

CHAPTER I

GENERAL

Puri, one of the coastal districts of Orissa, is famous for its historic antiquities and religious sanctuaries. It boasts of a continuous history from the 3rd century B. C. to the present day and its unique monuments like those of Jagannath at Puri, Lingaraj at Bhubaneshwar and the Sun-God at Konarak are famous in the world. It has the Chilka lake, one of the largest lakes in India, that holds a picturesque sea-scape and offers an ideal resort for birds who migrate from different parts of the continent. There are two perennial hot springs with their sulphuretted water containing curative properties. Besides, there are many a natural spring reputed throughout India for their health-giving mineral water. By virtue of its geographical location, the climate of Puri is equable throughout the year. Thus, Puri with its historicity, religious sanctity, architectural grandeur, sea-scape beauty and moderate climate holds a wealth of attraction for the visitors.

INTRODUC-
TION

The district has been named after its headquarters town, Puri. According to Cunningham the ancient name of this town was Charitra mentioned by the Chinese pilgrim Hiuen Tsang as Che-li-ta-lo. But the restoration of the word Che-li-ta-lo as Charitra and its identification with the town of Puri are open to doubt. The importance of the town as a seat of Vaisnavism increased when Chodaganga Deva constructed the temple of Purusottama Jagannath and installed the images of the deities. Thereafter, it became famous as the abode of Purusottama and was popularly called Purusottama Kshetra.

Origin of
the name of
the District

In the drama Anargharaghava Natakam attributed to cir. 9th century A. D. we find the name Purusottama applied to this town. In the Nagari Plate of Anangabhima III of the Saka year 1151-52 i.e., 1229-30 A. D., the place is called Purusottama Kshetra. This name in the form of Purusottama Chhatar or only in the form Chhatar was used by the Mughal, the Maratha as well as the early British rulers in their official records. Even in Yoginitantra¹ and Kalikapurana the city is referred to as Purusottam. Puri² region was also known as Utkal.

1. B. C. Lal—Historical Geography of Ancient India, p. 184

2. D. C. Sircar—Study in Geography of Ancient and Medieval India, p. 84.

The name Purusottama Kshetra was also for sometime known as Purusottama Puri and as the word Purusottama Kshetra was contracted into Kshetra or Chhatra so also Purusottama Puri was expressed in the contracted form Puri. In fact, in many early British records this town is known by the name Pooree. In modern times Puri has become the most popular of all the other names of this town.

Location,
general
boundaries,
total area
and popula-
tion

The district of Puri lies between 19°28' and 20°35' North latitude and 84°29' and 86°25' East longitude. It is bounded on the north and north-east by the districts of Dhenkanal and Cuttack, on the west and south-west by the districts of Baudh- Khondmals and Ganjam, and on the south and south-east by the Bay of Bengal.

It extends over an area of 10,159 sq. km. (Surveyor General of India) and had a population of 2,340,859 souls (1,183,838 males and 1,157,021 females) in the year 1971. The district with 6.52 per cent of the State's area and 10.67 per cent of the State's population occupies the ninth and the second place respectively among the thirteen districts of Orissa.

History
of the
District as an
administra-
tive unit
and changes
in its parts.

Under the Mughal rule (1592-1751), Orissa for the purpose of Revenue Administration was divided into three *circars*, namely, Jaleswar, Bhadrak, and Kataka, each of which was subdivided into Mahals or Dandapatras, and the Mahals were again subdivided into Bishis. Puri formed a part of Kataka *circar* and comprised the following Mahals :

Khettra—Areas about 25 sq. km. neighbouring Puri town.

Chabiskot (Chabiskud)—It comprised Manikapatna and Malud.

Sirai—Consisted of Bishis, namely, Aru, Kavara, Talitara and Sirai and comprised the territory to the north-west of the Chilka lake.

Kotdesh—The present Kotdesh pargana of Puri district. It consisted of two Bishis, namely, Ormola and Karmal.

Dakhandikh (Dakhinadiga)—Consisted of 17 Bishis, namely, Athais, Antrodh, Oldhar, Kate, Kurulo, Kudahara, Kotrahang, Kodhar, Domarkhand, Deogaon, Paschim-duai, Purb-duai, Banchas, Marada, Rahang, Saibir and Sailo.

The Ain-i-Akbari mentions Manikapatna as one of the Mahals. But it was, in fact, included in the Dandapata of Chabiskot. According to it there were 21 Mahals under Kataka *circar* but actually it gives only the names of 20 Mahals. But as viewed by M. M. Chakravarti Lembai Dandapat identified with the Lembai Pargana of Puri district was the 21st Mahal of Kataka *circar*.

After their occupation of Orissa in 1751, the Marathas brought about some changes in the revenue divisions of the Province. They divided Orissa, which then extended from the river Suvarnarekha in the north to the lake Chilka in the south, into five *chakalas*, viz., (i) Pipli (ii) Kataka (iii) Bhadrak (iv) Soro and (v) Balasore. The Chakala of Pipli comprised major portions of the modern district of Puri. The Chakalas were divided into Parganas and the Parganas into Mahals or Taluqs.

The Raja of Khurda was a very influential ruler since the Mughal time and under him there were two hundred *killas* and thirty-one Zamindars. Out of these thirty-one Zamindars, some chiefs like those of Baramba, Tigiria, Narasinghapur, Talcher, Athgarh, Nayarhar, Ranpur, and Daspalla became feudatory chiefs under the British rule while some continued as Zamindars. The last named three feudatory states are now included in the Nayagarh subdivision of the Puri district.

The conquest of Orissa by the British in 1803 set forth great changes in revenue divisions and political relations. In June 1804, the Province was divided into two divisions, namely, the northern and southern divisions, the river Mahanadi, forming the natural boundary. Robert Ker and Charles Groeme were appointed as Judge, Magistrate and Collector in northern and southern divisions respectively. But by the Regulation XIII of 1805 the northern and southern divisions were amalgamated and placed under one Collector. Regulation XIV of the same year created two separate posts. Accordingly G. Webb succeeded Groeme as Collector and Robert Ker became the Judge and Magistrate of the whole province.

As the Raja of Khurda revolted in 1804, he was arrested and was placed in confinement in the Fort of Barabati at Cuttack. His territory was confiscated and the Raja was subsequently released. In 1807 he was permitted to live at Balisahi in the town of Puri and functioned as the Superintendent of the temple of Jagannath.

Puri (Pooree) was the capital of the province of Orissa and the headquarters of the Collector till 1816. In 1806 there was a proposal to remove the headquarters to Jajpur (Jajipur), but it did not get government sanction. In August 1814 an Act of the Administration, Odisha

establishment was removed to Cuttack, which was again brought back to Puri in December. A petition from a number of Zamindars for the removal of the Collectorate to Cuttack, which was the seat of administration under the Mughal and the Marathas, although rejected by the Collector, was finally approved and the headquarters was permanently shifted from Puri to Cuttack in 1816.

By the Regulation I of 1818 the office of the Commissioner was established and Robert Ker became the first Commissioner. From 1813 to 1819 there was a Joint Magistrate at Puri with jurisdiction over the Thanas of Pipli, Gop, Hariharpur and Kiran. But this office was abolished in 1819 and the Joint Magistrate of Khurda was given the charge of the above Thanas. On 14th February 1822, the office of the Joint Magistrate of Khurda was also abolished and the Collector of Cuttack was given the charge of that office. By this arrangement Orissa was again divided into two divisions with the river Baitarani as the dividing line. Wilkinson, the Collector of Cuttack, was placed in charge of Cuttack and Khurda, and Ricketts with powers of a Collector was given the charge of Balasore and Bhadrak. Finally on the 23rd October 1828, the province was divided into three districts, namely, Balasore, Cuttack, and Jagannath, later known as Puri.

Regulation IV of 1821 had provided that the power of a Magistrate and Collector might be vested in one and the same person and accordingly one Magistrate and Collector was appointed in each of the above three districts. H. Ricketts, R. Hunter and W. Wilkinson were the first Magistrates and Collectors of Balasore, Cuttack and Puri districts respectively.

In 1837 it was decided to separate the magisterial powers from that of the Collectors. And although by 1845 the separation of powers was effected in Bengal, Bihar and Assam, the three districts of Orissa continued to have the old arrangements as laid down in the Regulation IV of 1821.

In 1912 the new Province of Bihar and Orissa was formed and subsequently Orissa became a separate province in 1936. During these years no conspicuous change had occurred in the territorial extent of the district. But after integration with Orissa on 1st January 1948 of the feudatory States of Nayagarh, Daspalla, Khandapara and Ranpur with a total area of 3941.1 sq. km. a separate subdivision comprising these ex-States was added to Puri district with headquarters at Nayagarh. The fourth subdivision of Bhubaneswar was carved out on 26th January, 1959.

Thirty-one revenue villages comprising an area of 78·06 sq. km. pertaining to Nimapara, and 35 revenue villages with an area of 85·47 sq. km. of Daspalla Tahsils of Puri district were transferred to Cuttack district and tagged to Jagatsinghpur and Narasinghapur Tahsils respectively under Revenue Department Notification No. 67290-R., dated the 7th November 1969 and No. 63013-R., dated the 6th November 1967. Similarly 28 revenue villages covering an area of 67·34 sq. km. of Sadar Tahsil of Cuttack district were transferred and attached to the Bhubaneswar Tahsil of Puri district under Revenue Department Notification No. 51402, dated the 30th September 1969. Thus ultimately Puri district parted with an area of 95·79 sq. km. in the exchange.

The district is divided into four subdivisions, namely, Puri Sadar, Khurda, Nayagarh and Bhubaneswar. It consists of eleven Tahsils and twenty-eight police stations. The five towns of Puri district are Puri, Bhubaneswar, Khurda, Nayagarh and Jatni. Of them, the population of Bhubaneswar exceeds one lakh.

