depend to a large degree on the form of exploitation involved. Illegal felling of trees must be eliminated immediately without any form of redress. Stock grazing by migrant herdsmen must also be stopped immediately, although some alternative grazing areas may need to be provided outside the Park. Temporary cultivation by resident people should be terminated within the first few years of the Plan period and alternative cultivation areas outside the Park should be provided, at least to people who have no other means of livelihood. The speed with which stock grazing by residents can be re-directed to other areas will depend on the speed of implementation and success of the Government's range management programme for this region (ref. paras 98-99), but it is expected that total protection of hill features and a substantial reduction of grazing pressure in the valleys can be effected within the next two years, to be followed by a continuous but more gradual reduction over the Park as a whole. Permanent, irrigated cultivation will be the form of land use most difficult to eliminate, although, fortunately, the area involved is relatively small (ref. para 51). Further extension of these areas must be halted immediately and some of the smaller and more isolated areas may be eliminated by the provision of alternative land or by acquisition for Park development (ref. paras 137 and 152). At the end of the Plan period, the Park authorities may decide to exclude from the Park what irrigated cultivation areas remain by establishing boundary lines around these blocks (ref. para 96).

65. If commercial exploitation can be removed, then manipulation of habitats for conservation purposes will probably prove to be unnecessary during the present Plan period.

66. The second objective raises two principal problems. First to ensure that no form of use should conflict seriously with the conservation aims, which are the primary objectives, and, secondly, to avoid conflict between one form of use and another. These problems can be avoided by intelligent Park planning, particularly through area zoning and visitor direction. Different zones will be used to provide for different visitor needs. Intensive use zones will be used to relieve pressure on other areas required by more sophisticated users, such as research workers, and within any one zone, arrangements will be made to ensure that use is well distributed.

67. Arid regions such as the Khirthar lack spectacular waterfalls, rivers and forests that satisfy the purely casual visitor to Parks in temperate regions. The provision of good education and interpretation facilities within the Khirthar Park is therefore particularly vital if the area is to be used adequately and its aims are to be met. Although some development of the area to facilitate visitor use is clearly necessary, it is most important that it be restricted to essential services and that any facilities that are created should provide solely for uses that are in strict accord with the Park's objectives.

1.3 International Requirements for National Parks.

68. Certain international criteria have been established for the selection of reserve areas that are to be included in the United Nations List of National Parks and Equivalent Reserves. The requirements for national parks may be summarized as follows: (1) the protected status of the area should be conferred by the highest central political body in the country (2) the area should be of sufficient size to be ecologically viable and able to provide for the year round needs of the biotic communities that it is to protect (3) it should have adequate staff and budget to enable it to function effectively (4) the Park's renewable resources should be free of commercial exploitation (5) visitors should be encouraged to make use of the Park for educational and recreational purposes.

69. It is appreciated that a newly created Park will often fail to meet these standards, but such areas can be added to the United Nations List, provided a course of action to rectify these faults is being actively pursued and there are grounds for assuming that these aims will be achieved within a reasonable period of time.

70. The Kirthar National Park already meets international requirements in regard to size and ecological viability of the area and to staff. Additional staff and a firm budget will be provided in the immediate future and many of the prescriptions in this Plan are concerned with the promotion and regulation of visitor traffic. Its protected status will be conferred by the State Government which is the highest political body able to confer such protection under the present Constitution. The Central Government strongly supports the establishment of areas of this type within the Provinces. At the moment there is considerable commercial exploitation of natural resources within the Park but wildlife is already being protected and elimination and restriction of commercial exploitation of other renewable resources is one of the major aims during the period of this Plan.

71. In summary, it may be assumed that, perhaps with some relatively minor exceptions, Kirthar National Park will meet all the international requirements for the United Nations List of National Parks within the period of this plan.

2. Period of the Plan.

72. This plan has been prepared for a period of five years. The aim is to begin implementation of its prescriptions in July 1973, but substantial operations may be delayed for one year by financial restrictions. The sequence of operations (ref. para 177) is therefore provisional and is listed by numbers of years and not by actual dates.

73. No substantial revision of the Plan's prescriptions are likely to be required during the five years, although more detailed proposals may need to be formulated, as experience is gained, to meet requirements under certain topics.

3. Authority and Administration.

74. Overall authority for the Park and its management will be vested in the Sind Wildlife Management Board.

75. Authority for the policing and control of illegal activity within the Park will continue to be performed by the Honorary Game Warden but technical and administrative responsibility for the organisation and functioning of the Park will be undertaken by a Park Director, who will be directly responsible to the Sind Wildlife Management Board (ref. paras 76 and 78).

4 STAFF ORGANISATION, DUTIES AND TRAINING.

4.1 Staff Organisation.

76. In the past, the duties of the Honorary Game Warden and his staff have been confined almost entirely to policing the area and apprehension of offenders under the various Acts to protect wildlife. The Warden and his deputies are respected members of the local community and poaching throughout the Sanctuary and stock grazing on hills have been curtailed without causing resentment among the people. In the future, however, creation of the National Park will necessitate technical management and detailed administration of the region for which the Game Warden has insufficient time and for which his staff are entirely untrained. A Park Director (of Conservator rank) and eight Park Rangers (of Range Officer and Forester rank) will be recruited from the Wildlife and Forest Department to fulfil these functions. Forest staff are trained in natural area management and basic ecology and they are the best qualified cadre of staff presently available to undertake National Park work and practical in-service training in wildlife management.

4.2 Staff Duties.

77. The Honorary Game Warden, his deputies and Wildlife Watchers will retain their present responsibilities. Patrolling and policing duties of the Wildlife Watchers will require expansion as a result of the Park's formation and the need to prevent and restrict commercial exploitation within the area (ref. paras 91-105). No increase in staff is required but some Watchers may need to be temporarily re-deployed within the area to places that require extra policing following re-direction of grazing or resettlement of cultivators. Consideration should be given to creating the post of Senior Wildlife Watcher for senior men whose service has been exemplary and to up-grading other Watchers to compensate them for additional duties and responsibilities that they will need to undertake. The Game Inspector should be provided with transport or travelling funds to enable him to visit all Wildlife Watchers once a month, to receive reports on their operations, to issue instructions for the coming month and to promote good liaison among the Wildlife Watcher force.

78. The Park Director and Rangers will assume responsibility for the administration of the Park, organisation of Visitor Centres (ref. paras 135-148), direction of visitors (ref. para 132) and technical studies (ref. paras 106-112).

79. The closest liaison and cooperation will be maintained between the two staffs and their senior officers, who should meet at regular intervals. The Wildlife Watchers may, as the necessity arises, be requested to assist the Rangers in wildlife counts and other data collection, or to provide advice on local features

and inventories of natural resources. The Rangers will report any misdemeanours or other information to the Watchers and provide them with all reasonable help in the course of their work.

4.3 Training.

80. The Park Director should be sent on the U.S. National Parks short course (10 weeks duration) one year after he has assumed his appointment and has accumulated some practical experience of the problems of Park administration and development. All Rangers should attend a short course on wildlife at (Peshawar Training College) Pakistan Forest Institute, Peshawar during the Plan period. The Director and Rangers should have regular discussions on their work and should be encouraged to study wildlife literature and apply the knowledge so acquired in their field work.

81. The Game Warden should organise regular seminars among the Wildlife Watchers to encourage exchange of practical information, to give instructions for future operations, and to ensure that the staff are familiar with wildlife policy in the region, provisions of the law, Park boundaries, new arrangements for re-directing exploitation and so on. The Park Director should normally be invited to attend these meetings to inform the Watchers of the results of technical studies in the Park area.

5. STAFF ACCOMMODATION, TRANSPORT AND EQUIPMENT.

5.1 Staff Accommodation.

82. No substantial alteration is required to the present accommodation for Wildlife Watchers, although some re-arrangement of their bases may be necessary as a result of expansion of duties or movement of villages and will be undertaken at the direction of the Honorary Game Warden.

83. The Park Director will be housed in Karachi. A new office is already available for his use. The Park Rangers will be stationed within the Park area in groups of two. One pair will be based at the Murri Mongthar Visitor Centre and another pair at the Karchat Visitor Centre (ref. paras 135-140). The third pair will be housed at the base of Dunbar Mountain and the fourth pair at the base of Kambhu Mountain. Accommodation will also need to be constructed for the domestic staff at the visitor centres (ref. para 140) and for barrier guards at Park entry points (ref. para 161).

5.2 Staff Transport.

84. The Game Inspector will require a motor cycle or funds for the hire of local horses or camels to enable him to tour Wildlife Watcher bases (ref. para 77).

85. The Park Director will need a four-wheeled drive vehicle. The Park Rangers will require one motor-cycle for each pair and additional funds for the hire of local horses or camels as necessary.

5.3 Equipment.

86. Some Wildlife Watchers, of long service, have been permitted to purchase shot guns at reduced prices from arms confiscated by the Government. Extension of this scheme to other Watchers may be permitted at the direction of the Honorary Game Warden.

87. Office equipment for the Park Director is already available. The Director and Rangers will all need binoculars, field compasses and note books for field work. Five telescopes and tripods, and metallic tapes of varying lengths, together with additional funds for the purchase of other technical equipment will need to be made available to them.

5.4 Uniforms.

88. All uniformed staff should be clad in Khaki or green uniforms. The blue shirts and berets with which the Wildlife Watchers are presently issued are impracticable for work in this area. The dark colour can be seen for long distances by wildlife and poachers alike. It is recommended that the Watchers berets be replaced with Khaki turbans.

89. In future, all staff will be under scrutiny by numerous visitors from home and abroad. It is most important that staff be smartly turned out at all times both in regard to their uniforms and personal appearance.

