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NOTES ON THE MAMMALS OF SOUTHERN NEPAL

For 18 months, from June 1964 to December 1965, I compiled notes on the mammals of southern Nepal. These observations were made in conjunction with my assignment to the Birganj Forest District Office as an American Peace Corps forester. Additional notes on Nepal's mammals were gathered as follows: during October 1964 on a 20-day trek around the Annapurna Massif north of Pokhara; in March and April 1965 on a 50-day trip in far western Nepal; in May 1965 in the Rapti Valley while attempting to census the great Indian one-horned rhinoceros (*Rhinoceros unicornis*) population there; and on a 12-day trek in October 1965 into the Helumbu region north of Kathmandu.

Seven broad geographical zones, with a variety of environments ranging from tropical to arctic, traverse Nepal (Hagen *et al.*, Nepal, 119 pp., 1957). The southernmost zone in Nepal, the Terai, where the Birganj Forest District is located, is a narrow alluvial plain, beginning at the southern border of Nepal and extending north to the edge of the Siwalik Hills, with an average elevation of only 200 meters. The pressure of a rapidly increasing human population in the Terai, estimated by Pradhan (Nepalese economics, 292 pp., 1962) to be more than 300 persons per 2.6 square kilometers, is rapidly changing its ecological landscape. Clearing of jungle areas for farm land and intensive logging operations have removed much of the natural vegetation of this zone. In 1965 less than 50 per cent of the Birganj Forest District was covered with jungle, and continued logging, burning, and settlement was steadily reducing this remainder. The Terai can be divided into four broad zones or types, which reflect its usage, topography, and vegetation. Rice farming dominates the farming activities of the southern half of the Terai. Small villages are scattered throughout the farming area, and this region supports a high human population.

The tropical deciduous forest of the Terai can be divided into three major forest types. Uniform sal (*Shorea robusta*) forests, growing in fairly open stands with little undergrowth except grasses, cover the higher areas of the plain and the hills along the southern edge of the Siwaliks. The riverain forest, occurring along the rivers and streams, can be divided into two distinct sub-types. New riverain forest, composed solely of two tree species, *Acacia catechu* and *Dalbergia sisso*, is subject to annual flooding during monsoon rains. Old riverain forest lacks *Acacia catechu* and *Dalbergia sisso* in its flora and is no longer subject to annual flooding. The mixed forest zone occupies the area between the old riverain and sal forests. *Bombax malabaricum*, *Adina cordifolia*, *Albizia* sp., *Lagerstroemia* sp., and *Hymenodictyon* sp. are common trees in the mixed forest zone.

The Siwalik Hills form the southernmost beginning of the Himalayan system, rising jaggedly along the northern edge of the Terai plains. Structurally unstable, the unconsolidated materials of the Siwaliks are subject to severe erosion. Average elevation in these hills is 1500 meters but occasional hilltops may reach 2000. Sal forests on the lower slopes of the Siwalik Hills are replaced above 500 meters by a mixed forest of chir pine (*Pinus roxburghii*) and hardwoods.

The Rapti Valley lies between the Siwalik Hills and the Mahabharat Lekh and is one of the largest, broad, relatively flat valleys, locally termed *duns*, found in Nepal. These *duns* constitute the third major geographic zone of the country. Two large rivers, the Narayani and Rapti, with their numerous tributaries, drain southwestward through the valley, eventually joining the Candak River in India. As in the Terai, the vegetative pattern in the Rapti Valley reflects the high degree of human disturbance. The three remaining zones of tropical deciduous forest—sal, mixed, and riverain—are similar to those described for the Terai zone. Bordering the rivers of the Rapti Valley, tall grasses (*Saccharum munja* and *S. spontaneum*) form another distinct vegetative type.

The Mahabharat Lekh forms the first dramatic mountain chain in Nepal and extends across the country in one continuous east-west chain. Its steep, rugged hillsides, often with summits of 3000 meters, are covered with rhododendrons (*Rhododendron arboreum*) and oaks (*Quercus* sp.). Because of the unfavorable terrain, only the lower slopes of the Mahabharat Lekh support a sparse human population.

The Midlands, the zone in which the capital Kathmandu is located, lies between the Mahabharat Lekh and the high Himalayas. This zone, with an elevation varying from 600 to 2000 meters, is characterized by soft, gentle contours and a temperate climate, which supports a high human population. Pradhan (*op. cit.*) estimated that the 1960 population density of the Kathmandu Valley was 1885 persons per 2.6 square kilometers. Consequently, most of the natural vegetation in the valley has been removed.