Subdivisions,
Tahsils and
Thanas

The Sadar subdivision occupies mostly the south-eastern portion of the district and has an area of 3558·8 sq. km., and had a population of 899,032 persons as enumerated in the 1971 Census. It consists of four Tahsils and nine police stations. Puri, the famous historic town, is the only town of this subdivision.

Khurda subdivision occupies the tract intervening between Nayagarh on the west and Puri and Bhubaneswar on the east. Its area and population in 1971 were 1914·1 sq. km. and 467,819 persons respectively. Khurda and Jatni are its towns. It is divided into two Tahsils and five police stations.

Nayagarh is the westernmost subdivision of the district. According to 1971 Census its area was 3941·1 sq. km. with a population of 578,498 souls. Nayagarh is its only town. It has four Tahsils and nine police stations.

Youngest of the subdivisions, Bhubaneswar, occupies the north-eastern portion of the district. Its only town Bhubaneswar is the Capital of Orissa. Its area and population were 935·2 sq. km., and 395,510 souls respectively in the year 1971. It has five police stations and one Tahsil coterminous with the subdivision.

The subdivisions derive their name from the names of their respective headquarters towns.

The names of Tahsils of each subdivision with their area and population and the names of component police stations are given in the Table below.

Subdivisions	Tahsils with area in sq. km. and population	Police Stations
Puri	1. Krushnaprasad A-772.7 P-25,990	(a) Krushnaprasad
	2. Sadar A-1,438.5 P-395,170	(a) Sadar (b) Brahmagiri (c) Satyabadi
	3. Pipli A-388.0 P-149,277	(a) Pipli (b) Delang
	4. Nimapara A-959.6 P-328,595	(a) Nimapara (b) Gop (c) Kakatpur
Khurda	1. Khurda A-997.2 P-259,573	(a) Khurda (b) Bolgarh (c) Begunia
	2. Banpur A-916.9 P-208,246	(a) Banpur (b) Tangi
Bhubaneshwar	1. Bhubaneshwar A-935.2 P-395,510	(a) Bhubaneshwar (b) Balipatna (c) Baliana (d) Chandaka (e) Jatni
Nayagarh	1. Nayagarh A-1429.7 P-271,469	(a) Nayagarh (b) Odagaon (c) Nuagaon (d) Sarankul
	2. Daspalla A-1366.5 P-83,074	(a) Daspalla (b) Gania
	3. Khandapara A-621.7 P-138,702	(a) Khandapara (b) Fategarh
	4. Ranpur A-523.2 P 85,253	(a) Ranpu

Besides, Puri Municipality area is covered by the Town Police Station, Puri; and Bhubaneswar Notified Area by Capital Police Station and Saheednagar Police Station. The last named police station comprising some areas of Bhubaneswar and Capital Police Stations was constituted under Home Department Notification No. P 6 P-37/74 Pt. 14189/P dated 22nd April 1974.

The whole of the district may be divided into three dissimilar natural divisions, the littoral tract, a level alluvial tract and the hilly tract. Of these the last two tracts are conspicuous.

TOPOGRAPHY

Natural divisions

Khurda subdivision marks the transition from the peaceful, thickly populated deltaic region to the wild jungles and the mountain passes of the Nayagarh subdivision. The country along the Daya is flat and alluvial, while further inland, there are long ranges of rugged hills. The river Daya is, in fact, the boundary between the plains and the inland hilly tract. The country to its north and west is studded with hills, while to the south and east it is plain and fertile.

This strip of the country lies between the alluvial plain and the Bay of Bengal. It assumes the form of a bare belt of sandy ridges which stretches along the sea-shore for the full length of the district, varying from 6.5 km. to a few hundred metres in width. Accumulations of wind-blown sand give rise to ridges parallel to the coast. It forms the dividing line between the Chilka lake and the ocean.

The littoral tract

This level alluvial region is full of villages and rice fields, watered by a network of channels, through which the water of the Kuakhai, the most southerly branch of the Mahanadi, find their way to the sea. In this region there are a few detached hills, such as the Dhauli hills and the hills close to the Delang Railway Station, which rise somewhat abruptly from the alluvial plain. Almost the whole of the cultivable land is under plough. The highlands, for which no means of irrigation has yet been devised, are under cultivation of *biali* or autumn rice, pulses, etc, while *sarada* or winter rice is grown in the marshy depressions known as *pats* and in other low-lying land. To the north of Puri, *dalu* or spring rice is grown.

The level alluvial tract

The higher lands are occupied by small patches of forest, by extensive mango, jack and *polang* groves and by village sites concealed from view in the foliage of banyan, tamarind and other trees. Rice lands of varied levels fill up the intervening space and the whole combines to form a pleasing picture, the eye being nowhere wearied in the dull flat expanses stretching unbroken to the horizon. As we proceed further south we come to the second zone of the delta where there is less diversity and level and woodland scenery is rare. The village sites are more exposed and clusters of coconut, palmyra and date-palms take the place of the more leafy groves of the north. The villages are surrounded by picturesque groves of trees.

To the extreme east, however, between the Kushabhadra river and the boundary of Cuttack, there is a strip of high and less fertile land where cultivation is varied by stretches of moor-land and patches of scrub jungle; this tract eventually merges in the jungle round the mouths of the Devi river, where it finds an outlet to the sea in a network of creeks.

Hill tract

Corresponding with the Khurda and Nayagarh subdivisions, this tract is a hilly broken country. This territory unlike the alluvial plain country is well above the flood level and forms the watershed between the Mahanadi and the Chilka lake. The hill ranges break the country into small but well cultivated fertile valleys intersected by hill streams. The west and north-west of the Khurda subdivision is rocky and separates it from the Nayagarh subdivision. All the Tahsils of the Nayagarh subdivision which are coterminous with the ex-State areas are almost separated from one another by long tree-clad hill ranges. In the open undulating country of this tract are found extensive fertile and populous villages. The natural beauty of this hill-tract is exceedingly fine. With its wide ranges of tree-clad hills, well-watered valleys gleaming bright in the sun, green waving crops of paddy and the deep green foliage of the forest the whole country assumes the form of a gigantic park.

Hill System

Describing the hill system of the old Puri district, that is, the present district barring the Nayagarh subdivision, P. T. Mansfield writes;

“Practically all the hills in the district are in the Khurda subdivision, where they are found in more or less extensive ranges or in detached peaks and blocks, with elevations varying from under five hundred to three thousand feet above sea-level. One of these ranges beginning in Dompara in the Cuttack district and running south-east in an irregular line towards the Chilka lake, forms the watershed between it

and the Mahanadi valley. The eastern faces of the hills are usually rocky and precipitous. The western slopes are easier, and are well covered with earth and jungle, often with beds of laterite and gravel, from which issue good springs of pure water. On the north-west of the Chilka the hills become bold and very varied in shape, with fertile valleys running far inland between the ridges, and throw out spurs and promontories into the lake, forming island-studded bays.

The most conspicuous peaks are Solari in Banpur, Bhelari on the south-west boundary of the Khurda subdivision and Baitha and Barunai, a mile to the south-west of Khurda town. Solari is a group of peaks rising one above another from the flat land near the Chilka lake, and the other three are saddle-backed hills rising into bare and often inaccessible precipices. There is a splendid tank, believed to be the work of prehistoric builders, on the Solari hill; and both this and the Barunai hill contain caves which have been hermitages and places of pilgrimage from the time immemorial. Historically, however, the most interesting hills are Khandagiri and Udayagiri, two hills, separated by a narrow gorge, which rise abruptly from the rocky soil near Bhubaneswar, and are honeycombed with cells and cave dwellings cut from the solid rock by the Jains over two thousand years ago. Among other interesting places in the hills may be mentioned Atri, where there is a hot mineral spring in the midst of highly-cultivated valley; and two picturesque passes on the Ganjam road, one at Singeshwar and one at Kurarhmal, five miles south of Khurda.

There are a few outliers of the Khurda hills in the alluvial plains which constitute the rest of the district. They cross the valley of the Daya at Dhauligiri, an isolated peak which is famous for the Asoka inscription carved on a great slab of rock at its base, and at Jagdalpur, where there is a line of low hills intersected by the railway. The highest peak in this range is about five hundred feet above sea-level and is crowned by an ancient Hindu temple."

Important hill ranges of the district are generally seen in the Nayagarh subdivision. On the west and south of the Daspalla Tahsil there are fine hill ranges without any peaks of special height. These ranges are covered with dense forest specially to the north where there are large tracts of valuable Sal (*Shorea robusta*) forests. A continuous range of hills stretches along the south bank of the Mahanadi from Gania to the border of Baudh broken only by the valley of the Burtanga river near Chhamundia. The range increasing in height and steepness as it passes west into the Satkosia gorge of the Barmul pass where the slopes facing the river are extremely precipitous. "To the south and west of Khandapara Tahsil are found hill ranges of

negligible height clad with fine Sal. A splendid range of hills varying from 610 to 762 metres in height runs through the centre of the Nayagarh Tahsil. Another chain of precipitous hills surrounds the southern and eastern boundaries of the Tahsil in the form of a semi-circle. These ranges are unbroken though at places alternated by small peaks. In south-west of Ranpur Tahsil is found a region of forest clad hills which walls whole of its western side except a single pass leading into the Nayagarh Tahsil.

Other important hill ranges of Nayagarh are the Langalkhol range (between Daspalla and Baudh whose highest peak is 610 metres above sea level), the Aswinkhol hills (said to contain lime-stone in large quantity), the Goaldei range (on the right bank of the Mahanadi), the Birigadei range (a circular range in the centre of Daspalla) and the Sikharpanga range (on the boundary between Daspalla and Ganjam district).