6. CONTROL OF EXPLOITATION.

6.1 Settlement of Rights.

90. No concerted effort to relieve pressure of exploitation on the Park area can begin effectively until the rights of the present occupants are determined and settled. A settlement officer and appropriate supporting staff should be appointed to undertake this task as soon as possible, preferably before July 1973.

91. Initially, the principal needs will be to determine which persons have legitimate rights to exploit natural resources within the area and to ensure that these privileges are not abused from the onwards. As the Range Management Scheme (ref. paras 98-99) in surrounding areas gathers momentum, however, the aim will be to offer more and more of the Park's human occupants alternative land for stock grazing or cultivation (to graze or cultivate) outside the Park. It should be clearly explained to local people that the operation as a whole is not a move to dispossess them of their means of livelihood but rather to redirect their activities to better managed and often larger areas of land, where their standards of living can be improved, and thus leave the Park area to be developed for purposes for which it is better suited.

92. Very careful selection of the man to occupy the post of Settlement Officer is essential to the success of the scheme. Ideally, he should be familiar with both the people and the region.

93. Priority areas for elimination of rights are, first, the main hill features of the Park (Karchat, Dunbar, Kambhu and Murri Mongthar) on which domestic stock grazing should be banned throughout the year, and, secondly, the valleys on either side of the Karchat Mountain. Both grazing and cultivation should be eliminated from the latter region at an early stage, so that one representative portion of the Park is completely free of human exploitation, and natural vegetation is given the opportunity to recuperate.

6.2. *Cultivation.*

94. Cultivation is currently the most destructive form of land use practised in the area in regard to the maintenance of natural vegetative cover, and the most offensive to visitors to a National Park. Every effort must be made to reduce this cultivated area as rapidly as possible.

95. In regard to temporary cultivation, licences to cultivate Government Wasteland should be withdrawn within the initial stages of the plan. Some leniency may be required where it can be shown that the withdrawal would cause undue hardship to people who have no other means of support. Restriction of cultivation of privately owned land will need to be undertaken through provision of alternative land elsewhere and, temporarily, by convincing land owners of the economic advantages of stock management over cultivation. Ideally, cultivated land that is abandoned should be allowed to regenerate to a natural vegetative cover without interference. The Park authorities may be under pressure to re-seed these areas to grass, however, to provide additional grazing for stock in the interim between grazing restriction within the Park and provision of alternative grazing outside the Park. If re-seeding is unavoidable, then only indigenous species of grasses should be used.

96. No extension of permanent (irrigated) cultivation areas should be permitted after July, 1973. Some permanent cultivation areas may be acquired for visitor centre, picnic or rest sites (ref. paras 137 and 152) within the period of this plan, and their present owners compensated. At the end of the plan period, the Park authorities should re-examine the situation. Irrigated areas in which there is no likelihood of acquiring the land for Park purposes or of moving the cultivators elsewhere should be excluded from the Park by fixing a boundary around the perimeter of the cultivation.

6.3. *Domestic Stock Grazing.*

97. Stock grazing by immigrant graziers from outside the Park area will cease as a result of the settlement of rights within the Park. Alternative grazing areas may need to be found for some of these stock owners.

98. The reduction of stock grazing by resident graziers will be an infinitely longer task. It is no exaggeration to state that the ultimate success of the Khirthar National Park will depend to a very large degree on the success of the range management programme in adjacent tracts of land and the extent to which grazing in the Park can be transferred to managed areas in the surrounding tracts.

99. Continued degradation of range lands within this region of the province, as a result of overgrazing and primitive methods of animal husbandry, has prompted the Government to adopt a far-reaching range management programme to regenerate over-used rangeland, improve stock raising and, as a result, to provide for better living standards for the people. In brief, the feasibility study for the project calls for the establishment of a Range Management Service within the Wildlife and Forest Department that would operate over large tracts of land principally to the East and South East of the Park. The reasons for failures of earlier schemes have been examined and a new approach has been devised to ensure active co-operation and support from the people who will be involved and who will benefit from the programme. Pilot projects will be initiated in a number of selected areas in which the Government will apply proven methods of scientific range management such as rotational grazing with periodic resting of over-used blocks, re-seeding of plots with high yielding perennial grasses, and the reduction of stock numbers and improvement of their quality. Water points will be established in selected areas and silage will be prepared and made available to graziers to carry their stock through the dry seasons. The programme will gradually be expanded until large blocks of the region are brought under proper management. Veterinary facilities will be improved and marketing facilities will be established to ensure that stock breeders receive a fair return for their labour. Private land-owners will be brought into the scheme and there will be officers to advise them on the management of their land. There is provision for training of Range Officers and for an education and extension service for local people. The programme is due to commence in July, 1973.

6.4. *Tree Felling.*

100. Tree felling within certain areas of the Park has caused very serious changes to the natural vegetation (ref. para 52). It is illegal practice and the persons who are principally responsible are in no way dependent upon these operations for their livelihood. The theft of timber must be stopped immediately and action taken to ensure that it does not re-occur in the future.

101. Branch lopping of standing trees by graziers, to provide additional forage for stock during the dry season must also cease immediately. Although the Divisional Forest Officer, Karachi, has been given responsibility to put an end to timber thefts, effort on the part of all Wildlife Watchers in the area will be required to ensure that protection of woodland is effective, and instructions to this effect should be issued to them forthwith.

6.5. *Hunting.*

102. Hunting within the Park is also illegal. Very considerable progress has been made in the elimination of hunting in the Kirthar within the past two years. The only serious losses to poachers at the present time appear to be those caused by Baluchistan bandits in their spasmodic sorties into this part of the Province. The Wildlife Watchers are not sufficiently numerous nor sufficiently well armed to attempt to apprehend gangs of bandits, who, in any case, generally poach wildlife only when their banditry has been unsuccessful. If the Watchers' patrolling systems are increased, however, and better communication is establish-

ed in the Park through the visitor centres' radio telephones (ref. para 142) and improved roads and transport facilities (ref. para 84-85, 164), it should be possible to transmit information to the police on bandit entry with some rapidity and to bring this problem under control.

6.6. *Other Exploitation.*

103. As far as can be ascertained, no person within the Park area is dependent upon stone quarrying for their livelihood. The stone is generally of poor quality and the reduction of human population in the Park should reduce the need for stone for local building. Quarrying should cease and tracks up to the quarries should be blocked.

104. Honey hunting should also be banned. Apart from the fact that, as a matter of principle, all forms of wildlife within the Park are protected, the smoking out of bees will constitute an increasing fire hazard as the quantity of vegetation and litter builds up within the Park as a result of improved protection.

105. It would be unrealistic to ban the cutting of grass or palms in small quantities for local thatching purposes, but the Park Director may issue instructions as to where and under what conditions such material may be collected.

7. RESEARCH.

7.1. *General.*

106. In principle, there will be two types of research programmes undertaken within the Park. The first will consist of strictly management-oriented, basic studies, undertaken mainly by the Park's technical staff. The second will comprise more detailed studies, to be undertaken on selected subjects by local Universities, visiting scientists, or government officers seconded for some specific project. Certain studies may involve co-operative investigations by both Park technical staff and University or other personnel from outside.

7.2. *Basic Study Programme.*

107. The basic programme will be concerned primarily with the compilation of inventories of the Park's natural resources and with monitoring the effects of protection within the Park area. The Wildlife Society's "Wildlife Management Techniques" (third edition) will be used as the principal reference book for the basic programme, which does not, of course, preclude the use of techniques from other sources. The technical staff must be prepared to modify standard techniques to suit local conditions and to seek advice from international organizations, through correspondence or discussion with visiting scientists, should the necessity arise.

108. Inventory studies will comprise the compilation of lists of all animal and plants species and the locality or habitat type in which they occur. Although local advice may be sought on the types of animal and localities that could occur, no species should be entered into the records unless it has been seen by a competent observer of the rank of Ranger or above. Identification of plant species may require the assistance of University personnel. Although limited

plant collection for identification purposes is permissible, no vertebrate animal should be killed for this purpose without the approval of the Sind Wildlife Management Board. Inventory work will gradually be expanded to include identification and record of biotic communities, in which the assistance of University personnel may be necessary.

109. Inventories will also involve the compilation of data on natural features within the Park that may be of scientific or recreational significance, such as the location and mapping of caves and identification of their animal and plant occupants, and location of areas of geological or scenic importance.

110. Monitoring studies will mainly involve estimates of changes in animal or plant abundance, and identification and mapping of changes in serial stages of plant communities as a result of improved protection. Regular counts of the larger vertebrate animals should begin as soon as possible. Direct counts will probably be possible over much of the area, but the census methods and times of the year when counts may best be undertaken will be determined by the Park Director. Measurement of changes in plant abundance and diversity should be made by the establishment of permanent transects or study plots in representative samples of the Park. Responsibility for the choice, location and use of these plots will, again, rest with the Director.

111. Additional etho-ecological data on the fauna and flora of the Park will need to be collected by the staff in the course of their normal duties. The accurate dating of breeding and parturition of vertebrate species, times of flowering and seeding of plants and changes in behaviour of animal as a result of changing human utilization of the Park are examples of the topics on which data are required.

112. All technical data collected by the staff will need to be filed and indexed. The Park Director will be responsible for compiling regular summaries of this information for conducting periodic analyses of the material as it is accumulated, and for publishing the results, for the information of visitors and the scientific community, and for transmitting this information to the field staff.

7.3. *Detailed Studies.*

113. Proposals for detailed studies should be submitted to the Sind Wildlife Management Board for approval before the study commences, to avoid any possible conflict between long term studies and Park development or other uses, and, if appropriate, to enable the Board to recommend modifications to the proposals for inclusion of topics of particular interest to Management of the Park. All researchers within the Park must give an undertaking to submit a copy of their results and conclusions to the Board for future use in the Park's Management or to provide the basis for brochures for visitors (ref. para 146).