Abruptly, the high Himalayas rise north of the Midlands, forming a steep, rugged barrier along Nepal's northern border. Vegetation on the southern slopes of the Himalayas resembles that of the Mahabharat Lekh to about 3000 meters; then a temperate wet forest of rhododendron-juniper (*Juniperus* sp.) replaces the mixed hardwood-pine stands. In turn, the rhododendron-juniper association is replaced between 4500 and 5000 meters by alpine meadow.

North of the high Himalayas, another geographic zone, the Inner Himalayas, is represented by broad mountain valleys. These valleys, with elevations of 2400 to 5000 meters, form the transitional area between the north Indian monsoon region and the arid, high plateaus of Tibet. Pine forests dominate the vegetation of these high valleys.

The Tibetan Marginal Mountains mark the southern edge of the true Tibetan Plateau and occur only along the northernmost borders of Nepal. These mountain summits reach 6000 to 7000 meters and have the arid climate typical of central Tibet. Only north of Jomosom is the edge of this geographic region encountered.

Unfortunately, all collected specimens were lost in Nepal while in transit. Taxonomic order in this paper follows that of Simpson (Bull. Amer. Mus. Nat. Hist. 85:1-350, 1945), but generic and specific nomenclature follows that of Ellerman and Morrison-Scott (Checklist of Palaearctic and Indian mammals, 1758 to 1946, 810 pp., 1966). Longitudes and latitudes are given with the initial mention of each area.

Suncus murinus (Linnaeus)—House shrews were common around and in houses at Birganj (27° 0', 84° 45') and in the Kathmandu Valley (27° 44', 85° 22'). One specimen was collected 21 November 1964 at Singaul (27° 12', 85° 16') in the Birganj Forest District.

Pteropus giganteus (Brünnich)—Indian flying foxes were seen only in the Kathmandu area, usually flying low over houses and buildings at dusk. Bodies of these bats were occasionally seen tangled in the utility lines around the city.

Macaca mulatta (Zimmermann)—The rhesus macaque was common in the Birganj Forest District—Singaul, Tekan (27° 10', 85° 20'), Chandikhola (27° 04', 85° 22'), Russian Camp (27° 12', 85° 04'), and Simri (27° 06', 85° 14'), along the Narayani River in the Rapti Valley—Simri (27° 36', 84° 19' and Dudurhani (27° 34', 84° 14'), and in far western Nepal—Dhangarhi (28° 34', 80° 36'), Bilauri (28° 35', 80° 22'), Sukla Phanta (28° 50', 80° 11'), Barmdeo Mandi (28° 52', 80° 09'), and Chaur (29° 17', 80° 21'). Large numbers of these monkeys occur in the Kathmandu Valley, particularly in the Swayambhunath area. This species was usually seen at the edge of farm land and jungle and seldom in dense jungle.

Presbytis entellus (Dufresne)—Common langurs were usually found in the riverain and mixed forest zones of the Birganj Forest District—Singaul, Tekan, Chandikhola, Russian Camp, USAID Camp (27° 12', 85° 13'), in the Rapti Valley west of Hetaura (27° 26', 84° 59'), and in far western Nepal (Dhanghari, Sukla Phanta) in the Terai zone and in the pine-oak forests between Chaur and Rupal. Others were seen north of Pokhara between Ulleri and Ghorepani (28° 15', 83° 30') and in the valleys north of the Annapurna Massif in mixed hardwood-pine forests near Chamchae (28° 25', 84° 17') and between Chamay and Thonje (28° 31', 84° 22'). Langurs are found in dense jungle, but sometimes raid crops at the edge of farming areas.

Ochotona roylei (Ogilby)—Himalayan mouse-hares were seen on the west side of the pass between Muktinath and Manangbhot (28° 47', 83° 49') in talus slopes (approximately 5300 m) and were common in the stabilized talus slopes below Gosainkund (28° 07', 85° 26') in the Helumbu area (4500 to 5000 m).

Lepus nigricollis F. Cuvier—Indian hares were seen occasionally in the Birganj Forest District (Simri, USAID Camp), in the Rapti Valley on a large island in the Narayani River, and in far western Nepal—Dhangarhi and Mahendra Nagar (28° 49', 80° 11'). These hares occurred in relatively open jungle and at the edge of cultivated fields.

Callosciurus pygerythrus (Geoffroy)—The Irrawaddy squirrel was seen only twice in the mixed forest zone of the Birganj Forest District (Singaul, Russian Camp).

Funambulus pennanti Wroughton—Northern palm squirrels were common in the Birganj Forest District (Birganj, Tekan, Simri), particularly around towns and villages.

Cannomys badius (Hodgson)—This species of bay bamboo rat was collected in the Birganj Forest District at Singaul and was probably common in the area.