In Nayagarh subdivision are found almost all the principal peaks of the district. They are Mundula Parbat (784 metres) and Balimunda Parbat (855 metres) in Daspalla police station; Goaldei (779 metres) and Burudhani (720 metres) in Gania police station. Chiklikhai (737 metres) in Khandapara police station; Suliya (682 metres) in Nayagarh police station and Badamal (607 metres), Bharisahi Parbat (585 metres) and Tamna (749 metres) in Sarankul police station. Besides, many unnamed peaks of considerable height are also met with. Khundabola (949 metres) the highest peak in the district is in Banpur police station of Khurda subdivision. Another notable peak of Banpur is Bankar Pahar (547 metres).

Sea coast,
Bays

The length of the sea coast of the district of Puri is nearly 150.4 km. Sandy ridges are found along the sea coast, which stretch into the districts of Cuttack and Ganjam. One such narrow sandy spit divides the lake Chilka from the Bay of Bengal. These sandy ridges and dunes are formed by the strong monsoon currents which blow over the country for nearly 8 months of the year. The ridges vary from about 7 km. to a few metres in width and have prevented most of the rivers of the district from finding their way into the ocean.

Estuaries

The following are the important estuaries in the district:

Devi Estuary: The river Devi debouches into the ocean through a net work of creeks. It forms a wide tidal estuary which is navigable up to Machgaon, a distance of nearly 13 miles (21 km.) on the river. The estuary, while nearly half a mile (0.8 km.) wide at the mouth, gets wider towards the interior. The river Kadua joins the Devi in its right bank near the mouth.

Prachi Estuary: The river Prachi falls in the ocean some 7 miles (11.2 km.) to the south of Kakatpur forming a narrow estuary. The tidal effect is felt up to a distance of nearly 6 miles (9.6 km.) upstream.

Kushabhadra Estuary: To the south of Ramachandi the river Kushabhadra having been pushed north-wards by the coastal sand ridges falls into the ocean. It produces a shallow water mass just before entering the sea. Tidal effects are seen in the lower portion of the reaches.

No island is found in the coastal waters of Puri. But the Chilka Island lake is separated from the Bay of Bengal by a group of islands formed by silt deposit. The important islands found in Puri portion of the Chilka lake are (i) Nalabana island which was formerly covered with reeds, but is free from them at present, (ii) Barunikuda island and lastly (iii) Kankarkuda island. Besides these, isolated hillocks are found in some areas of Chilka.

Puri is endowed with no natural harbour nor its coast is suitable for any artificial one. Being on the roadstead some amount of import and export trade used to be made from Puri town in the past. It was open only for six months from middle of October to the middle of March. Usually the vessels stayed at a distance of about a kilometre from the shore in good weather, and the goods were loaded and unloaded through the fishing boats.

All the rivers of Puri district have a common characteristic. In the hot weather they are beds of sand with tiny streams or none at all, while in the rains they receive more water than they can carry. They enter the plains from the hills and during monsoons are charged with large quantities of silts. On entering the plains their velocity is retarded and is reduced to a point where the water can no longer carry the whole of the suspended matter which is deposited in the river-bed.

RIVER SYSTEM
AND WATER
RESOURCES

The bed thus tends to rise and so also the flood level. Consequently the water of the river overflows either of its banks and spreads the silt on the land in the vicinity. This process continues till the river is no longer able to flow along its course and a position of unstable equilibrium is reached when the river bursts into the bank and throws out a branch. The process is repeated as more and more silt is gradually deposited on the land. This is the typical feature of a 'deltaic country' where the river-bed rises up constantly overflowing their bank and casting off a network of branches. The deltaic characteristics are very noticeable in the coastal districts.

The rivers emerge in the plains subdividing themselves into main branches and innumerable minor streams, eventually re-uniting and flowing into the Bay of Bengal through estuaries. The construction of the Hirakud Dam at Sambalpur appears to have brought about a considerable change in the characteristics of these rivers.

Main rivers
and tributa-
ries

The principal rivers are the Mahanadi, the Kuakhai, the Kushabhadra, the Daya and the Bhargavi. The description of the rivers of the old Puri district comprising the present Puri, Khurda and Bhubaneswar subdivisions by P. T. Mansfield is as follows.

Kuakhai

The Kuakhai, a name meaning the crow's channel, is an offshoot from the Kathjori river, from which it takes off nearly opposite Cuttack. After flowing in a south-south-easterly direction for twelve miles, it throws off the Kushbhadra, and then travels nearly due south for seven miles until it reaches the village of Sardeipur, where it divides into two big branches: the Daya to the west: and the Bhargavi to the east. This river is practically a spill channel of the Kathjori, and its head is closed by a bar, so that little water flows into it except at flood time. There appears to be little doubt that the head of the Kuakhai is fast silting up: and it has been held by competent authority that, unless steps are taken to reduce the silting there the Kathjori, from which it derives its supply, may form a new bed for itself and leave the Kuakhai high and dry. Such a diversion would be disastrous to the district.

Kusha-
bhadra

The Kushbhadra leaves the Kuakhai at Belianta and flows in a south-easterly direction for some forty miles till it enters the Bay of Bengal near the shrine of Ramchandi, fifteen miles east of Puri. For the last few miles of its course it is called the Niakhia. The mouth of the Kushabhadra below Ramchandi is free from silt, but the river bed between the Niakhia ferry and its mouth is shallow. This is due to the meeting of the river current and the tide, which has resulted in the formation of a sandy bar at its mouth which checks the river discharge in time of heavy flood. During the cold and hot weather months the tide is felt as far inland as Padampada, but during the rainy season only as far as Matkatpatna, somewhat below Takna village. After the first three miles of its course the Kushbhadra narrows considerably, and as a result, at the time of flood, breaches are liable to occur anywhere in the embankments on either bank. The Kushabhadra receives no important contributions from the east; but on the west, at a point six miles from the sea, it receives the whole of the drainage of the tract between its own and the Bhargavi channels. The Dhanua, with its tributary

the Mugai, brings this large volume of water to the Kushabhadra, and the point of junction is said to be the lowest point in the delta. The distance of this point from the sea by a direct line is only six miles, but, as the fall is very gradual, the river follows a winding course, and does not reach its destination till it has covered twice that distance.

The Daya river, as already stated, takes off from the Kuakhai at Sardeipur. It runs due south for eight miles and then makes a sharp turn westward for four miles, and after that continues its course southward for the rest of its length, emptying itself into the north-eastern corner of the Chilka lake some thirty-seven miles from its off-take. The river is tidal as far as Bhatpara, but the action of the tide is inappreciable in the flood season. Two small rivers enter the Daya, the Gangua just above the village of Kanti, and the Managuni river a mile or two below Kanas ; though small, these streams drain a considerable area, and during the rains add a large volume of water to the Daya. On the right bank the Daya is embanked from its off-take as far as Dakshin Nuagan, two miles above Kanti, and then the country is open to spill until the Teremul embankment is reached opposite the Ghoradiha hills. This embankment is carried on to the outfall of the Managuni river, but from there to the Chilka lake no embankment exists. The Teremul embankment, it may be added, has been abandoned and is in a bad state of repair. An important problem in connection with the Daya is that the Chilka lake at its outfall is silting up, owing to the enormous quantity of silt which it brings down. The result is that a large volume of water cannot find a free outlet and overflows into the surrounding country.

The Bhargavi, after leaving the Kuakhai at Sardeipur, and following a circuitous course for forty miles finally empties itself into the outfall of the Daya, breaking up into numerous branches in the last two and half miles of its course. The Bhargavi is fifty-three miles in length, and for all this distance is very much constricted, owing to embankments constructed on either bank close to its channel. In consequence of this, breaches are apt to occur in any portion of the embankment during floods of any intensity; the growth of jungle and the cultivation of plantain and castor oil plants on any cultivable land between the embankments have gone on to such an extent as to retard the current materially, and this increases the danger of flooding.

A detailed description of the network of rivers forming the tributaries and offshoot of the Bhargavi would be tedious. There are four main branches, all taking off from the left bank, viz., the Kanchi,

at Janakadeipur, the East Kania at the thirty-fifth mile, the Naya Nadi, an artificial channel, at the fortieth mile, and the South Kania at the forty-fifth. The first of these falls into the Sar Lake ; and by various channels the first three are interconnected and finally join the Sunamuhi river which falls into the Harchandi, and so, finally, into the sea. The South Kania gets lost in the marshes on the western shore of the Chilka. The Harchandi river into which the three first branches of the Bhargavi finally fall, runs into the sea by the mouth of the Chilka lake. Its whole course is through sand and consequently it has become much silted up and is very shallow. It takes its name from a temple built on the sand about two miles from its head. The excavation of this river would do much to relieve the lower part of the Bhargavi, but owing to the south-west wind that blows steadily from February to June carrying sand with it, it would be next to impossible to keep the bed clear for any length of time without yearly excavation.

The country between the Bhargavi and the Daya is drained by the Ratnachira and the Nuna, the former of which rising to the east of the old Trunk road, crosses it near Satyabadi and falls into the Bhargavi ; while the latter falls into the Daya.

Kadua The Kadua (or muddy river) is a monsoon stream which falls into the Prachi below Bandalo. It is formed by the confluence of two small streams at Charigan, and receives a good deal of the spill water of the Kushbhadra.

Prachi The Prachi drains the country at the border of Cuttack and Puri, having its origin near Kantapara on the direct Cuttack-Gop road, and passing through the village of Kakatpur to fall into the sea eleven km. to the south of it.

Devi The Devi is one of the branches of the Kathjiri, which itself is a branch of the Mahanadi. It runs into the district of Puri near the extreme east of the district, forming a tidal estuary with numerous branches. It is navigable up to Machgaon, and is used by country boats trading in oilseeds.

The Khurda subdivision is mainly an elevated tract above flood-level in which, as is to be expected, the rivers are liable to sudden rises and falls. The drainage of the west and south is carried into the Chilka lake, of the north into the Mahanadi ; and of the east into the Kuakhai or the Daya. The following is a brief account of the more important rivers in this subdivision.