114. The Board should be prepared to initiate studies on subjects of special concern to the Park's Management and to submit these research proposals to local universities or to the Government for their consideration for investigation.

115. It would be both inexpedient and inappropriate for the authors of this Plan to append a list of detailed studies that are required, because research priori-

ties are unlikely to be readily identified until development of the Park and initial scientific investigations are operational. Three studies that should receive early consideration, however, are in investigation into the population dynamics and behaviour of the wild goat and wild sheep, as a basis for the preparation of a controlled hunting plan in the Surjani/Hothiano Game Reserve, an investigation into the ecological changes in the Hab river that will result from the construction of the Hab dam, and a study on the pattern and effects of increasing visitor use of the Park over the next five years. Dr. Schaller's investigations into the behaviour of the wild goat (ref. para 30) will provide a very valuable basis for the first study and it is understood that he is considering expanding his study in the Khirthar through the employment of a local University research student. It is essential that Dr. Schaller be consulted on the formulation of any proposal to undertake a long term study on the wild goats and sheep within the Park.

116. Other fields in which the Park authorities have special concern to encourage investigations are those of archaeology and geology. The fortress at Ranikot could become a major tourist attraction but its interest to visitors will be seriously impaired if no material can be provided on its history, details of its construction, and so on. The Director of the Government's Archaeology Department considers that a three month study by a team of specialists would be required to provide sufficiently detailed information to be of value, but he does not believe that Government funds could be procured for this purpose. The Park authorities, in cooperation with the Archaeology Department, may need to consider approaching some overseas University, with funds for archaeological research at its disposal, to undertake this investigation. It is possible that the Department of Tourism could assist in the solution of this problem. A similar investigation, on a much smaller scale, is required to examine the tombs around Taung and in the Ranikot fortress. In the geological field, further investigations and publication on the fossils within the Park area by the University of Sind should be actively encouraged.

117. It is assumed that most detailed studies will be financed from outside sources, but the Park authorities should be prepared to provide all reasonable assistance and facilities in the execution of such investigations.

7.4. Coordination of Research.

118. All research work within the Park will be coordinated through the Sind Wildlife Management Board. Within the first year of his taking office, the Park Director will consult with the Board, the Departments of Archaeology and Tourism, the Universities of Karachi and Sind, and with any other agency or individual researcher, within or outside Pakistan, who has an interest in scientific work with the Park, and will prepare a tentative research programme for the Board's consideration and approval. The programme should be revised and reconsidered annually, and in subsequent years should give some indication of progress of current work and the need for development of further investigations.

8. WILDLIFE MANAGEMENT.

119. During the period of this plan, the main management function of the staff and the Park authorities will be to provide protection both for the wildlife

and the natural habitats on which they depend. No manipulation either of the habitat or of wildlife populations is likely to be required during this time and no work of this type should be undertaken without the very careful consideration and approval of the Sind Wildlife Management Board.

120. It is essential that the entire Park staff and, in due course, visitors to the Park, clearly understand that protection within the area is extended unequivocally to all renewable resources and that species of wild ungulates, wild predators, trees and grasses rank equal importance as integral components of the ecosystem as a whole. Protection involves not only elimination of poaching but also prevention of unnecessary harassment of any kind. The occasional practice of driving wildlife to enable visitors to see them more easily will cease. Driving of wildlife will only be permitted for census purposes and, even then, will not be undertaken within two months of females giving birth and at least one month afterwards. Any form of chasing or driving animals by personnel in vehicles will be strictly banned and all visitor traffic will be restricted to the use of recognised roads and tracks (ref. paras 125-126).

121. Although some development of the region for visitor traffic is unavoidable, the aim of Park management will be to recreate as natural and as unspoiled an area of the country as is possible. Re-introduction of species that formerly occurred within the Park or parts of it is a legitimate conservation practice, in that it seeks to replace an integral component of the natural ecosystem and promotes the ecological diversity and stability of the system as a whole. There is scope for re-introduction of species (such as the Sind crocodile, *Crocodylus palustris* in the Hab river and the caracal *Felis caracal* in the foothills) but it is recommended that no re-introduction should be undertaken during the period of this plan and until the present renewable resources of the area have begun to recuperate. Introduction of species (either plant or animal) that have never occurred in the Park area within historic times should not be considered. Introduction of exotics adds nothing to the enjoyment of the discerning visitor, who has come to see a unique natural area of Pakistan and, even more important, it is not known to what degree the presence of exotic species would disrupt the stability of the Park ecosystem. This question is one on which the Park authorities must be pedantic; sowing of exotic grass seeds in connection with the range management programme should not be undertaken either within the Park (ref. para 95) or within the buffer zones, for fear of contaminating the Park's flora.

122. Data on the ecological requirements of the species within the Park are generally lacking but, at the present time, it would seem that good vegetative cover is likely to be more limiting than water for many Park species that are adapted to an arid environment. Widespread construction of watering points for wildlife would, therefore, seem to be unnecessary, but a few watering points might be constructed in the vicinity of visitor centres, principally to enable visitors to watch wildlife. A small dam is being constructed on Karchat mountain and the Park authorities will need to assess its effectiveness in due course. It is possible, however, that such dams might also attract domestic stock, in spite of restrictions, and thereby causes unnecessary friction with local people and that future watering points should take the form of "guzzlers", which are smaller, much less subject to loss by evaporation, have little or no effect on surrounding vegetation and could be constructed from local materials. (Details of their design are contained in "Wildlife Management Techniques").

9. PARK ZONING PLAN AND VISITOR DIRECTION.

9.1. General.

123. No survey has been undertaken to assess the likely visitor pressure on the Park, but its proximity to the city of Karachi and the present paucity of outdoor recreational facilities in the region suggest that visitor traffic could be high and some form of zoning of the Park, to relieve and direct human pressure on its renewable resources, is essential. The following zoning plan or land capability classification is provisional, but is unlikely to require any substantial modification in the future.

9.2. Zone Classes.

124. *Class 1: Intensive Use Zones* are likely to receive very high visitor use and most of the development work in the Park will be concentrated here. The area of these zones will be small and they will be fairly well distributed within the Park, with some relative concentration in the Murri Mongthar area. They will consist of the visitor centres at Karchat and Murri Mongthar and the picnic or rest sites along the Hab river and at half-way points between the visitor centres and the main Park entrances.

125. *Class 2: Moderate use zones*—will receive relatively high visitor use, but it will be spread over a fairly large area. Only one block of the Park is concerned, namely the Murri Mongthar Mountain complex and surrounding foothills, which comprise the Karachi district sector of the Park. Vehicle traffic will be restricted to roads and there will be no roads constructed in the mountains. Visitors on foot or on horse or camel back will have unrestricted access to the mountains. Certain areas of the mountains, such as the Thonkari area, where wild sheep commonly drop their lambs, may be placed out of bounds to visitors at certain periods of the year at the discretion of the Park authorities.

126. *Class 3: Wilderness areas*—are likely to receive very light use by visitors except on the roads. These areas will comprise most of the plains and valleys of the Park. Vehicle traffic will be restricted to roads but visitors on foot or horseback will have unlimited access to these regions.

127. *Class 4: Nature Reserves*—will comprise all the mountain features within the Park except Murri Mongthar. No roads will be constructed in these areas and walkers or riders will be required to keep to marked footpaths unless they are in a party under the supervision of a member of the Park staff. Parts of valleys to the east and west of Karchat mountain may eventually be added to the Nature Reserve zone (ref. para 93).

128. *Class 5: Historic Sites and Natural Features*—will comprise the Ranikot fortress, the tombs at Taung and selected caves and fossil sites. Ultimately, visitors, will be able to drive within easy walking distance of these sites but, in the interim, visitor parties from within the Park to Ranikot fortress will travel partly by vehicle and partly on horseback and will be organised from the Karchat visitor centre. The fortress is also accessible from outside the Park (ref. para 57).

129. *Class 6: Buffer and Controlled Hunting Zones*—are outside the Park and comprise the adjacent blocks of the original Khirthar Wildlife Sanctuary to the south and south west of the Park and the Surjani/Hothiano Game Reserve to the east and south east. These areas will not normally be accessible to casual visitors and will serve as buffers between the Park and range lands further afield, which, as a result of the range management programme, might ultimately be managed relatively intensively for stock raising. These zones are not included in the Park development programme but, in due course, as their wildlife populations increase as a result of protection and emigration of animals from the Park, they may be used for strictly controlled hunting on payment of high individual licence fees (ref. para 158).

9.3 Visitor Direction.

130. Every visitor car that enters the Park will be issued with a brochure that, on one side, will summarize the aims of the Park, its history, organisation and conservation work in progress, the regulations governing its use (for the Park as a whole and by zone classes), facilities provided, areas and wildlife species of special interest, and arrangements for supervised tours of nature reserves (ref. para 132) and, on the other side, a map showing the Park and its zone classes, roads, footpaths (including marked mountain routes), nature trails (ref. para 147), picnic and rest sites, visitor centres, historic sites and Ranger bases.

131. All roads and road junctions, footpaths, mountain routes, nature trails, visitor centres, picnic or rest sites, historic sites, scenic features etc. will be adequately signposted.

132. Visitors to the nature reserve zones (principally Karchat, Dunbar and Kambhu mountains) who do not wish to follow marked mountain routes will need to be escorted by a Ranger. There should normally be two tours each day during the visitor season (ref. para 133) one in the morning and one in the late afternoon, and visitors who wish to use this facility will collect at the Karchat visitor centre or the Ranger bases at Dunbar or Kambhu by a certain time, from where they will be escorted by the Ranger into the mountains. Full details of the arrangements will be included in the visitor brochure (ref. para 130).