Rattus rattus (Linnaeus)—The house rat, often a serious pest, is common in the villages and towns of southern Nepal.

Mus booduga (Gray)—Between 18 and 25 November 1964, two male little Indian field mice were trapped in the mixed forest zone of the Birganj Forest District (Singaul). Measurements (mm) were: total length, 165, 153; length of tail, 71, 76; length of hind foot, 19, 19; length of ear, 15, 14; weight, 13.8, 11.7 grams.

Bandicota bengalensis (Gray and Hardwicke)—One Indian mole rat was trapped in the Birganj Forest District (Singaul) in the mixed forest zone. The numerous burrow-mounds of this species in the mixed forest zone indicated it had a relative high population density here. In other areas of the Birganj Forest District I saw only occasional Indian mole rat burrows.

Bandicota indica (Bechstein)—The large bandicoot rat, a serious problem in some of the houses in the Birganj area, did considerable damage to stored foodstuffs.

Hystrix indica Kerr—Although reported as common by local residents, the only Indian crested porcupine I saw was in the mixed forest zone of the Birganj Forest District (USAID Camp).

Canis aureus Linnaeus—The Asiatic jackal was common throughout the Birganj Forest District (Birganj, Singaul, Tekan, Russian Camp, Simri) and was also seen in far western Nepal at Sukla Phanta and Sirse (29° 09', 80° 22'), in the Rapti Valley at Tikoli (27° 38', 84° 28') and Dudurhani, and north of Pokhara at the base of Ulleri hill. Jackals frequent

the edge of jungle and farm lands throughout the Terai zone, often scavenging food at the outskirts of the towns and villages.

Vulpes vulpes (Linnaeus)—A number of common red fox skins were for sale in the small store at Jomosom ($28^{\circ} 47'$, $83^{\circ} 31'$) north of Tukche, and local residents said they were common in the surrounding hills. Fox tracks were seen in the snow near the top of the pass between Muktinath and Manangbhot (5600 m).

Vulpes bengalensis (Shaw)—The Bengal fox occurs in the open farm lands of the Terai and was seen in the Birganj Forest District (Birganj, Singaul, Tekan), in the Rapti Valley (Tikoli), and in far western Nepal (Dhangarhi).

Selenarctos thibetanus (G. Cuvier)—Although reported in the Birganj Forest District by local residents, I did not see Asiatic black bears there. One bear was seen in the Rapti Valley (Dudurhani) on a large island in the Narayani River, and the pelt of a freshly-killed bear was seen in a Nepali house near Thonje.

Martes flavigula (Boddaert)—A family group of yellow-throated martens, two adults and four half-grown young, were seen in the mixed forest zone of the Birganj Forest District (Singaul) on 27 November 1964.

Lutra lutra (Linnaeus)—Skins of the common otter were sold in the small store at Jomosom and reportedly had been trapped along mountain streams in the area.

Viverricula indica Desmarest—A small Indian civet was seen along the main highway in the Rapti Valley about 9 km W Hetaura one evening in July 1964, and one was collected in the Birganj Forest District (Russian Camp) on 18 February 1965.

Herpestes edwardsii (Geoffroy)—Indian gray mongooses were common in the Terai zone in farming areas and in the scrub brush at the edge of thicker jungle areas. This species was seen in the Birganj Forest District (Singaul, Chandikhola, Simri, Birganj) and in far western Nepal (Dhangarhi).

Felis chaus Gldenstaedt—Jungle cats were seen in the Birganj Forest District (Singaul) in the mixed forest zone and around the edges of farm land, usually in tall grass. One jungle cat was killed inside a house at the United States Agency for International Development (USAID) compound at Hetaura after it had entered the house and killed two domestic kittens.

Panthera pardus (Linnaeus)—Leopards were occasionally seen in the Birganj Forest District (Singaul, Simri) and also near Hetaura. A male leopard was killed by a tiger (*Panthera tigris*) near Tikoli in the Rapti Valley on 24 September 1964, and in the same general area on 16 May 1965 rhino guards killed a leopard suspected of killing domestic stock. Near Sukla Phanta in far western Nepal a leopard was seen crossing a jungle road on 27 March 1965.

Panthera tigris (Linnaeus)—Considerable tiger sign was found throughout the year in the Birganj Forest District, particularly in the Singaul area near Lama and Dhansar Kholas, and each year hunters kill a number of tigers in the Simri area. Tiger sign was also common in the Rapti Valley at Patihari ($27^{\circ} 33'$, $84^{\circ} 16'$) and in far western Nepal, particularly in the Bilauri area.