The Salia rises in the jungles of the Ranpur Tahsil and after flowing through the Banpur Mals enters the cultivated tracts of Banpur Tahsil below the village of Pratap ; it then follows a southerly course, and after crossing the Ganjam road at the seventy-first mile from Cuttack enters the Chilka. The total length of the river is about thirty miles ; it is fed by several tributaries and as the area of the catchment basin is about sixty-nine thousand acres, it conveys a large volume of water into the Chilka during floods. The stream is used to some extent for irrigation purposes.

The Kusumi rises in Ranpur Tahsil and then flows along the boundary of Ranpur and Khurda, enters the latter subdivision near Mundila, and taking a south-easterly course, falls into the Chilka lake. There is a large masonry bridge over the river, where it crosses the Ganjam road at the fifty-fourth mile. About a mile below the bridge, the river bifurcates in village Kusumi, one branch flowing towards Jaripada and the other going off towards Saran.

The Managuni or Madagni (also called Malaguni) runs through Khurda Tahsil and is the channel by which almost the whole of the Ranpur Tahsil is drained. It is formed by the confluence of two streams close to Saharagai, near the boundary of Khurda and Ranpur, and further down, near Chanagiri, it is fed by an important tributary which drains almost the whole of Khurda on the south of the basin of the Ran river. Another tributary, called the Rajna, also drains a considerable portion of the Khurda subdivision. The Managuni joins the Daya river below the village of Balbhadrapur, and is navigable during the rains by small boats and dug-outs.

The Ran river rises in Khurda subdivision and eventually joins the Mahanadi after flowing through the Banki Tahsil in the district of Cuttack. It is navigable, during the rains, from the Mahanadi to Baghamari on the Kantilo road, thirteen km. from Khurda. An area of 26 sq. km. in Khurda subdivision is liable to inundation from this river when the Mahanadi is also in flood and forces back its waters.

Among other rivers may be mentioned the Kansari, which has a catchment area of 15,783 hectares and is joined by the Champajhar, the Hara, with a catchment area of forty-five thousand acres, the Baghchal, Ghaguria, Kani and the Sarada.

Among the rivers of Nayagarh may be mentioned the Mahanadi, the Burtanga and the Kusumi. Besides, numerous hill streams are also met with.

Mahanadi

After forming the boundary between this district and Dhenkanal for a certain distance the Mahanadi enters the Gania police station of the Nayagarh subdivision from its north-western corner and takes almost an easterly course in the district for a few kilometres. It then passes out of the district and for a considerable distance flows along the boundary between Cuttack and Puri. The portion of its course from Baudh border to Barmul is known as the Satkosia gorge and presents a magnificent scenery. The river here discharges a very large column of water in a narrow compass compressed by high and precipitous hills. It then enters the Cuttack district leaving the Fategarh police station of the Nayagarh subdivision.

Burtanga

Rising at Daspalla the Burtanga drains a major portion of it and carries a good flow of water throughout its length for over half of the year, though it dries up towards the end of January.

Kuanria

The Kuanria flows through the open and better populated areas of Daspalla and joins the Kusumi river at Potharwar village in Khandapara. It flows jointly for a course of five kilometres before it falls into the Mahanadi.

Kusumi

The Kusumi rises at Panchabhuti in Nayagarh and takes a winding course. It meets with Duanā and the Dauka near Khandapara border and flowing through Khandapara discharges itself into the Mahanadi near Kantilo. Though the river Dauka takes its course at Daspalla, major part of its length lies in Nayagarh. The river bifurcates into two, that is the Dauka and the Lunijhar, at a point eight kilometres north-west of the Nayagarh town. Then it takes an independent course for about eight kilometres. But the old Dauka is no longer in use and all its waters run into the Lunijhara. It ultimately meets with the Kusumi at the border of Nayagarh and Khandapara. Duanā takes its origin from the south-east corner of Nayagarh. Lathipada is the meeting point of the rivers Duanā and Kusumi.

Lakes and tanks

The Chilka lake was probably a part of Bay of Bengal separated later by the formation of sand ridges. The southern extremity of the Mahanadi delta has also contributed towards its isolation from the sea and formation as an inland lake.

Chilka lake.

The Chilka lake is a shallow inland sea situated in the extreme south of the district and extends into the district of Ganjam. It is separated from the Bay of Bengal by a group of islands formed by silt deposit and by a long strip of land which for miles consists of

nothing but a sandy ridge, little more than two hundred yards (180 metres) wide. It communicates with the bay by a narrow inlet through the sandy bar thrown up by the sea, an inlet which in some years has to be kept open by artificial means. On the south-west it is walled in by lofty hills, in some places descending abruptly to the edge of the water and in others thrusting out arms and promontories of rock into the lake. To the north it loses itself in endless shallow sedgy banks and islands just peeping above the surface formed year by year from the silt which the Daya and other rivers bring down. Thus hemmed in between the mountain and the sea, the Chilka spreads itself out into a pear-shaped expanse of water.

The size of the lake is like a pear having its wider end towards the north-east and the conical end towards the south. It is about 72 km. long (north to south) of which the northern half has a mean breadth of 32 km. while the southern half tapers into an irregularly carved point barely averaging 8 km. in width. Area and volume

The area of the lake fluctuates in different seasons. During dry weather it approximates to 891 square km. whereas with the intensity and duration of the annual river floods, and with the ebb and flow of tide its area extends to 1,165 sq. km. The major portion of its area, approximating 803 sq. km., is included in the district. The average depth is from 1.5 to 1.8 metres and scarcely anywhere exceeds 3.7 metres, except in the south-west. The bed of the lake is lower than the high water of the sea and is gradually rising up with the deposit of silts brought down by the rivers. An attempt to reclaim land from the Chilka lake is said to have been made over a century back by one Gojeya by raising a Dam from Bhubaneshwar to Mangalajodi. The work could not be completed and the remains of the *bundhs* are locally known as Gojeya Bandha. However, in 1951, about 1,200 acres of land in the fore-shores of the lake near Bhusandpur was reclaimed by the Government for the purpose of resettlement of displaced persons from East Pakistan.* The neck which joins the sea is only 183 to 274 metres broad, but the narrow tidal stream which rushes through it suffices to keep the lake distinctly salty during the dry months from December to June. In rainy season its water becomes sweet due to inflow of large volume of flood water by the rivers. This transformation results due to a regular combat between the rivers on the one hand and the sea on the other in which the former struggle to empty their waters and silt while the latter with its sand laden currents repels them with unusual velocity.

The water owing to its extreme salinity is not suitable for daily bathing, but a trip on the lake is always refreshing. It is said to heal cough and other digestive ailments. Dips in the lake produce a very

*Now Bangladesh.

virulent form of skin disease (ringworm) as is seen among the fishermen, which may be attributed to the presence of excessive sodium salts and low mineral contents in the water. There are healthy places along the sandy ridge that separates the Chilka from the sea, the old route that connected Ganjam with Puri.

The Fisheries Department of the Government of Orissa operates in the Chilka lake the scheme "Applied Research in the Chilka lake and other estuarine fisheries". The lake being a fine spot for the tourists various facilities are provided by the Government for their comforts. Besides, Government of India has decided to establish a Naval Cadet Training Centre in the Chilka lake. The State Government have also declared Chilka a sanctuary for the birds. In near future the importance of the lake may rise to a great height.

More about Chilka will be found in Chapters V and XIX.

Sar Lake

To the north-east of Puri Town in the Puri subdivision there existed originally an extensive swamp formed by the backwater of the river Bhargavi which has almost lost its existence today. Popularly it was known as Sara Pata. The flood water of the Bhargavi got discharged into it through her distributary, the Kanchi. It occupied an area of nearly 810 hectares which varied according to the volume of flood water. The accumulated water receded to the Bhargavi through the Kanchi and Atharanala rivulet after the floods had abated. The Sar Lake area was classified as a flooded area within "Kushabhadra Bhargavi Doab" and between 1919 and 1920 the flood level in the lake recorded between 17 to 19 feet (5 to 6 metres) as indicated in the final report on Embankment and Flooding in Puri District contained in the "Report on the Contour Survey of the Flooded Tract of Orissa 1924". Dalua or spring rice cultivation occupied major portion of the area. A channel was opened in 1931 for facilitating drainage of flood water from the lake into the sea. Owing to deposit of silts for years together the bed of the lake gradually rose up. During the rainy season the average depth of water in some portion of the area is about 3 to 4 feet (90 cm. to 120 cm.). In winter no water remains deposited over the tract except inside the channel. Sarad cultivation has almost replaced Dalua. The present Settlement has recorded the entire area as *anabadi* with *hal kisan* of paddy lands.

Tanks

There are five sacred tanks in Puri town and two in Bhubaneswar. They are Narendra, Markanda, Swetaganga, Indradyumna and Parbatisagar at Puri, and Vindusagar and Kedargouri at Bhubaneswar.

The tank has been named after Lakshposi Narendra who is reported to have excavated it. It covers a vast area of little above 3 hectares and is located to the north of Puri town close to the river Madhupur, popularly known as Mangala river. The tank was provided with sluice gates on the side of the river for the purpose of flushing. The system, however, has stopped working for sometime past resulting in pollution of water. The tank was partly desilted in the *Na-anka* famine (1866) period. In 1929, the Mahanta of Emar Math, Puri, got it desilted at a huge cost. Thereafter, it was again renovated in 1972. It is used by the pilgrims as well as by the local people mostly for bathing. There is a small temple located inside the tank which is connected with the south bank by a bridge. The proxy of Lord Jagannath is brought to this temple during the Chandan Jatra festival which takes place for about three weeks starting from the Akshya Trutiya day of the month of Baisakh (April—May) every year. During the festival large number of pilgrims and local inhabitants throng in to swim and rejoice when Madanmohan, the representative deity of Lord Jagannath, floats round the tank in a gorgeously decorated flotella.