10. VISITOR SEASON.

133. Mid-October until mid-March, when the weather is reasonably cool and the likelihood of rain is small, will be regarded as the main visitor season. During this period, visitor centres will be fully staffed, Rangers will be available for visitor direction and all other facilities will be operational. Visits by the general public and tourists may still be relatively slack during the early and late parts of this period and the opportunity should therefore be taken at this time to arrange for organised parties of school-children or youth clubs to visit the Park, stay at its lodges and use its facilities.

134. Outside the main visitor season, a reduced staff will be maintained at the visitor centres, principally to cater for occasional week-end visitors, visiting research groups or other casual visitors. The centres may close completely during

the monsoons, except for the presence of field and maintenance staff. Technical studies, staff attendance at courses, staff leave and road work should, as far as possible, be concentrated during periods outside the normal visitor season.

11. PARK FACILITIES DEVELOPMENT OF CLASS I ZONES.

11.1 Visitor Centres.

135. Visitor centres will comprise visitor accommodation, of two classes, field and domestic staff accommodation (ref. para 89) and interpretive centres, including herbaria.

136. The Park authorities should make no attempt to provide luxury accommodation or entertainments that are not in keeping with National Park objectives. Visitors who propose to stay at the Park lodges require clean rooms, attractive, relatively unspoiled surroundings, comfortable beds, a bath or shower and well prepared, wholesome food—all of these facilities will be provided.

137. Within the plan period, two visitor centres will be required, the first at Murri Mongthar between Murri and Luser Mountains and the second to the east of Karchat Mountain. Final selection of sites should be made by the Park Director with the approval of the Sind Wildlife Management Board. It is recommended, however, that at Murri Mongthar, the Faqir Muhammad village be acquired as a visitor centre site, with adequate compensation or alternative land and assistance being provided to the present occupants, and that at Karchat, a presently uninhabited area of land, some three miles to the west of Keiji village, be considered as a lodge site (ref. map, Appendix 1).^{*} Both sites have extremely attractive views and some tree cover, bore holes in these areas are likely to provide sweet water and the sites are well situated for visitor requirements.

138. First class accommodation within each centre will consist of a main building, comprising a restaurant and bar, lounge, veranda, office and shop, and six huts scattered around the main block and within easy walking distance of it. Each hut will provide a bed/sitting room and a bathroom. The shop will sell local handicrafts; embroidery work and, possibly, fossils. (Casual collection of fossils by visitors will be prohibited.)

139. Second class accommodation will consist of one building that will provide dormitory accommodation (partitioned cubicles) and a kitchen where meals may be purchased or visitors may cook their own food.

140. Ranger housing and domestic staff accommodation will be situated some distance from the main visitor centre complex. Horses and camels for the use of visitors (ref. paras 125-127 and 157) will be hired from local people and no stables for these animals will be required at the centres.

141. All visitor accommodation will be adequately furnished, including the provision of soft furnishings (mosquito nets, sheets, towels, curtains etc). No air conditioning units are required. The lounge should be equipped with a small library.

^{*}The exact location of this site was suggested by, and is known to Dr. Rizvi

of books and papers on wildlife and natural vegetation of relevance to the Park area and should include copies of the "Outdoorman", preferably with past issues as well as current ones.

142. Arrangements should be made for the office to be provided with a radio telephone. One four-wheeled drive vehicle and trailer should be attached to each centre for collection of provisions, occasional transport of research workers and general administrative or emergency purposes. Raingauges and hygrometers should be set up at each centre and meteorological records maintained.

143. After careful consideration of the problems involved, it is recommended that buildings be constructed in concrete, with false fronts of mud and wattle walls, and thatched roofs with wooden linings. These structures will preserve a rustic appearance whilst reducing fire hazard and the entry of insects and reptiles that might normally occur in conventional mud walls. Every effort should be made to ensure that these structures blend with the landscape and are sited as unobtrusively as possible.

144. Water should be available for irrigation and a certain amount of landscape gardening should be undertaken within the centre. A lawn should be established, but flowers, shrubs and trees that are planted should be confined to indigenous species.

145. The interpretive centre will comprise a small museum building consisting of one large room of the order of 30x15 feet in size and a herbarium consisting of suitably labeled specimens (Sindi English and Latin names) of trees, shrubs, herbs and grasses that commonly occur in the Park. The Park authorities should not consider the establishment of paddocks for wild animals found within the Park, such "zoos" are difficult to maintain and are better located in cities.

146. The museum should contain photographs or good quality paintings of the principal vertebrate species found in the Park together with notes on their life histories. It should also contain labeled specimens of fossils and rocks from the Park area, posters and diagrams of geological formations and photographs of historic sites with notes on their history. Brochures on the historic sites, scientific notes on the Park fauna and flora and similar literature including notes on conservation work in progress should all be on sale at a nominal fee in the museum.

147. Two or three nature trails, approximately one or two miles long, should be established on a circular route from the centres. They should be well signposted with stopping places clearly indicated. Visitors will be able to obtain a leaflet for each trail that will give details of fauna or flora that may be seen at each stopping place.

148. As an alternative form of evening recreation, visitors may be taken by a staff member to nearby water holes or "guzzlers" where they can observe wildlife from a hide. Ultimately, the Park authorities may wish to erect arc lights over these holes (wild animals will usually become accustomed to the light) so that wildlife may be observed drinking after dark. A diary, that will be avail-

able for examination by visitors in the lounge library, should be maintained of the species and numbers of animals observed each evening.

11.2 Picnic and Rest Sites.

149. A dozen or so picnic sites should be established near the banks of the Hab river. Their location should be selected by the Park Director and careful consideration must be given to ensuring that they are not sited in areas that might be subject to erosion of the river banks or sufficiently precipitous to cause a hazard to children. The sites should be approximately 2 or 3 acres in size, preferably some natural shade. Grass should be encouraged by reseeded, if necessary, and Wildlife Guards should be instructed to warn local graziers against using these areas for stock grazing. Heavy wooden benches and forms and a number of open, stone fireplaces should be constructed within these areas, ample litter bins should be placed on the sites and there should be notices warning against spreading litter or polluting the river. Local people should be employed to destroy the litter and keep the areas tidy. Development of angling around the Hab dam after 1976 (ref. para 54) may call for additional picnic facilities and possibly some shelters in this area.

150. Picnic/rest sites will be larger than picnic sites and will be intended principally as stopping places for vehicles visiting the northern areas of the Park. They will have all the facilities listed for picnic sites together with a small, clean and well constructed kiosk, that will sell soft drinks and be managed by a local person. They should also have latrine facilities. The Park authorities will select the person to operate the kiosk and will provide him with assistance in the construction of the building, although the latter will remain his property. Periodic inspection of the property will be made to ensure that good, hygienic standards are maintained. The kiosk owner will be responsible for the cleanliness of the site.

151. It is recommended that three picnic/rest sites be established within the plan period, in the vicinity of (1) Goth Alani, to the north of Murri Mongthar, (2) Taung village in the north central sector of the Park and Goth Hashim to the east of Kambhu mountain (ref. map, Appendix 1).

152. Areas of presently irrigated cultivation will be acquired for picnic and picnic/rest sites as far as possible.

12. PARK FACILITIES—DEVELOPMENT OF CLASS 2-6 ZONES.

153. The Class 2 zone (Murri Mongthar area) will require a greater network of roads than in other zones, which is reflected in the road construction programme (ref. para 164). Most of the picnic sites will also be concentrated in this zone along the Hab river (ref. para 149). Visitors will have unlimited access to most of the mountain range (ref. para 125) and special attention may need to be given to organising points within the zone where horses and camels may be available for hire from local people and to ensuring that this information is made available to visitors through the brochures handed to visitors on entry (ref. para 130) and by suitable sign posts.

154. Little or no development is required in the Class 3 zones (principal valley areas in the main Park sector) during the plan period other than road development (ref. para 126) and the erection of signposts (ref. para 131).

155. Similarly, the Nature Reserve zones (Class 4 principal mountain features) require little development other than the marking of mountain routes (ref. para 167).

156. Within the initial period of the plan, the main effort required in respect of historic site and natural features (Class 5) will be the identification and compilation of data on the history of the Ranikot fortress and tombs at Taung (ref. para 116), and the mapping and examination of caves and fossil sites (ref. paras 109 and 116), particularly those that could be readily accessible to visitors. Thereafter, some construction of carparks, improvement of footpaths, erection of notice boards and the preparation of information brochures will be necessary.

157. Eventually, during the next plan period after 1978, it may be possible to consider improving the track from the Karchat/Thano Bula Khan road to Ranikot fortress to a standard whereby it can be negotiated by ordinary motor vehicles, but during the period of the present plan, transport of visitors from within the Park to Ranikot will require careful organisation. In brief, it is recommended that the track to Ranikot be improved as far up the Sham Dhoro river bed as possible without incurring heavy expenditure, and that a post be established at the roadhead from which horses or camels can be hired. Visitors staying at the Karchat lodge who wished to go to Ranikot would drive to the post relatively early, transfer to horses or camels, tour the fortress area and then return to the lodge in their cars for a further night. Ultimately, when road access to Ranikot is established, it is to be hoped that a third Park visitor centre might be established in the valley within the walls of the fortress.

158. The Class 6 buffer/controlled hunting zones occur outside the *Park and may be used for strictly controlled hunting of wildlife that have increased within these areas following protection or that have emigrated naturally from the Park (ref. paras 115 and 129). The harvest might consist of a small animal take of trophy animals by rich, visiting or local hunters at a substantial licence fee (e.g. Rps. 2,000/- wild goat). All hunters should be accompanied by a Wildlife Watcher.