Elephas maximus Linnaeus—Wild Indian elephants still occur sporadically in the Birganj Forest District (Singaul, Tekan, Russian Camp) and damage field crops grown near the edge of the jungle. Three adults and a young passed twice within 30 meters of our Tekan camp in mid-evening on 2 December 1964. Our forest survey crews occasionally saw elephants or their sign in the jungle.

Rhinoceros unicornis Linnaeus—Scattered reports exist of great one-horned Indian rhinoceros living along the Bagmati River at the eastern border of the Birganj Forest District. I saw none in the area, but Mr. James Mangalraj Johnson, one of the Indian foresters, found rhino tracks here in 1962. Most of the remaining rhinoceroses in Nepal are found along the Narayani and Rapti rivers in the southwestern end of the Rapti Valley. A few rhinoceroses may survive in far western Nepal in the Bilauri area, but their status is unknown.

Sus scrofa Linnaeus—Wild boar were common in the dense jungle and sal forests of the

Birganj Forest District (Singaul, Tekan, USAID Camp, Simri) and in the jungles of the Rapti Valley near the Narayani and Rapti rivers.

Muntiacus muntjak (Zimmermann)—Indian barking deer were common in the Birganj Forest District (USAID Camp, Simri) and in the jungles of the Rapti Valley near the Narayani and Rapti rivers.

Axis axis (Erxleben)—Chital were regularly seen in the mixed forest zone of the Birganj Forest District (Singaul, Simri, Russian Camp) and in sal forests of the Rapti Valley near Tikoli. They also lived on islands in the Narayani and Rapti rivers. In far western Nepal I saw these deer near Dhangarhi, Bilauri, and Mahendra Nagar.

Axis porcinus (Zimmermann)—Hog deer were not seen during field work in the Birganj Forest District, but hunters occasionally took them in the Simri area. These deer were seen in tall grass areas near Bilauri and Sukla Phanta in far western Nepal.

Cervus unicolor Kerr—Hunters take sambar in the Simri area of the Birganj Forest District, but I saw none in the area. Sambar were seen in the sal forest zone of the Rapti Valley near Tikoli, and sign was also found on islands in the Narayani River near the village of Simri. Five sambar were seen along the Rapti River near Pathari in old riverain forest.

Cervus duvaucelii Cuvier—The only swamp deer seen in Nepal was between Bilauri and Mahendra Nagar in far western Nepal.

Tetracerus quadricornis (Blainville)—Four-horned antelope were not seen in the Birganj Forest District but are sometimes taken by hunters in the Simri area.

Boselaphus tragocamelus (Pallas)—Nilgai were seen at the edge of cultivations and in open jungle areas near Simri in the Birganj Forest District where they do considerable damage to cultivated crops. In far western Nepal this species was seen between Bilauri and Mahendra Nagar in relatively open mixed forest areas.

Bos gaurus H. Smith—Gaur are reported to be fairly common in the Rapti Valley, but the only animal seen here was on a large island in the Narayani River near Dudurhani on 23 May 1965. Sign of this species was not found elsewhere in Nepal.

Bubalus bubalis (Linnaeus)—Wild Indian buffalo are uncommon in Nepal, but tracks of this species were occasionally found in dense jungle areas of the Birganj Forest District near Singaul and Russian Camp.

Antelope cervicapra (Linnaeus)—Blackbuck were reported to be common in the Bilauri area of far western Nepal but none was seen while working in this area during March and April of 1965.

Capricornis sumatraensis (Bechstein)—Serow may occur intermittently throughout the hills of Nepal, but the only indication of their presence was a set of horns from a freshly-killed animal at the village of Chandricot (28° 15', 83° 49') northwest of Pokhora.

Nemorhaedus goral (Hardwicke)—Several goral were seen at 3300 m on 9 April 1965 in oak-rhododendron forest between Chaur and Rupal in far western Nepal.

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CHROMOSOMES OF *SYLVILAGUS FLORIDANUS* AND *S. TRANSITIONALIS*

Chromosome counts have been reported for only three species of *Sylvilagus*. The diploid number of chromosomes of *S. audubonii* and *S. nuttallii* is 42 (Worthington and Sutton, Mamm. Chromosome Newsletter, 22:194, 1966). *S. floridanus* also has 42 chromosomes (Palmer and Armstrong, Mamm. Chromosome Newsletter, 8:282-283, 1967). As part of an ecological study, two specimens of each sex of *S. floridanus* and three specimens of each sex of *S. transitionalis* were examined cytologically. The animals were trapped in Mansfield, Tolland Co., Connecticut.

Bone marrow was used for karyotype preparation. The animals were injected intraperitoneally with 5 milliliters of 0.05 per cent colchicine 2 hours before they were sacri-