Narendra

With its embankments stone-lined the Markanda tank extends over an area of nearly 1.6 hectares. It has an irregular shape. On its south-west bank the temple of Markandeswar is located. It is said to have been repaired by the late Raja Kirtichandra of Burdwan. It is held to be a sacred tank and used for bathing purpose.

Markanda
tank

Vindusagar is the largest tank in Bhubaneswar which extends over an area measuring 396 m. by 213 m. Its depth varies at different points from two to three metres. It is embanked by a stone wall with magnificent flights of steps. At present its embankment is in a bad state of repair. The tank must be fed by natural springs at the bottom. Water from the tank is drained out through an outlet in its north-eastern corner. The pilgrims and local people bathe in it. It is believed that the tank contains drops from all the sacred rivers of India. The credit of excavation of this sacred tank goes to King Varaha Kesari. During Chandan Jatra or Akshya Trutiya festival which lasts for 22 days the proxy of Lord Lingaraj is taken to the small temple inside the tank and on every evening made to move around it in a boat beautifully decorated.

Vindusagar
tank

Besides the above, there are numerous other tanks scattered in the countryside catering to the needs of the villages. Notable among them are the tank at Danmukundpur and the Kausalyaganga tank near Dhauli, by the side of the State Highway. The Fisheries Department started a fish farm at Kausalyaganga in 1953. It has been converted into a research-cum-training institute from 1957.

**Springs and
spring
heads**

There is a hot spring near the village Atri about eight miles (13 km.) from Khurda Town where the spring water has been artificially confined into the limits of a stone ring-wall. Boiling hot current of bubbles rise up in a continuous stream and the surplus water flows into an adjoining small shallow pool which serves as the ideal bathing tub for leprotic and other patients. A very strong sulphurous smell pervades the whole air around. The soil near the spring and for a considerable distance round about is composed of alluvium or of marl and laterite. People of the locality assemble here on the day of Makara Sankranti to bathe in the spring. The prejudice that the spring miraculously removes the barrenness of women is the sole attraction of the place.

The discovery of a sulphuric hot spring in the village Nilakanthaprasad in the Khandapara Tahsil has recently been reported.

Waterways

Rivers form a considerable water traffic of the district during the rainy season. With the commencement of hot weather these rivers dry up and are rendered unfit for navigation.

For a major part of the year the Kushabhadra, the Bhargavi and the Daya serve the purpose of navigation. The Kushabhadra dries up earlier in its upper reaches, but in its lower part, country boats are to be seen throughout the year. But the Daya and the Bhargavi are navigable up to the month of January. These two rivers empty their water into the Chilka lake and from their respective mouths up to a distance of about ten miles (16 km.) upstream they are navigable even in hot dry weather. Traders from the district of Ganjam with their heavy loads of bamboos and other commodities come by way of the Ganjam canal and the Chilka lake. This water traffic is available throughout the year. Rice is exported on the Devi river by boat to the Taladanda canal of the Cuttack district.

GEOLOGY**Geological
Antiquity**

The rocks occupying the greater part of the district belong to the Eastern Ghats Group, which are Archaean formations comprising khondalites, charnockites and granite gneisses, forming the base-ment to the younger groups such as the Gondwanas, laterite and recent alluvium.

The Archaean rocks are highly metamorphosed sedimentary and igneous rocks, and occur mainly in the hill ranges of the western and central portions of the district. Charnockite is the most prevalent

rock type. Garnetiferous granite gneisses rank next in the order of abundance. They occur mainly on the hill ranges and also as isolated outcrops in the plains. Khondalite also is quite common, but is restricted to the hill ranges in the western and central parts of the district.

Emplaced into the central region of a plunging anticline in the khondalite suite around Dhuannali, Banpur Tahsil, is a major patch of rare anorthositic rocks. The Archaean rocks are also traversed by many quartz and pegmatite veins.

The next higher formation in the geological time scale belongs to the upper division of the Gondwanas, and is represented by fine to coarse grained sandstones, shales, grits and conglomerates with beds of white clay. Thus there is a great stratigraphical hiatus in the geological history of the region as no intervening formations occur between the immeasurably older Archaeans and the much younger Gondwanas. A fairly large exposure of these rocks occur in the topo sheets 73H 11,15, 16.

The youngest rocks of this area belong to the subrecent and recent periods and are represented by laterite and alluvium.

The following is a generalised sequence of the geological formations encountered in the district : Geological formation

Recent to		Alluvium, soil and
Sub-recent :		Laterite
.. .. .	Unconformity	
Upper Gond- w a n a s :		Sandstones, carbonaceous shales and conglomerates with beds of clay.
(Jurassic).		
.. .. .	Unconformity	
		Pegmatite and quartz veins
Archaean	{ Granite Gneisses	{ Anorthosites Garnetiferous granite gneis- ses, granulites and leptynites.
	{ Charnockites	{ Acid : Hypersthene bearing granulites and por- phyritic gneisses.
	{ Khondalites	{ Inter- mediate: Hypersthene bearing granulites (Dioritic). Basic : Norites and amphi- bolites.
		{ Quartz : garnet-sillimanite graphite schists and gneis- ses, Garnetiferous quart- zites, Calc granulites.

The Archaean, in general, have a foliation trending E-W to ESE-WNW with a northerly dip commonly known as the Mahanadi trend. In the Banpur and Gania areas, however, Eastern Ghat trend (NE-SW) and the Mahanadi trend are both seen. Many synformal and antiformal local folds with various plunge directions have been observed in the rocks, which are also affected by some small and minor faults. A mylonite zone of about 22 km. long and 3 km. wide occurs south of the Mahanadi river in sheet 73 H/3. The rocks here are highly crushed and pulverised, which is probably a zone of shear and movement.

Khondalites

Khondalites, probably the oldest rock formations, are a series of para-gneisses and schists, greyish to purple or reddish brown in colour. The constituent minerals are quartz, feldspar, garnet, sillimanite, and occasionally graphite; Ilmenite, magnetite, zircon and apatite occur as accessories. They show a prophyroblastic texture and intense granulation, crushing and other cataclastic effects.

Calc granulites and garnetiferous quartzites occur in a few places intimately associated with the khondalites. They represent the calcareous and arenaceous members respectively of the khondalite suite. That all these types belong to one and the same group of khondalites, is clearly evident as they gradually merge into one another.

Charnockites

Hypersthene granulites, which are quite similar to the typical basic charnockites in general appearance and mineral composition, are found at several places in the district. Such rocks are generally found as fragmented inclusions of various dimensions. They are generally disposed along the foliation planes of the granite gneisses and in the acid types of charnockites. They are seldom seen cutting across the foliation planes of the rocks.

The hypersthene granulites are dark-grey in colour and granulitic in texture. They are composed essentially of feldspar, hypersthene, diopside and greenish brown hornblende.

Hypersthene bearing granulites and gneisses of intermediate and acid composition are widespread among the charnockitic rocks. They are mostly gneissose and coarse grained, and consist essentially of quartz, feldspar, hypersthene and minor garnet and biotite.

The khondalite and charnockite rocks of the Eastern Ghats group have the mineral assemblages suggesting the impress of high grade "granulite facies" metamorphism with subsequent retrogression.

These rocks consist of quartz, felspar, garnet and biotite. The rocks are in general greyish white in colour, medium grained and gneissose in texture. The rocks are well foliated.

Garnetiferous granite gneisses and granulites

Anorthosites occur in the Banpur Tahsil between latitudes $19^{\circ}41'$ and $19^{\circ}54'$ N. E. and longitudes $85^{\circ}06'$ and $85^{\circ}18'$. They are found in the axial region of an anticlinal fold plunging towards WSW formed by the khondalites and the associated charnockites and granite gneisses.

Anorthosites

The anorthosites are, in general, coarse grained and greyish black or greyish white in colour with a uniformly coarse texture and consist essentially of felspar (labradorite) and pyroxene with ilmenite, magnetite and biotite in minor amounts.

Quartz and pegmatite veins are found at several places as intrusive bodies into all the earlier formations.

Quartz and Pegmatite veins

The next younger geological formation in the district belongs to the Jurassic period and is represented by the fresh water deposits of the Upper Gondwana formation. Thus, there is a stratigraphical break between the Archaeans and the Upper Gondwanas.

Upper Gondwanas

The rocks are fine to coarse grained felspathic sandstones, grits, carbonaceous shales, boulder beds and beds of white clay. Felspathic sandstones are the most prevalent rock type consisting of highly kaolinised felspar grains. Current bedding is clearly noticed in them. They have low dips rarely exceeding 10° .

These sandstones, on alteration, give rise to thick laterite deposits.

Thick deposits of reddish brown, highly cavernous laterite occur in the central part of the district. The low hills in these parts are all formed of reddish brown laterite. Their thickness is more than 6 m. It is formed as a result of the subaerial alteration in situ, of the Gondwana sandstones.

Laterites

In the Archaean terrain, low mounds of laterite occur in a few places.

Recent deposits of alluvium and soil are restricted to the river banks and the coastal area.

Alluvium and soil

The granite gneisses and acid charnockites support red, coarse, sandy soils.

The clayey soil present between Sarankul and Odagaon is very fertile.

Mineral and
other resour-
ces

Building
materials

The laterite exposed extensively in the central part of the district is quarried, at many places, for bricks. Other rocks like khondalite, the Upper Gondwana quartzite, charnockite and the granite gneiss are also good building materials.

The calcareous concretions known locally as "Kankar" or "Ghootin" are found at many places in the district. The exposures are usually small and are locally used for lime making. They are formed by the subsoil weathering of granite gneisses and acid charnockites.