159. In the meantime, the western boundaries of the Hothiano/Surjani Game Reserve to the north of Darwat Pass should be extended down to the Baran Nadi so that this boundary becomes contiguous with the Park's eastern boundary and the northern boundary of Surjani mountain should be extended to Darwat Pass and thus becomes contiguous with the remainder of the Reserve. Cultivation within this area should be restricted, grazing should be curtailed and eventually eliminated, and anti-poaching operations maintained or increased. Wildlife counts in the Park (ref. para 110) should be extended to cover the Hothiano/Surjani Reserve, and technical investigation should be initiated during the plan period to determine the degree of migrations of wildlife between the Park and the buffer zones.

*No hunting, of course, will be permitted within the park itself.

13. ACCESS POINTS, ROADS AND MOUNTIAN ROUTES.

13.1 Access Points.

160. The number of access points to the Park will be kept to a minimum in the interests of economy and effective control of entry. Some existing roads within and entering the Park will be improved (ref. para 164) and others will be allowed to fall into disrepair. Barriers will be erected on improved roads only, so that no direct control will be exercised over a few tracks that enter the Park. All of these tracks are impassable by ordinary vehicles and their use is likely to be confined to stock driving by local people but they should be kept under surveillance by Wildlife Watchers and, if there is evidence of their being used by poachers or local visitors attempting to avoid payment of entry fees, then they should be blocked or a barrier should be erected on them.

161. Five road barriers need to be erected during the plan period at Thabadi, Goth Godar and near Hinidan, in the Karachi district sector, and to the west of Thano Ahmad Khan and near Goth Mehar, in the south eastern part of the Dadu district sector (ref. map Appendix 1). Each barrier should have two uniformed barrier guards, and accommodation for the guards in the immediate vicinity. The Guards will need to collect admission fees for cars (pedestrians will be admitted free of charge) and distribute information brochures. It should be noted that the Thabadi/Hinidan road is a public bus route.

162. Each Park entry point should have large, attractively designed notices providing the name of the Park, listing the regulations governing its use and providing a large scale map of the area, showing the principal points and areas of interest and visitor use zones (ref. paras 124-129). Additional notices may need to be erected during periods of particular fire hazard (ref. para 169).

13.2 Signposts.

163. Reference has already been made to the need for adequate signposting on roads, nature trails, mountain routes and areas of special interest (ref. para 131).

13.3 Road Construction and Maintenance.

164. It is estimated that a total of 252 miles of existing tracks within the Park and 46 miles of access road outside the Park will require to be improved. A further 53 miles of new roads will be needed to link up with existing circuit routes or to provide access to visitor centres. The approximate alignments of these roads are shown on the map in Appendix 1 and a breakdown of individual road lengths is provided in Appendix 5. The length of new feeder roads between the Thabadi and Hindan road and proposed picnic sites near the Hab river has been estimated and these routes are not shown on the map (ref para 149).

165. The majority of these routes already exist as tracks, they are largely confined to the valleys and follow relatively easy gradients. Road improvement could, for the most part, be undertaken with a road grader at relatively low cost. The construction of "bunds" upstream in river beds crossed by the roads, to reduce land slips and sedimentation, and concrete bases to major river crossings will be

more expensive but should not present exceptional difficulty. A notable exception to these generalizations is the Goth Alani-Goth Gul Muhammad road, the construction of which will be difficult, particularly in the very steep climb over the Karachi Dadu district boundary. The work will require a bulldozer or considerable labour, and the area should be examined by the Park Director with a view to selecting an alternative route. The alignment of the road between Goth Paradin and the proposed barrier post to the west of Thano Ahmad Khan may also require re-alignment to avoid the numerous ravines on the present route.

166. Road maintenance by grader or hand labour should be undertaken annually, immediately after the rains. In years of heavy rainfall, practically all the roads in the Park will probably require some attention.

13.4 Mountain Routes.

167. Mountain routes on Karchat, Dunbar and Kambhu mountains need to be marked and signposted. As far as possible, these routes should be confined to one or two sectors of the mountains, leaving the remaining areas relatively undisturbed. It is recommended that on each mountain a number of routes of approximately 2, 5 and 10 miles, or longer for riders, should start and finish from the same point. Different colours of signposts or paint on rocks should be used for routes of varying standard lengths. Unlike nature trails (ref. para 147), no leaflets will be issued for these routes to describe particular areas of interest. Particular attention is required to route gradients, both for ease of walking and to avoid possible soil erosion, if the routes are heavily used.

14. FIRE HAZARD.

168. At the present time, there is little fire hazard in the Park because there are few areas with a continuous cover of dried vegetation sufficient to permit the passage of a serious fire. This situation will change as stock grazing pressure is reduced and dry ground vegetation and litter begins to accumulate. Wildlife populations will never maintain the artificially high stocking of domestic animals to which this region has been accustomed and be able to hold vegetation in the same degree of check. It is quite impossible at the moment to estimate how rapidly the fire hazard might develop.

169. Park regulations should warn visitors of the dangers of fire, from discarded cigarette ends and general carelessness, from the time of the Park's opening. No camp fires should be permitted in the Park other than at authorised fire places at picnic sites (ref. para 149).

170. The Park authorities must keep this problem under review throughout the period of the plan. If the Park Director considers that a fire hazard has developed in some areas of the Park before the end of the Plan period, then he must prepare a local fire plan to cover arrangements for staff and vehicles to be on stand by duty during the dry season, for assistance in fire fighting to be obtainable from local villages, and for location of fire brooms at specific points. An overall strategy should be devised for fire fighting in particular localities with due regard to topography, position of roads and areas with high fire risk. It is un-

likely that purchase of fire equipment (water trailers, knapsack pumps etc) or measures such as early burning of roadside vegetation will be required during the plan period, but emergency funding might be required if such a situation developed.

15. BENEFITS OF THE NATIONAL PARK.

171. The creation of the Kirthar National Park, and the development of the complementary range management scheme for surrounding tracts with which the management of the Park is inextricably linked, will provide considerable benefits for local people, both within the Park area and its environs, including urban as well as rural dwellers. It is rarely possible to effect sweeping changes in the land management of a large area and in the life style of its people, even when it is for their betterment, without inciting some degree of criticism from the uninformed, particularly during the interim period of change. The Park authorities must be alive to this problem, but should recognise that the Park concept has everything to gain and little to lose by publicizing the aims and objectives of the Park and the means by which they will be accomplished. Even during the preparatory stages of the Park's development, they should be ready to conduct senior politicians, local dignitaries and members of the press around the area, to point out the problems as well as the ultimate benefits that the Park will confer upon local people, visitors and the country as a whole.

172. Perhaps the most important feature of the Park's creation is that the renewable resources (fauna, flora, soil, scenery) and historic cultural sites will be conserved in perpetuity for the use, study and enjoyment of many people from within and outside the Province. If present land management practices were not changed, the whole area could degenerate into a desert with the loss of all present resources and leaving a region of little or no use to anyone.

173. The Park function of principal interest to the lay public will be the educational and recreational facilities that the area can offer. Karachi, the largest city in Pakistan with over 3 million human inhabitants, is only forty miles from the Park's border. At present, the city's inhabitants have few sources of outdoor recreation and the Park will provide a much needed breathing space for city dwellers, who require relief from the bustle of crowded city existence. The Park will represent much more than an oversized municipal park or green belt where people can sit on the grass on a Sunday afternoon. Its objectives are to educate people in the recognition and understanding of their natural heritage and to instil interest in natural, unspoiled areas and their wildlife. At a slightly more specialised level, the Park will provide an open air demonstration area for potential education and study of nature by school-children, youth organisations and university students alike.

174. At a more specialised level still, the Park will provide an outdoor laboratory for research by local and overseas scientists. Increasing human population pressures throughout the world and inevitable despoliation of the earth's natural areas have emphasised the need for the establishment of natural "bench-marks" within countries, whose scientists (particularly those concerned with pure and applied natural sciences such as biology, agriculture, forestry, geology and meteorology) can compare natural systems with the modified systems presently managed by man. In addition to its comparative scientific values, the Park will maintain

a bank of relatively undisturbed genetic material through its flora and fauna that will have value in scientific study and, its practical application, for example, in breeding experiments of high yielding grasses, cereals and trees for man's use.

175. It is frequently impossible to place a monetary value on the resources of a national park and its benefits. No one can estimate the financial loss if future generations of Pakistani children only knew a wild goat from its photograph. If, thirty years ago, every animal and plant that had no immediate financial benefit to man had been exterminated there would be no penicillin, no pyrethrum, and medical research would have been impaired enormously by the virtual absence of numerous animals for experimental purposes. Some financial values can be estimated, however, and a definite return forecast. Tourism is a major revenue earner in many countries of the world but the world tourist market has hardly been tapped in Pakistan. National Parks, natural areas and wildlife would provide an excellent counterpart attraction to the numerous archaeological sites that Pakistan can show to the world. A large national park within easy reach of the country's largest city could obviously play an important role in drawing tourists to Pakistan. An entrance fee will be charged on vehicles entering the Park and the return from this source alone could be substantial. Wildlife that is surplus to the carrying capacity of the Park, or that has built up in adjacent game reserves as a result of protection, will be hunted under strict control. High licence fees will be charged for the right to kill wild goat, wild sheep and gazelles, for example.

