

areas. Another area has been allotted as "King's Reserve" and another as "Shooting Blocks" (see map No. 2).

IV. GEOGRAPHICAL AND ECOLOGICAL

The present rhinoceros area comprising the valleys of the rivers Naranyi, its tributary the Rapti, and the Rapti's tributary the Reu, is often loosely spoken of as part of the Nepal *terai*. *Terai* in northern India and Nepal is, strictly speaking, moist country a few miles from the base of the Himalayas, below the *bhabar*, which is dry country with a subsoil of boulders right at the foot of the Himalayas. Chitawan, or the Rapti Valley, is a *dun*—a plateau or flat valley inside the foothills of the Himalayas; its altitude is between 900 and 1,000 feet above sea level, and it has most of the typical vegetation of the *terai* which is usually at 350 to 600 feet.

The *dun* of the Rapti Valley is approximately 40 miles long from east to west, and varies from 4 miles wide at Ramoli at the eastern end, to about 16 miles at its widest, in the west near the Narayani river. This is the main rhinoceros area, bounded on the north by range upon range of the Mahabharat (Himalayas) and on the south by the Churia Range (Siwaliks). Another area with similar vegetation lies west of the Narayani River and down the bank of that as far west as Tamashpur. A third area is the Reu Valley which is divided from the Rapti Valley by a ridge of the Churia Range. The scenery, climate and vegetation of the Rapti *dun* is very similar to that of the beautiful Corbett National Park of Uttar Pradesh in India.

Records of rainfall for this area are scanty, and have only been kept during the past three years. It appears that 65–70 inches, falling mainly between June and September, is the normal rainfall of Bharatpur at the western end of Chitawan.

The terrain of these three valleys can be conveniently divided into riverain, grassland, and timber forest.

1. Riverain, comprising all the low-lying strips along the river beds as well as the islands in the river beds.

2. Grassland, above flood level, most of which is either being or is about to be occupied, cultivated and grazed by human settlers.

3. Timber forest, mainly on the higher undulating portions of the *dun*, and covering most of the hills of the area.

Riverain.

The Narayani (or Gandak) is a huge river, and occasionally washes a live rhinoceros down into India. In this area it widens

out to a mile or two and has islands (*tapoos*). To get over it one often has to cross three, four or five channels as well as the islands in between, and this takes about half a day. In addition to this mile or more of channels and islands, there runs along each bank a strip of riverain forest and savannah which varies in width up to a mile or more. The low lying islands in the river, which could be classed as sand banks, become flooded during most of the rainy season, June to September. The higher islands and most of the low-lying strips of forest and savannah along the banks get flooded during peak floods of the monsoon. All this area is excellent rhinoceros habitat, containing the water, grasses, reeds and forest cover they need—particularly during the dry weather, November to May.

The Rapti river is small compared with the Narayani, and in the dry weather can be crossed by jeep at many places where its shingly bed widens out. It too has islands, particularly in its lower reaches, and strips of riverain forest and savannah on either bank, varying in width from a furlong to a mile or so. The Reu, main tributary of the Rapti, is much the same as the Rapti but very much smaller, and the valley very much narrower.

The vegetation of the riverain tracts consists of tree forest and savannah.

Tree Forest.—The trees are mainly of flood resisting species such as *simul* (*Bombax malabricum*), *sheesham* (*Dalbergia sissoo*), and *khair* (*Acacia catechu*). There is a tangled mass of undergrowth, much of which is evergreen and much of which is also thorny, affording the fullest shelter for rhinoceros during the day time, especially in the dry weather.

Savannah.—The vegetation of the savannah varies a great deal according to whether it is above or below the river level of normal rains. It consists mainly of the reeds and grasses usually found in this part of the world, viz. *ekra* (*Erianthus spp.*), *khagri* (*Phragmites karka*), *nal* (*Arundo donax*) and *thatch* (*Imperata cylindrica*). Frequently there is an intermingling of forest and savannah, forming dense scrub thickets with plenty of cover.

Nearly all the savannah areas of the riverain tracts are burnt off annually by the local villagers to improve the grazing for their cattle—and incidentally, for the wild herbivorous animals. This has been taking place, at least to some extent, for thousands of years, and has become part of the ecological pattern.