Fairly large occurrences of "Kankar" are noticed at the following localities :

1. North-West of Banigochha
2. 3 km. south of Kujamendhi
3. South of Kalamba
4. On either bank of the Burtanga river around Banigochha
5. Between Bamuri, Odakapa and Kaliamba
6. South of Gumi
7. South of Balamundia (Δ 916)
8. North west of Ghantuliabania ($20^{\circ}21' : 84^{\circ}48'$)
9. On either side of Odassara-Tumandi path SW of Ghantuliabania.
10. South of Gorimara ($20^{\circ}16' : 84^{\circ}59'$)
11. On either side of Barapalli-Daspalla road SE of Barapalli ($20^{\circ}22' : 84^{\circ}50'$).
12. NW of Sirirampur ($20^{\circ}21'30'' : 84^{\circ}51'15''$)
13. NE of Chilipathara ($20^{\circ}24' : 84^{\circ}45'$)
14. WSW of Khajurdhai ($20^{\circ}25'30'' : 84^{\circ}53'30''$)
15. West of Madhakandha ($20^{\circ}20'45'' : 84^{\circ}56'$) at the foot hill.
16. On the western and northern flanks of Solari Pahar (411).

Road Metal

Charnockite, found in abundance throughout the district, is a readily available rock for use as road metal. Fine to medium grained, basic and intermediate charnockites provide the best material for roads which are to carry heavy traffic. Granite gneisses and acid charnockites may be used for medium to heavy traffic provided they are not very coarse grained. Those containing large crystals of felspar disintegrate rapidly along cleavages.

At places, khondalite is also used as road metal. Laterite too can be used for purposes of constructing "Kutchra" roads in the interior areas.

Anorthosites occurring on the Mamu-Bhanaja hill near Balugaon are worked for road metal and also for railway ballast.

(a) Occurrences of pure white clay in the form of pockets are recorded at places in the district. They are mostly the alteration products of anorthosites (in Dhuannali-Patrapur). The clay is free from quartz. The deposits are located within a distance of 2.4 km. and 5.6 km. from Dhuannali forest bungalow. China clay

The first mentioned deposit extends for 91 metres and is 90 cm. thick. The second one is fairly thick and extensive.

(b) A small china clay deposit occurs between Malisahi and Badasinga, 1.6 km. SE of Geredi. It has resulted from the alteration of garnetiferous granite gneisses. The deposit is 11 metres long, 5 metres wide and about 1.2m. thick. The clay is pure white in colour and is highly gritty due to quartz.

(c) Associated with the Upper Gondwana sandstones are some occurrences of clay deposits, noticed in Jagannathprasad Reserved Forest area east of Chandaka-Khurda Road, and NE of Jagannathprasad village. Clay occurs below a 3 m. overburden of soil and sandstone. It is a flat-lying extensive deposit. Presently the deposit is being worked on lease by the Orissa Porcelain Works Ltd., Barang, Cuttack district, for the manufacture of ceramic materials.

(d) In Ghatikia RF, a clay deposit occurs north of the hill 259, associated with felspathic sandstone.

(e) At the foot of the Baideswar hill, in a Nala west of the Inspection Bungalow is the occurrence of a dirty yellow, gritty kaolin mixed with soil material. It is used for colour washing the village huts.

(a) Magnetite occurs in the plain SSW to SW of Suliya hill (854 near Mahitama ($20^{\circ}17' : 84^{\circ}57'34''$)). It occurs along with some limonite, and the whole deposit is very limited in extension. The ore has a little vanadium and titanium. The limonitic portions are richer in vanadium and titanium. Magnetite

(8 Rev.—4)

(b) Magnetite occurs on the southern flanks of Jatia Parbat (.275), NE of Dungamal ($19^{\circ} 41' : 85^{\circ} 12'$), on the hillock west of Nuagarh ($19^{\circ} 42' : 85^{\circ} 10' 30''$) and on the southern flanks of the hill west of Patharkata ($19^{\circ} 48' : 85^{\circ} 17'$). Another small occurrence is near Padhansahi.

(c) Magnetite occurs in association with a quartz vein at the base of the hill, about 1.5 km. north of Pokasunga. The vein is about 35 m. long and about 3 m. wide. Magnetite is strewn all along the quartz vein. The occurrence does not warrant further investigation because of its limited occurrence.

Mica

A mica bearing pegmatite occurs south of Takara-Daspalla road, 3 miles from Takara ($20^{\circ} 23' 45'' : 84^{\circ} 45'$). The pegmatite vein is about 140 m. long and 8 m. wide. Small pieces of muscovite mica are profusely scattered over the area. They are much decomposed and stained, and do not seem to contain such quantity as to be commercially feasible.

Another mica-bearing pegmatite occurs in between two hills 3 km. SE of Takara. Here the mica is of poor quality.

About 400 m. north of the above, a small biotite bearing pegmatite is present.

A small pegmatite vein occurs on the slope of the hill SE of Guriabari, about 3 km. north of Mardabadi ($20^{\circ} 25' : 84^{\circ} 49' 30''$). It contains small flakes of muscovite and biotite.

A mica-bearing pegmatite vein occurs 2 km. away from Pan-chama towards Nuagaon. Muscovite occurs in small flakes, which are highly stained.

Grinding
stone

Granulitic charnockites occurring in the Bhandar hill, west of Sarankul are used locally for making grinding stones for domestic use.

On account of their fresh and unaltered nature coupled with extreme hardness, the anorthosites of Sunakhala area are made use of in making grinding stones.

Copper

Traces of malachite and azurite have been observed in a quartz vein about 200 m. north of Betanati. The quartz vein occurring at the foot hill, is about 3 m. in length and 1.5 m. in width. The occurrence is only of academic interest.

On the hill 307, about 3 km. south of Sunakhala, there occurs a conglomeratic rock with pisolites of bauxite in its matrix. The rock, as a bauxite ore, is unimportant.

Rutile is found associated with other heavy minerals like garnet, zircon, ilmenite, monazite etc. in the beach sands of the coastal tract of the Puri district.

In the saline tracts bordering the coast of the district, salt is being manufactured from sea water by a process of solar heating.

The outstanding features of the flora of the deltaic portion of Puri district are the beautiful groves of coconut palm which distinguish village sites from a long distance. Another outstanding feature of this area is the raised gardens of betel leaf which is a principal money crop of many villages. Among the trees lining the roads can be seen the Polang whose seeds produced the principal illuminant before kerosene came into use.

In recent years the district has not been botanically surveyed. The following description given in the Gazetteer published in 1929 which excludes flora of the Nayagarh subdivision is reproduced below:

“The sand hills stretching between the fertile rich plains and the sea constitute the only really distinctive feature of Puri from a botanical point of view, and present not a few of the littoral species characteristic of the Madras sea-coast, and unusual in Bengal, such as spinifex, hydrophylax and geniosperum prostratum. The summits of these ridges are for the most part covered with stiff thorny plants ; and in some places, especially about the Black Pagoda (Konarak), the surface of the sand is covered by a thick network formed by the interlaced stalks of creeping convolvulus, which is for half the year loaded with large flowers of a bright purple colour. To the north-east, where the Devi finds an outlet, there are numerous tidal creeks fringed with jungle ; and the banks of the sluggish rivers and creeks, which wind through the swampy low-lying country near the sea, exhibit the vegetation of a mangrove forest.

In the zone of cultivated land between the sea and the Khurda hills the usual rice-field weeds are met with, while ponds and ditches are filled with floating water weeds or submerged water plants, including the dangerous water hyacinth. Near human

habitations shrubberies containing various semispontaneous shrubs are common. This undergrowth is loaded with a tangled mass of climbing naravelia, various menispermaceae, many apocynaceae, several species of vitis, a number of cucurbitaceae, and several convulsiaceae. The trees in these village shrubberies include the red cotton tree (*Bombax malabaricum*), *Odina wodier*, *Tamarindus indica*, *Moringa pterygosperma*, the pipal (*Ficus religiosa*), the banyan (*Ficus bengalensis*), the palmyra (*Borassus flabellifer*) and the date palm (*Phoenix sylvestris*). The usual bamboo is *Bambusa arundinacea*. Open glades are filled with grasses, sometimes of a reedy character and used for thatching; sedges are abundant, and ferns are fairly plentiful.

In the Khurda subdivision there are extensive forests, which lie within what is technically known as the dry evergreen forest zone and comprise Sal and mixed forest. In the metamorphic region to the south-west Sal (*Shorea robusta*) is seen at its best, its chief companions being Kendu (*Diospyros melanoxylon*), *Careya arborea*, Asan (*Terminalia tomentosa*) and *Buchanania latifolia*. In the mixed forest the chief species are *Anogeissus latifolia*, Jiyal (*Odina wodier*), Kusum (*Schleichera trijuga*) and *Dillenia pentagyna*, while in the north-west *Xylia dolabriformis* (the ironwood tree of Pegu and Arakar) is common. Of bamboos, *Bambusa arundinacea* and *Dendrocalamus strictus* are most common. Climbers are numerous, the most noticeable being *Bauhinia vahlii*, *Milletia auriculate*, *Entada scandens* and *Combretum decandrum*".

A feature of the landscape of coastal Orissa which one could not miss is the numerous masses of water hyacinth covering almost every sheet of water whether in a tank or in a sluggish stream. The 400 acres water surface of Kausalyaganga tank, the very large tank at Danmukundpur, the entire Sar lake, nearly half of Samangapat and stretch of Athranala rivers were so choked with water hyacinth that it would be difficult to see the water surface. Through the efforts of Commissioner N. F. Peck, the Collector of Puri, the Subdivisional Officers, the District Board, the Zamin-dars and village Chowkidars, within 2 years all the water hyacinth was removed. Peck has given an account of the efforts for removing water hyacinth in Orissa in a booklet which was published by the Government. While administrative action was being taken to remove water hyacinth, Dr. P. Parija did some research to help the effort by removing the plant before the seeds had a chance of dropping into the water and germinating at the bottom of the lake. As soon as the seeds germinated the tender leaf would rise to the

surface and grow there. The advice was that the Plant should be removed from the water surface before the seeds formed. This was done and the success of the effort made in 1928-29 can now be seen in the clear water surface of sheets of water in the district.