176. Although the Park will serve numerous functions for many different people, it is the local people of the area who ultimately stand to gain most. Many of the Park's present human inhabitants will, over a period of time, be given the opportunity to move to better managed rangelands or cultivated areas in adjacent tracts, those that remain, however, can expect better sources of income and higher living standards than the depleted area that they presently occupy could hope to provide. Access within the area will be substantially improved, there will be amelioration of climatic conditions and of the natural surroundings. People will find employment on the Park staff (Wildlife Guards, gate guards, domestic staff at visitor centres) in the provision of services (kiosk and picnic site attendants, owners of horses and camels that will be hired by visitors) and through the supply of local goods for sale (local clothes and embroidery). Numerous other sources of employment, not specifically referred to in this plan, will undoubtedly arise as a result of increasing use of the Park by visitors. In addition to the official arrangements for visitor direction and provision of services, some local people will undoubtedly find casual employment as guides, local villages will probably provide refreshments, large villages at the Park's perimeter will probably be called upon to provide garage services, and so on.

16. SEQUENCE OF MAJOR OPERATIONS—OPENING OF THE PARK.

16.1 *Provisional Sequence of Major Operations.*

177. Reference has been made to the difficulties of preparing a precise timetable for the sequence of operations required to establish the Park (ref para

72). The final responsibility for this matter must rest with the Sind Wildlife Management Board but the following provisional sequence is recommended:

FIRST YEAR.—Employment of Director, 2 Rangers and 6 barrier guards. Director to organise research programme, select picnic sites along Hab river and check road alignments. Intensive study of wild goats and sheep to commence. Technical studies to be initiated.

Restriction of human exploitation within the Park to start and to continue throughout the plan period.
Roads and barriers in Karachi sector of Park to be improved, including access roads and road between Karachi and Dadu district sectors.

SECOND YEAR.—Employment of 4 further Rangers. Technical studies to be expanded and further intensive studies to commence. Director to attend U.S. course. Preparation of interpretative material for Park brochures etc. to be commenced and continued throughout plan period.

Visitor centre at Murri Mongthar, including staff quarters and herbarium, to be established.

Picnic sites at Hab, picnic/rest sites and signposts etc. to be completed in Karachi district sector.

THIRD YEAR.—Employment of 2 further Rangers and 4 further barrier guards. Dadu district sector main road system to be established two road barriers to be erected. Ranger accommodation at Karchat, Dunbar and Kambhu to be built.

FOURTH YEAR—Karchat road system to be completed, mountain routes to be marked, picnic/rest sites and all sign-posting to be completed. Karchat visitor centre to be established. Controlled hunting programme in buffer zones to start.

FIFTH YEAR.—Consolidation of conservation and development work.

16.2 *Opening of the Park to Visitors.*

178. From the conservation and Park presentation standpoint, it would be desirable to delay the opening of the Park as long as possible. If the Park were opened when there were virtually no facilities available, many visitors would be disappointed; if no substantial reduction in human exploitation had been accomplished, many visitors would be highly offended and, understandably, in some doubt as to the objects of the Park. On the other hand, it is desirable that the proposal to establish the Park be published, to ensure public support, and it would be quite unreasonable to expect the public to wait indefinitely for the Park opening. Some compromise is clearly necessary.

179. It is recommended that the Park authorities should concentrate initially on the development of the Karachi sector of the Park, as is reflected in the sequence of major operations (ref. para 177) and the aim should be to open this sector officially sometime in the second year of this plan. Visitor use within this area will provide valuable experience in the development of the much larger Dadu sector. If some visitors choose to enter the Park before the official opening, they should not be dissuaded from doing so. It is likely that very large crowds will visit the Park immediately after the official opening and that visitor traffic will settle down soon afterwards. Anything, such as preliminary visits before the official opening, that will tend to reduce the initial influx should be encouraged—in moderation.

180. Official opening of the Park as a whole should be delayed until the third year of the plan, although visitors should be already warned that facilities within the Dadu Sector are incomplete.

181. The final decision on this matter must, again, rest with the Sind Wildlife Management Board. If political, or other pressures to open the Park early are great, if funds for development and staff are available and, if, most important of all, reduction of human exploitation is progressing rapidly, there is no reason why the provisional time table of operations and the Park's opening should not be brought forward. It must be appreciated, however, that wildlife populations, which will undoubtedly form the main visitor attraction, will take some years to recuperate, and earlier the visitors are allowed into the Park, the greater will be the risk of disappointment as a result of their failure to see wild animals.

SUMMARIES

1. PRESCRIPTIONS.

1. *Objects of Management.*—Conserve natural fauna, flora and scenic features in perpetuity. Promote regulated use of natural resources and historic cultural sites for educational, aesthetic, recreational and scientific purposes.

2. *Period of the Plan.*—Five years, to commence July, 1973, subject to availability of adequate finance.

3. *Authority and Administration.*—Overall authority vested in Sind Wildlife Management Board; Honorary Game Warden to be responsible for policing and control of illegal activity. Park Director to be responsible for technical and administrative organisation of Park.

4. *Staff Organisation, Duties and Training.*—Park Director (Conservator Rank) and eight Park Rangers (Range Officer and Forester rank) to be recruited from Wildlife and Forest Department for technical and administrative work.

Patrolling and policing duties of Wildlife Watchers to be expanded. Creation of Senior Wildlife Watcher rank and upgrading of other Watchers recommended.

Closest Liaison to be maintained between policing and technical staff.

Park Director to attend U.S. National Parks short course in 1974. Rangers to attend Wildlife courses at Peshawar. Regular seminars to be organised for Wildlife Watchers.

5. *Staff Accommodation, Transport and Equipment.*—Park Director to be housed in Karachi. Eight Ranger houses required in the Park, (two at Murri Mongthar, two at Karchat, two at Dunbar, two at Kambhu).

Motor cycle or funds for local transport required by Game Inspector. Four wheeled drive vehicle required for Park Director. Four motor cycles and funds for local transport required by Park Rangers.

Binoculars, field compasses, telescopes and other technical equipment required by Director and Rangers.

Revision of field staff uniforms recommended.

6. *Control of Exploitation.*—Settlement Officer to determine and settle rights of human occupants of Park as soon as possible. Local people to be offered alternative grazing or cultivation areas outside Park wherever possible over the plan period.

Licences to cultivate government land to be withdrawn; no extension of irrigated cultivation to be permitted. Irrigated areas that are not acquired for Park purposes during plan period should ultimately be excluded from Park.

Stock grazing by immigrant cattle to cease. Phased reduction of stock grazing in Park to be undertaken as range management scheme in surrounding tracts gathers momentum.

Tree felling and branch lopping to be stopped immediately. Anti-poaching measures to be increased, stone quarrying and honey hunting to be banned, and grass cutting to be restricted.

7. *Research.*—Two research programmes to be undertaken:

(1) management-oriented basic studies, mainly by the Park's technical staff (2) detailed studies on selected topics by local Universities, visiting scientists or seconded Government officers. The first will consist primarily of compiling inventories of Park natural resources and monitoring effects of protection. The second will concern special projects such as population dynamics of wild goats and sheep, fossil studies and investigation of Park's historic sites.

All research work will be coordinated by Sind Wildlife Management Board. The Park Director will consult all interested agencies and persons and prepare a programme that the Board will review annually.

Technical studies will be financed by the Park and detailed studies from outside sources.

8. *Wildlife Management.*—All species of fauna and flora to be totally protected. No manipulation of Wildlife populations or habitats to be undertaken during plan period without special approval of Sind Wildlife Management Board. No re-introduction of species to be considered during plan period.

9. *Park Zoning and Visitor Direction.*—Six land use zone classes defined and their locations indicated: Class 1 Intensive Use Zones, Class 2 Moderate Use Zones, Class 3 Wilderness Areas, Class 4 Nature Reserves, Class 5 Historic Sites and Natural Features, Class 6 Buffer and Controlled Hunting Zones (Class 6 zones occur outside the Park).

Visitor direction to be organised through issue of brochures and maps, signposting and staff supervision.

10. *Visitor Season Mid-October.*—Mid-March to be regarded as main visitor season. Staff leave, courses and studies to be concentrated outside the period as far as possible.

11. *Park Facilities—Development of Class 1 Zones.*—Construction of visitor centres (visitor accommodation of two classes, field and domestic staff accommodation, and interpretive centres, including herbaria) required at Murri Mongthar and Karchat. Construction details and locations recommended.

Picnic sites to be concentrated primarily along the Hab river. Three picnic rest sites with kiosks to be located near Goth Alani, Taung and Goth Hashim.

12. *Park Facilities—Development of Class 2-6 Zones.*—Relatively little development required in these zones beyond road construction, marking of mountain routes and organisation of horses and camels for hire. No development within Class 6 (Buffer zones), but western boundaries of Hothiano/Surjani Game Reserve to be extended, stock grazing to be eliminated and controlled hunting plan to be developed based on a detailed study programme.

13. *Access Points, Roads and Mountain Routes.*—Five road barriers to be erected at Thabadi, Goth Godar, near Hinidan, West of Thano Ahmad Khan and near Goth Mehar. Two barrier guards required at each with accommodation at barrier points.

Total of 252 miles of existing tracks in Park and 46 miles of access road outside the Park to be improved. A further 53 miles of new roads required in the Park. Road maintenance to be undertaken annually.

Roads and mountain routes to be adequately signposted.

14. *Fire Hazard.*—Fire hazard will increase with protection and accumulation of vegetation and vegetative litter. Visitors must be warned of the hazard. Park Director must keep situation under surveillance and a fire plan should be prepared and emergency funding for equipment sought if the risk increases substantially towards the end of the plan period.

15. *Benefits of National Park.*—Conservation, educational, recreational, scientific and economic benefits of Park to local people and visitors reviewed; importance of publicizing objectives, problems and work in progress in Park stressed.

16. *Sequence of Major Operations. Opening of Park.*—Recommended that Karachi sector of Park become fully operational within two years and Dadu sector within four years.

Park official opening dates dependent on numerous factors and final decisions to be made by Sind Wildlife Management Board, but suggested after eighteen months for Karachi sector and two and a half years for entire Park.

2. ESTIMATED EXPENDITURE.

Capital Expenditure (in five years).