Whenever a small stream, known locally as a *khola*, flows out of the hills, or through grassland into a river, there is to be found

a small riverain tract usually thickly forested, of varying width according to the size of the tributary. These *kholas* provide corridors for movement of game away from the main rivers as well as thick cover during day time.

Hardly any of the riverain tracts of the three rivers contain houses or even cultivation, as they are liable to flooding during the monsoon months. Practically all of them are made use of by villagers for firewood-cutting, thatch-cutting, and grazing. The thickest of the tree forest and scrub forest areas are seldom interfered with, due to thorns and impenetrability.

Grassland.

On leaving the low-lying riverain tracts one finds flat grasslands above flood level stretching for a furlong or two in the Reu Valley, for a mile or two on the west bank of the Narayani River at Sandhna, and for anything up to seven or eight miles in the *dun* north of the Rapti river. These grasslands contain the same reeds and grasses as the savannahs of the riverain tracts, with the addition of other high-ground vegetation which is not flood resistant. The soil is richer and more suitable for the growing of crops at the eastern end than at the western end, where it is lighter and more sandy in composition.

Nearly all the grasslands of the whole rhinoceros area have either been occupied by human settlers for cultivation or grazing, or are just about to be, with the notable exception of the south bank of the Rapti from Jaimangala village westwards past Darbar (a disused shooting lodge built for King George V when he visited Nepal in 1911) towards the junction of the Reu river and southwards to the Churia range. This is so far mostly unspoiled by human settlers.

Of the grasslands which have for some time been occupied by settlers, in some places the effects of continuous annual burning, over-grazing, cattle-tread and exposure to increased evaporation, are becoming evident from decreased fertility and increased desiccation.

Timber Forest.

In this area the sub-montane timber forest is mainly *sal*, which is to be found growing on some of the well-drained higher grassland, as well as on most of the surrounding hills. It is a tree of great beauty of form and colour, and contributes much to the aesthetic enjoyment of the place, especially when the snows of the Himalayas some 50–80 miles away are visible. The *sal* forests of the area are mostly virgin and contain some of the

best trees of this species in the world, rising to 160 feet, especially in the north of the Rapti Valley, in what is now the Mahendra National Park. The *sal* are being exploited by the Forest Department only in the east towards Hitaura. At present there is no exploitation west of Debichor, except some cutting by new settlers.

Most if not all of the *sal* forests are under the jurisdiction of the Forest Department, and are regarded as Reserved Forests. Unfortunately, however, it appears that the boundaries of some of these Reserved Forests have not been clearly demarcated, and unauthorized persons are said to be settling in parts of them with the usual accompaniment of felling and burning for cultivation and grazing. If this is true, it deserves the urgent attention of the authorities, especially as there are so many parts of these forested hills which, forming the catchments of the streams and rivers, need careful conservation in order to avoid soil erosion and desiccation.

V. ADMINISTRATIVE AND POLITICAL

Administration will be considered only as far as the rhinoceros and its preservation are concerned. Three different divisions of the Forest Department are involved. The Rapti Valley is under the Divisional Forest Officer of Chitawan residing at Hitaura; the Nawalpur area (west of the Narayani river) is under the D.F.O. of that district residing at Parasi, a journey of some distance from the rhinoceros area with no roads for travelling; the Reu Valley is under the D.F.O. of Birganj. From the rhinoceros preservation aspect it is unfortunate that this area of Nepal should fall under the jurisdiction of three different D.F.O.s, under two separate Circle Conservators, with no means of communication between them except via Katmandu. The D.F.O., Chitawan, residing at Hitaura, is in charge of the whole Rhinoceros Protection Department which operates in all the three areas; but he is unable officially to visit the Nawalpur or the Reu Valley areas except by arrangement with the D.F.O. of the district concerned. All this is not a criticism of the Forest Department: it merely states the position as it happens to be to-day. The Narayani river is possibly too great a physical barrier for both sides of it to be under one D.F.O.

Poaching of Rhinoceros.

The Rhinoceros Protection Department, the personnel of which has already been given, mans 42 *chowkis* (posts), 26 in