In Nayagarh subdivision Sal (*Shorea robusta*) constitutes the principal species in the forest. The species generally found in association with Sal (*Shorea robusta*) are, Asan (*Terminalia tomentosa*), Bahara (*Terminalia belerica*), Harida (*Terminalia chebula*), Mahul (*Madhuca indica*), Jamu (*Eugenia jambolana*), Kendu (*Diospyros melanoxylon*), Piasal (*Pterocarpus marsupium*), Kasi (*Bridelia retusa*), Sidha (*Lagerstroemia parviflora*), Sisoo (*Dalbergia latifolia*), Bandhan (*Ougeinia dalbergioides*), Kumbhi (*Careya arborea*), Kurum (*Adina cordifolia*), Mitikinia, Kusum (*Schleichera trijuga*), and Sunari (*Cassia fistula*). The common shrubs are *Flemingia chappar*, *Indigofera pulchella*, *Wendlandia tinctoria*, *Woodfordia fruticosa*, *Ixora porviflora*, *Diospyros sylvatica*, Marda (*Millettia auriculata*), Siali (*Bauhinia vahlii*), *Butea parviflora* and Atundi (*Combretum decandrum*) are common climbers in the forests.

The chief timber trees are Sal (*Shorea robusta*), Piasal (*Pterocarpus marsupium*), Kurum (*Adina cordifolia*), Sisoo (*Dalbergia latifolia*), Bandhan (*Ougeinia dalbergioides*), and Asan (*Terminalia tomentosa*). The minor produce of local importance are Harida, Bahada, Anla, Kamalagundi, Sunari-bark, Kuchila, Broom-grass and Kendu leaves.

In Appendix I a list of principal vegetable products of the Puri district has been reproduced from "Orissa", by W. W. Hunter (1872).

Forest is mostly found in the Khurda and Nayagarh subdivisions. It extends in 1973 over an area of 3,173 sq. km. which is about 31 per cent of the district's area. Out of the total area reserved forests occupy 1,627 sq. km. and the balance of 1,546 sq. km. are covered by protected forests. Of the protected forests 664 sq. km. are demarcated and 882 sq. km. are undemarcated.

Forest belts
and area
covered

For administrative purposes the forest areas are formed into two divisions, namely, Puri and Nayagarh and are placed under the control of two Divisional Forest Officers with their respective headquarters located at Khurda and Nayagarh.

The forest division of Puri comprises 513 sq. km. of reserved, 333 sq. km. of demarcated and 518 sq. km. of undemarcated protected forests. The forests are usually seen on hills varying in elevation from sea level to 749 metres. The Nayagarh forest division consists of 1,114 sq. km. of reserved, 331 sq. km. of demarcated and 364 sq. km. of undemarcated protected forests.

Character of
Forest and
types of
vegetation

The forests of Puri Division fall under the classification of dry, evergreen or semi-evergreen and approximate more to the type met within the Carnatic sub-region than to the dry deciduous type prevalent in other parts of Bihar and Orissa. The presence of Sal (*Shorea robusta*) differentiates parts of the area and produces a type of forest, which contains species common to both the northern and southern tracts. In Puri division Sal has practically reached its south-eastern limit, which is found a short distance further south in Ganjam district. It cannot, therefore, be described as a climax type and is liable to be encroached upon and exterminated by the more luxuriant evergreen species if the balance is at all turned in their favour. The factors adverse to Sal (*Shorea robusta*) appear to be more climatic than edaphic.

Puri Forest Division may be conveniently divided mainly into two blocks, (A) area comprising the northern and central ranges and (B) the Banpur *mals*, which include Arang, Bankar, Tamna, Kotwal and Rajin blocks. Both the areas differ conspicuously in their flora and more prominently in their quality. The former is entirely of coppice origin, while the Banpur *mals* consist generally of high forest.

(A) The forests of the northern and the central ranges fall into three groups : (i) those which contain Sal (*Shorea robusta*), (ii) those in which Kongra (*Xylia xylocarpa*) forms the principal species and (iii) those consisting entirely of miscellaneous species without the Sal or Kongra.

(i) The Sal forest found in this region is of coppice origin (quality III-IV) and is entirely in the pole stage. It is found on the more level and almost invariably on laterite tracts. The growth is slow but the density is usually good and the crop is to a great extent homogeneous. It is generally found associated with Asan (*Terminalia tomentosa*), Mahul (*Madhuca indica*), Bahara (*Terminalia belerica*), Jamu (*Eugenia jambolana*), Tinia (*Albizzia lebbek*), Kendu (*Diospyros melanoxylon*) with an undergrowth of *Carissa spinarum*, *Flacourtia sepiaria*, *Maba buxifolia* etc. The assertion that Kongra (*Xylia xylocarpa*) is not found in association with Sal is not correct although it is not common in this type of forest, preferring the sand-stone formation.

(ii) The Kongra (*Xylia xylocarpa*) type of forests are found in parts of Chandka, Barapita and Tarkai blocks. All these areas are of Athgarh sandstone. The Kongra does not form a homogeneous crop and rarely constitutes more than 25 to 30 per cent of the growing stock, indeed the proportion is often much less. All the trees are in the pole stage. A tree of 12 inches (30 cm.) diameter is rarely found. Its common associates are Kasi (*Bridelia retusa*), Giringa (*Guazuma tomentosa*), Mai (*Odina wodier*), Kalchua, Kalicha, Dhaman (*Grewia tiliaefolia*), Tinia (*Albizia lebbek*), Anla (*Phyllanthus emblica*), Sidha (*Lagerstroemia parviflora*), Kumbhi (*Careya arborea*), Kuchila (*Strychnos nux-vomica*), Bel (*Aegle marmelos*), Bhenta, Sunari (*Cassia fistula*), Mangai and Panikodalo etc. The undergrowth consists chiefly of *Carissa spinarum*, *Flacourtia sepiaria*, *Randia malabarica*, *Webera corymbosa*, *Cipadessa fruticosa* and *Strobilanthes scaber*. A considerable amount of small variety of the thorny bamboo occur. Regeneration of Kongra (*Xylia xylocarpa*) and Giringa (*Guazuma tomentosa*) is usually good.

(iii) The forests consisting of miscellaneous species without Sal or Kongra are found mainly on the *gneiss* hills in Panchagarh, Bagapali, Sulia and Kuhuri blocks. They also occur in other localities such as Churang, Ranpur and Bharatpur blocks on sandstone. It is virtually the same as type A (ii) described above but without the Kongra (*Xylia xylocarpa*) and includes Niras, Dolanku, Ghontol, Karada (*Helicteres isora*), *Gelonium multiflorum*, *Euphorbias*, and in Bamnai block Chakundi (*Cassia tora*) is common. Most of these forests were reduced to scrub by incessant cutting and overgrazing prior to reservation. Gamble's report in 1881 describes the condition to which almost all the forests in the north of Khurda had been reduced.

(B) The Banpur *mals* fall under four distinct types :

(i) A distinctly evergreen type is found in Arang parts of Bankar on the lower slopes of Katwal, Tamna and Rajin blocks and in other small areas. There is no Sal (*Shorea robusta*). The trees commonly found are Amba (*Mangifera indica*), Rai (*Dillenia pentagyna*), Jamu (*Eugenia jambolana*), Kusum (*Schleichera trijuga*), Giringa (*Guazuma tomentosa*), Kalchua, Ojbhar, Asan (*Terminalia tomentosa*), Mankadakendu (*Diospyros embryopteris*), Champati (*Polyalthia cerasioides*), Halda, Kumbhi (*Careya arborea*), Kahsi (*Bridelia retusa*), Gaigutia, with Bheru (*Chloroxylon swietenia*), Ghonto, and Khair (*Acacia catechu*), on lime soils. The crop is very dense but apart from Mango (*Mangifera indica*) and Rai (*Dillenia pentagyna*) few large trees are found.

(ii) Sal forests mixed with evergreen species merging into dry mixed forest are found on the hills. This is found typically in compartments 4, 5, 6, 12 and 13 of Tamna and in several parts of Rajin Block. The Sal is usually of 2nd grade but occasionally attains 1st grade. Few trees of importance chiefly Mango (*Mangifera indica*), Rai (*Dillenia pentagyna*), Giringa (*Guazuma tomentosa*), Dhaman (*Grewia tilicefolia*), Kumbhi (*Careya arborea*) and Kusum (*Schleichera trijuga*) are found besides the Sal (*Shorea robusta*). Piasal (*Pterocarpus marsupium*) occurs locally but is rare. Thorny bamboos are generally abundant.

(iii) Dry mixed forest contains Salia bamboos. This type is chiefly found in the extreme western corner of the division in compartments 19 to 28 of Rajin Block. It is to a great extent beyond the influence of the sea breeze due to the existence of the high range of hills leading up to Khandabalo. This type closely resembles the dry forests of Singhbhum and Sambalpur and is hardly found in Puri division outside these compartments. Patches of Sal are found here and there in this area associated with dry miscellaneous species.

(iv) Ranpur Forests : These forests may be divided chiefly into the following four classes.

(a) Sal Forest : Sal occurs mainly in the mal block and is found best where the soil is deep. It also occurs in a part of the Patia block.

(b) Semi-evergreen type mixed Forest : It occurs in close proximity to the Sal and usually occupies the lower slopes of the hills. This type of forest is usually the result of repeated felling for toila cultivation. By the process, Sal has become almost extinct.

(c) Dry type mixed forest : It is commonly met with on upper hill slopes. Dhani, Champagada, Mainak, Satabhaya and Sulia blocks all contain this type. The growth all over is poor and the forests are more or less reduced to scrub.

(d) Bamboo Forest : Almost pure patches of bamboos can be found in portions of Patia and Dhani blocks. Salia bamboo occurs in very small quantities and is confined to the upper portion of the hills.