Item.	Thousand of Rupees.
(a) Roads and Paths:	
Regrading	miles of track.
Installing bunds upstream of crossing points.	
Construction of	miles of new road

Additional funds for construction of 15 miles of road in difficult terrain (Goth Glani, Gul Muhammad and Goth Paradin/T. Ahmad Khan Barrier roads).

Marking and posting nature trails and hill routes.

(b) Buildings:

Field Staff Accommodation.

8 Park Rangers (Forester grade).

10 Gate Guards.

Visitor Centres.

2 Restaurant/lounge/office complexes (1st class).

2 kitchens (1st class).

10 cottages, with bath (1st class).

2 dormitory/kitchen complexes (2nd class).

2 staff dormitories.

2 managers houses.

2 interpretation/museum rooms.

Other Items.

2 Visitor centre water supplies (Murri Mongthar and Karchat).

2 Staff water supplies (Dunbar and Kambhu).

6 Wildlife water supplies.

2 sets of furnishings for visitor centres (furniture, soft furnishings, cooking and eating utensils, refrigerators, lamps).

2 sets of tables, shelves etc. for interpretation centres.

2 Landscaping, garden and tree establishment (visitor centres).

Item	Thousands of Rupees
2 Herbaria (visitor centres) Signposts	
(c) Equipment :	
3 jeeps and trailers.	
5 motor cycles.	
2 radio telephones for visitor centres.	
9 binoculars, 5 telescopes, 9 field compasses, 1 altimeter	
18 metallic tapes (Six 10, 50 and 100 foot).	
2 raingauges and hygrometers	
Technical equipment contingency fund.	

Recurrent Expenditure (per annum)

Item	Thousands of Rupees/annum
(a) Staff Salaries :	
1 Park Director (Conservator rank) for 5 years.	
8 Park Rangers (Range Officer and Forester rank); 2 for 5 years; 4 for 4 years; 2 for 3 years.	
3 Drivers; 1 for 5 years; 1 for 4 years; 1 for 2 years.	
10 Gate Guards; 6 for 4 years; 4 for 3 years.	
2 Visitor Centre Managers; 1 for 4 years; 1 for 2 years.	
16 cooks, cleaners, orderlies, gardeners; 8 for 4 years; 8 for 2 years.	
(b) Additional Salaries :	
Up-grading 4 Wildlife Watchers to Senior Watchers.	
Up-grading 20 Wildlife Watchers for additional duties.	
(c) Staff Travelling and Subsistence :	
Park Director (1).	
Park Rangers (8).	
Visitor Centre vehicles (2).	
Game Inspector (1).	

Item	Thousands of Rupees/annum
(d) Other Items :	
Publication of brochures:	

Special Travel and Subsistence Expenditure.

- (a) Staff Training :**
- Park Director: U.S. Parks Short Course (2 months).
8 Park Rangers: Peshawar Wildlife Course (2 months).
- (b) University and visiting Scientists Travelling within Park and general assistance.**

Total Estimated Expenditure (5 years)

Item	Thousands of Rupees
Capital.	
Recurrent.	
Special.	
Grand Total	

3. Estimated Revenue :

It is extremely difficult to estimate future revenue from the Park and the following figures are intended principally for guidance on the likely order of magnitude of the return only.

National Park	Thousand of Rupees
Entrance Fees Rs. 20/car).	
Second Year estim. 200 cars/week for 6 mths.	104
Third year estim. 250 cars/week for 6 mths.	130
Fourth Year estim. 300 cars/week for 6 mths.	156
Fifth Year estim. 300 cars/week for 6 mths.	156
Total	546

Buffer Zones/Game Reserves (Hunting fees)

Fourth and Fifth Years.

10 trophy animals Rs. 2,000/licence) (wild goat, sheep, gazelle).	40 40
Total	<u>40</u>
Thousands of Rupees	
Total Estimate Revenue (5 years)	546
Park.	40
Buffer Zones.	<u>586,000</u>

APPENDIX 2.**PRINCIPAL SPECIES OF VEGETATION—KIRTHAR NATIONAL PARK.**

Serial No.	Local Name.	Botanical Name.
TREES.		
1.	Babul	.. Acacia arabica.
2.	Khor	.. Acacia senegal.
3.		.. Acacia farnesiana.
4.	Bhavuri	.. Acacia jacquemonti.
5.	Nim	.. Azadirachta indica.
6.	Gangi	.. Grewia populifolia.
7.	Kankori	.. Gymnosporia montana.
8.	Kandi	.. Prosopis spicigera.
9.	Ber	.. Zizyphus jujuba.
10.	Roheero	.. Tecoma undulata.
SHRUBS.		
1.	Thor	.. Euphorbia caducifolia.
2.	Gugat	.. Commiphora mukul.
3.	Gugai	.. Commiphora stocksiana.
4.	Marai	.. Lycium europaeum.
5.	Kapas	.. Gossypium stocksii.
6.		.. Sida spinosa.
7.	Ber	.. Zizyphus nummularia.
8.		.. Zizyphus rotundifolia.
9.	Akhrai	.. Solanum gracilipes.
10.	Jang sopari	.. Hibiscus micranthus.
11.	Kind Koran	.. Cadaba fruticosa.
12.	Singrali	.. Cadaba indica.
13.	Kazbium	.. Cassia obovata.
14.	Kasbium singroli	.. Cassia pentatropis spiralis.

Serial No.	Local Name.	Botanical Name.
15.	Sanna	.. <i>Cassia angustifolia</i> .
16.	Mohernooti	.. <i>Tephrosia subtriflora</i> .
17.	Booi	.. <i>Aerva tomentosa</i> .
18.	Boor	.. <i>Aerva pseudotomentosa</i> .
19.	Devi	.. <i>Prosopis juliflora</i> .
20.		<i>Indigofera paucifolia</i> .
21.	Jhill	<i>Indigofera oblongifolia</i> .
22.	Jar	.. <i>Salvadora oleoides</i> .
23.	Khabar	.. <i>Salvadra persica</i> .
24.	Sim	.. <i>Crotalaria burhia</i> .
25.		<i>Astragalus stocksii</i> .
26.	Kapaswal	.. <i>Abutilon indicum</i> .
27.	Lanski	.. <i>Grewia villosa</i> .
28.		<i>Aloe barbadensis</i> .
29.	Nurua	.. <i>Phragmites karka</i> .
30.	Nari	.. <i>Phragmites communis</i> .
31.	Phog	.. <i>Calligonum polygonoides</i> .
32.	Dib	.. <i>Typha angustata</i> .
33.	Lai	.. <i>Tamarix dioica</i> .
34.		<i>Althaea lundurigia</i> .
35.		<i>Rhamnus virgatus</i> .
36.		<i>Leptadenia pyrotechnica</i> .
37.		<i>Capparis decidua</i> .

Serial No.	Local Name.	Botanical Name.
GRASSES.		
1.	Jabal-jo-ache-phulwala ghas	.. <i>Chrysopogon fulvus</i> .
2.	Damni	.. <i>Cenchrus setigerus</i> .
3.	Damni	.. <i>Cenchrus pennisetiformis</i>
4.	Damni	.. <i>Cenchrus biflorus</i> .
5.	Foai	.. <i>Cymbopogon jwarancusa</i> .
6.	Dinai	.. <i>Chleris inflata</i> .
7.	Samni	.. <i>Brachiaria ramosa</i> .
8.	Lumb	.. <i>Aristida adscensionis</i> .
9.	Lumb	.. <i>Aristida mutabilis</i> .
10.	Lambs	.. <i>Aristida hirtigluma</i> .
11.	Damni	.. <i>Melanocentris royleana</i> .
12.	Gum	.. <i>Eragrostis poaeoides</i> .
13.	Dinnal	.. <i>Dichanthium annulatum</i> .
14.	Samni	.. <i>Echinochloa colonum</i> .
15.	Ghandhir	.. <i>Eleusine flagellifera</i> .
16.		<i>Digitaria nodosa</i> .
17.	Ghandhir	.. <i>Dactyloctenium scindicum</i> .
18.	Lumb (Kind)	.. <i>Dactyloctenium aegyptium</i> .
19.	Lumb (Kind)	.. <i>Sporobolus arabicus</i> .
20.	Dab	.. <i>Desmostachya bipinnata</i> .
21.	Ghandhir (Kind)	.. <i>Eleusine aristata</i> .
22.	Ghandhir (Kind)	.. <i>Eleusine indica</i> .
23.	San	.. <i>Elyonurus hirsutus</i> .
24.		<i>Elyonurus royleanus</i> .
25.	Ghumbole	.. <i>Panicum antidotale</i> .

Serial No.	Local Name.	Botanical Name.
26.	Murt	<i>Panicum turgidum.</i>
27.		<i>Pennisetum cenchroides.</i>
28.		<i>Rhazya stricta.</i>
29.		<i>Senra incana.</i>
HERBS.		
1.		<i>Heliotropium ophioglossum.</i>
2.		<i>Heliotropium undulatum.</i>
3.		<i>Barleria sp.</i>
4.	Lullar	<i>Digera arvensis.</i>
5.	Damse (Dhamsio)	<i>Fagonia cretica.</i>
6.	Tikandri	<i>Tribulus terrestris.</i>
7.	Maliru	<i>Commelina albescens.</i>
8.	Gerani	<i>Convolvulus pluricaulis.</i>
9.	Garān	<i>Convolvulus microphyllus.</i>
10.	Moth	<i>Cyperus rotundus.</i>
11.	Dharankhatri	<i>Cleome brachycarpa.</i>
12.	Dharankath	<i>Cleome scaposa.</i>
13.	Tukhamran	<i>Salvia aegyptiaca.</i>
14.		<i>Cyamopsis psoralicide.</i>
15.		<i>Cyamopsis psoralioides</i>
16.	Vaic	<i>Trianthema hydaspica.</i>
17.	Pathri	<i>Boerhaavia diffusa.</i>
18.	Bankwal	<i>Boerhaavia verticillata.</i>
19.	Kinriwal	<i>Euphorbia pilulifera.</i>
20.	Wal	<i>Alysicarpus monolifer.</i>

Serial No.	Local Name.	Botanical Name.
21.		<i>Enicostemma verticillatum.</i>
22.	Jangli Lashsun	<i>Dipcadi erythraeum.</i>
23.	Dedo	<i>Cucumis prophetarum.</i>
24.	Magarbooti	<i>Indigofera cordifolia.</i>
25.	Assat	<i>Blepharis sindica.</i>
26.		<i>Orygia decumbens.</i>
27.	Manderi	<i>Corchorus depressus.</i>
28.		<i>Chlone brehyerapa.</i>
29.		<i>Zygonhyllum simplex.</i>
30.		<i>Salsola foetida.</i>
31.		<i>Farsetia jacquemont(i).</i>
32.		<i>Spergula arvensis.</i>
33.		<i>Portulaca tuberosa.</i>
34.		<i>Physorrhynchus brahuicus.</i>
35.		<i>Medicago lupulina.</i>
36.		<i>Opuntia spp.</i>
37.		<i>Calotropis spp.</i>
38.		<i>Periploca aphylla.</i>
39.		<i>Sarcostemma stocksii.</i>

APPENDIX 3.

INCOMPLETE LIST OF MAMMALS THAT OCCUR IN KIRTHAR NATIONAL PARK.

Long-eared hedgehog	<i>Hemiechinus auritus.</i>
Brant's hedgehog	<i>Paraechinus hypomelas.</i>
Greater mouse-tailed bat	<i>Rhinopoma microphyllum.</i>
Chinese pangolin	<i>Manis pentadactyla.</i>
Desert hare	<i>Lepus nigricollis dayanus.</i>
Five-striped palm squirrel	<i>Funambulus pennanti.</i>
Baluchistan gerbil.	<i>Gerbillus nanus.</i>
Indian gerbil	<i>Tatera indica.</i>
Desert gerbil	<i>Meriones hurrianae.</i>
Soft furred field rat	<i>Millardia meltada.</i>
Cairo spiny mouse	<i>Acomys cahirinus.</i>
Hispid mouse	<i>Mus platythrix.</i>
Porcupine	<i>Hystrix cristata.</i>
Pakistan wolf	<i>Canis lupus pallipes.</i>
Asiatic jackal	<i>Canis aureus.</i>
Desert Fox	<i>Vulpes vulpes griffithi.</i>
Bengal or Pakistan fox	<i>Vulpes bengallensis.</i>
Ratel or honey badger	<i>Mellivocapensis indica.</i>
Small Indian mongoose	<i>Herpestes auropunctatus.</i>
Striped hyaena	<i>Hyaena hyaena.</i>
Desert Cat	<i>Felis libyca oranta.</i>
Jungle cat	<i>Felis chaus.</i>
Leopard	<i>Panthera pardus saxicola.</i>
Chinkara or ravine gazelle	<i>Gazella gazella bennetti.</i>
Sind wild goat	<i>Capra hircus blythi.</i>
Urrial or wild sheep	<i>Ovis orientalis blandfordi.</i>

(N.B.—The caracal *Felis caracal* is believed to be extinct in the National Park area.)

APPENDIX 4.

INCOMPLETE LIST OF BIRDS THAT OCCUR IN KIRTHAR NATIONAL PARK.

Long legged Buzzard*	<i>Buteo rufinus.</i>
Bonelli's Hawk-eagle*	<i>Nisaetus fasciatus.</i>
Imperial Eagle	<i>Aquila heliaca.</i>
Tawny Eagle*	<i>Aquila rapax.</i>
Cinereous vulture*	<i>Aegypius monachus.</i>
Griffon vulture*	<i>Gyps fulvus.</i>
Lammergeier or Bearded Vulture*	<i>Gypaetus barbatus.</i>
Lagger falcon	<i>Falco biarmicus jugger.</i>
Redheaded merlin, Turumti*	<i>Falco chicquera.</i>
Kestrel	<i>Falco tinnunculus.</i>
See See Partridge	<i>Ammoperdix griseogularis.</i>
Grey Partridge	<i>Francolinus pondicerianus.</i>
Stone curlew	<i>Burhinus oedicnemus.</i>
Indian sandgrouse	<i>Pterocles exustus.</i>
Coroneted sandgrouse*	<i>Pterocles coronatus.</i>
Closebarred or painted sandgrouse*	<i>Pterocles indicus.</i>
Blue Rock Pigeon*	<i>Columba livia.</i>
Little Brown Dove or Senegal Dove*	<i>Streptopelia senegalensis.</i>
Eagle Owl, Great Horned Owl	<i>Bubo bubo.</i>
House Swift	<i>Apus affinis.</i>
Indian Roller or Blue Jay	<i>Coracias benghalensis.</i>
Hoopoe, Hudhud	<i>Upupa epops.</i>
Sind pied woodpecker	<i>Dendrocopos assimilis.</i>
Black crowned Finch Lark	<i>Eremopterix nigriceps.</i>
Desert Finch Lark*	<i>Ammomanes deserti.</i>
Crested Lark	<i>Galerida cristata.</i>
Pale crag martin*	<i>Hirundo obsleta.</i>

Great grey shrike	<i>Lanius excubitor.</i>
Rufousbacked shrike	<i>Lanius schach.</i>
Rosy pastor	<i>Sturnus roseus.</i>
Raven	<i>Corvus corax.</i>
Common wood shrike*	<i>Tephrodornis pondicerianus.</i>
Small minivet	<i>Pericro cotus cinnamoneus.</i>
Whitechecked bulbul*	<i>Pycnonotus leucogenys.</i>
Common babbler*	<i>Turdoides caudatus.</i>
Redbreasted flycatcher	<i>Muscicapa parva.</i>
Brown longtail hill warbler	<i>Prinia criniger.</i>
Streaked scrub warbler*	<i>Scotocerca inquieta.</i>
Orphean warbler	<i>Sylvia hortensis.</i>
Lesser whitethroat*	<i>Sylvia curruca.</i>
Cniffchaff (or Brown leaf Warbler)*	<i>Phylloscopus collybita.</i>
Black redstart	<i>Phoenicurus ochruros.</i>
Stonechat	<i>Saxicola torquata.</i>
Pied bush chat	<i>Saxicola caprata.</i>
Redtailed chat or wheatear*	<i>Oenanthe xanthopyrma.</i>
Desert wheatear (only seen in surrounding plains.)	<i>Oenanthe deserti.</i>
Pied chat	<i>Oenanthe picata.</i>
Hume's chat or wheatear*	<i>Oenanthe alboniger.</i>
Indian robin*	<i>Saxicoloides fulicata.</i>
Blue rock thrush	<i>Monticola solitarius.</i>
Brown rock pipit*	<i>Anthus similis.</i>
Purple sunbird	<i>Neoriniaas</i>

Whitethroated munia, Common silverbill	<i>Lonchura malabarica.</i>
Trumpeter bullfinch	<i>Rhodopechys githaginea.</i>
Common rosefinch, Scarlet grosbeak	<i>Carpodacus erythrinus.</i>
Pine bunting	<i>Emberiza leucocephalus.</i>
Black headed bunting*	<i>Emberiza melanocephala.</i>
Striolated (Striped) bunting*	<i>Emberiza striolata.</i>

*More spectacular species; likely to be of special interest to visitors.

APPENDIX 5

ROAD CONSTRUCTION AND IMPROVEMENT PROGRAMME.

NEW ROADS (National Park) ..	
Tranger N (684) -Bhal	3.0
Bhal D—Goth Paradin	6.0
Keiji to Goth Lai Khan (new road)	9.0
Goth Gul Muhammad -9	6.0
Khar N—Lusar	1.5
12 roads from Thabdi/Hinidan road to Hab river picnic sites (estimated)	36.0
Total ..	61.5 miles

ROADS REQUIRING IMPROVEMENT (National Park)

Khabadi—Kand Jhang	31.5
Goth Godor—Khar N	10.5
Mendiario N—Kand Jhang	30.5
Kand Jhang—Goth Alani	2.5
Kand—Goth Alani	4.0
Goth Alani—Goth Gul Muhammad	15.5
Taung—Bailithap	8.0
Bailithap—Baran	12.5
Baran—Taung	14.5
Taung—Dajo Dhorc	7.0
Dajo Dhorc—Goth Paryo	7.0
Goth Parvo—Hikabaro D—Dajo Dhorc	12.5
Taung—Goth Bijar (crossroads)	10.5
Goth Bijar (crossroads)—Hikabaro D (crossroads)	8.0
Goth Bachejece Bhal D	6.0
Goth Bijar (crossroads)—begin of new Road (north)	3.0

First crossroads on Taung—Goth Bijar (crossroads)—Karchat ..	5.0
Karchat—Keiji	8.0
Goth Bijar (crossroads)—crossroads north of Tajewari Wah ..	10.5
Karchat—Sham Dhorc	12.5
88—Goth Mehar	18.9
Goth Paradin—Trangur N	8.0
Trangur N—Marai Nadi (park border)	5.0
Total ..	251.5 miles.

ROADS REQUIRING IMPROVEMENT (Access roads to Park).

Goth Khanu—Khabadi barrier	14
Goth Bachal—Goth Godor barrier	10
Gadap—Goth Gohram	8
Goth Ramzan—Goth Mehar barrier	10
Sumar—Thano Ahmad Khan	4
Total ..	46 miles.