The Nayagarh forest division lies entirely within the Nayagarh subdivision. The reserved forests are almost entirely confined to hill ranges except a few blocks situated on plain tracts. The elevation varies from 46 metres along the bed of the river Mahanadi near Kantilo to 855 metres in Balimunda plain in the central block. The forest of this division can be broadly described as 'Tropical Moist Deciduous

Forest' with its variations based on local climatic, edaphic and biotic factors. Thus climatically in the more hind zone towards the south and south-east it tends to be semi-evergreen. Towards the north and north-west it gets less moist. Tropical moist deciduous forests are represented as 'Moist Sal' when conditions are favourable for the growth of sal which is considered as climatic climax. Similarly in favourable areas within the semi-evergreen zone, small patches of sal forest are present as a sub-climax. Edaphically moist mixed deciduous forests occupy the damper localities whereas the comparatively drier areas particularly the hill slopes with hotter aspects tend towards a dry mixed deciduous forest until one comes across the Ambalimba where a dry mixed forest and also dry sal in patches on favourable soils are met with as a result of biotic influence. Similarly other edaphic variations though not extensive in area are represented in patches as 'Bamboo Brakes', riverain moist deciduous and typical vegetations of the eroded areas. Also patches of 'Induced Scrub Forests' are present here and there as a result of biotic influence.

Thus the main types and sub-types of forests met within the division are as follows :

- (1) The Coastal Semi-Evergreen Forest occurs over a small part of the division adjoining the *mal* forests of Puri division.
- (2) The Coastal Sal Forests of limited occurrence found in Gochha block only.
- (3) The Moist Sal Forest occurs in almost all the blocks of the division except in Gochha and Ambalimba blocks. It forms about 25 per cent of the entire forest division.
- 4) The Moist Mixed Deciduous Forest, an edaphic sub-type of the main Moist Deciduous Forest type, occurs over a considerable part of the forests of this division and comes next in importance to Moist Sal Forest.
- (5) The Moist Bamboo Brakes, an edaphic sub-type, occurs distributed over portions of Pokhrigochha, central Chadeypalli, Baishipalli and Mahanadi blocks where soil conditions are somewhat dry on slopes.
- (6) The Dry Mixed Deciduous Forest does not occur as a distinct type but only as an edaphic sub-type of the Moist Deciduous type. This occurs exclusively over a small part of the forests in Ambalimba blocks.

- 7) The Dry Sal Forests, a sub-type, occurs only to a limited extent in Ambalimba block.
- (8) The Riverain Forest, a Scrub sub-type, occurs in small patches on the beds and banks of streams inside the reserve forest and also along the river Mahanadi.
- (9) The Induced Scrub Forest, a special sub-type considered as a biotic sub-climax, and occurs in parts of Hatimunda, Sulia, Gochha, Ambalimba, Chadesh, Denga, Bahada and Pitha-khati blocks.
- (10) The Forest on Eroded Lands occurs almost in all types and sub-types of forests described above.

Type of
vegetation

(1) Coastal Semi-Evergreen Forest : This forest contains deciduous trees mainly Sal (*Shorea robusta*) in the top storey and trees of evergreen species like Kanta bamboo and canes in the lower canopy and undergrowth.

(2) Coastal Sal Forest : The forest contains semi-evergreen Sal (*Shorea robusta*) mixed with miscellaneous species in the top storey and Salia and Daba or Kanta-bamboos and many evergreen small trees and shrubs in the under storey and undergrowth.

(3) Moist Sal Forest : Sal (*Shorea robusta*) is the most important characteristic species of the type and tends to occur gregariously.

(4) Moist Mixed deciduous Forest : Sal is almost scarce and there are a number of dominant species like Asan (*Terminalia tomentosa*), Dhaura (*Anogeissus latifolia*), Kuruma (*Adina cordifolia*), Barahbakla etc., interminably mixed.

(5) Moist Bamboo Brakes : Only one species of bamboo namely Salia forms these bamboo brakes.

(6) Dry Mixed Deciduous Forest: The canopy is entirely formed of deciduous trees like Sahaja (*Terminalia tomentosa*), Chara (*Buchanania latifolia*), Karada (*Helictares isora*), etc.

(7) Dry Sal Forest : Sal of low quality occurs in these areas mixed with other species and the crop is open.

(8) Riverain Forest: The characteristic species found are Fasi, Arjun (*Terminalia arjuna*) and Pani Gambhari (*Trewia nudiflora*), etc

(9) Induced Scrub Forest: The main tree growth is poor and open and the forests have a dense undergrowth of species which are thorny and not palatable to the cattle and is fire hardy. *Zizyphus*, *Gardenia* and *Flacourtia* are the main species.

(10) Forest on Eroded Land: Here Sal is of sporadic occurrence, stunted and diseased. Suam (*Soymida febrifuga*), Khaira (*Acacia catechu*), Gohira, etc., are the commonest species occurring in these areas.

Besides the natural forests described above, there are about 6,880 hectares of artificially raised teak plantations in the district, of which 6,070 hectares are in Puri division and 810 hectares in Nayagarh division. The old plantations of the former division are being exploited at present.

Puri Division: It was presumably on the advice of Gamble that the first attempt was made to grow teak (*Tectona grandis*) on Barunai Hill in 1884-85, when 28 hectares were planted. In the following year, it was extended by a further 25 hectares and by 1889-90, the total area of this plantation was 112 hectares. Other areas were planted in Chandaka, Chudanga and Barapita blocks between 1886 and 1904. In spite of the poor soil the experiment in these localities succeeded and the plantation of Barunai Hill is a fine example of what teak can do under distinctly moderate, if not favourable conditions. Gamble describes the original crop on Barunai Hill as thorny scrub. At present the area outside the teak plantation consists of dense masses of thorny small trees and shrubs rarely exceeding 4 to 6 metres in height. The teak (now more than 45 years old) attains a height of 21 metres and a diameter of about one metre at the foot of the hill. Higher up on the rocky slopes the growth is poorer but it infinitely surpasses the original growing stock. Even along the crest of the hill it attains 20 centimetres diameter and 9—11 metres height.

Teak
plantation

The first plantation raised at Ankula in 1904 was only two acres in extent. Regular plantation work at Ankula near Berbera commenced in July 1905 under the prescriptions of the second working plan. The seed was obtained from Burma. The plantation in 187 hectares of land was completed by 1909 in the vicinity of Ankula and Berbera in Rajin block.

In 1910 it was decided to plant 6' X 6' (1.8 X 1.8 metres), and an experiment was carried out to determine the results of direct sowing. This proved successful and the results were excellent, but in 1914-15 there was a reversion due to the use of nursery transplants instead of direct sowing. Planting between the old lines continued until 1917-18

when stocking was considered to be complete. Thus there is a difference of some 12—13 years between the former and latter plants. Still it is remarkable how the plants put out between the lines have caught up with the older crop in many instances. Extension of this plantation continued until 1920 when the centre of operations moved to Dhuannali. Seeds of Dhaman (*Grewia tiliifolia*), Sisso (*Dalbergia latifolia*), Piasal (*Pterocarpus marsupium*) and Toon (*Cedrela toona*) were raised in a nursery and transplanted in 1916—18, but the process was not very successful.

The year 1919 saw the commencement of efforts to raise teak together with field crops by the *toila* method, areas being given out to villagers in Banker, Arang and Tamba blocks. Seed from Nilambur and Sambalpur was used besides the Burma seed. That from Sambalpur proved a complete failure.

The total area of plantation in the southern range in 1931 amounted to 554 hectares, those of the northern and central ranges aggregating 174 hectares, omitting small patches of less than 5 hectares. So the total area planted with teak amounts to 728 hectares.

Timber from the Berbera plantation was tested at Dehra Dun in 1929 and the results published in the Indian Forester of October, 1930. The tests proved that the Puri teak compared favourably with that of Burma.

Ranpur ex-State: At the suggestion of the Forest Adviser a teak plantation was raised in the year 1942-43 in the Mal block near the village Lakmudi. The crop here consists of miscellaneous evergreen type and the object of this plantation was to convert this useless forest into valuable teak forests. The method employed was to raise teak by root short cutting by *tanngya* system. The plantation work has not progressed far but from the results so far obtained, it can be safely said that very valuable teak can be grown here. Five year old teak plants are about 7.5 metres high and 15 inches (0.45 metres) in girth. More attention will have to be paid to the work. During the year 1946-47, instead of root-and-shoot method of planting, the *dona* system was employed and the results were very poor. There were no plants for stumping in 1947; and further plantations had to wait for one year. Between 1942 and 1946, 14 hectares were planted at a cost of Rs. 443. In 1946, 9 hectares were planted by the *dona* method and the results were most disappointing. Whenever plants were raised in proper nurseries and stumps put out in good time, the results were excellent.

Nayagarh ex-State: Teak plantation was started in a small scale in 1907 and an area of 7 hectares was planted between 1907 and 1911 in Badruma area. Another plantation was formed in Bhogra between 1914 and 1920. A total area of 34 hectares of teak was planted up to 1924 when this was abandoned on the advice of the Forest Adviser Dr. H. F. Mooney, I. F. S. Working plan for the Reserved Forests was preferred in 1941 (1941—61 period). Then teak plantations have been taken up quite extensively during the current plans since 1960-61.

The idea of forming a fuel plantation to supply the town of Puri was originally conceived in 1913 by the then Conservator of forests, Carter. The original site of 300 acres acquired was planted within the period from 1915 to 1919 although it was originally contemplated to cover about 4 hectares annually. Similarly between 1920 to 1922 a further area of 656 hectares was covered. With the casuarina some *Poonang* were also planted over a limited area which were not very promising. Subsequently it was felt necessary to raise a coastal belt plantation along the entire coast of the district to prevent sand-dunes, cyclone and tidal water damaging agricultural fields and villages. Now there are about 2023 hectares of casuarina plantation in the division.

Casuarina
Plantation

The difficulties such as heavy casualties, attack of pest and acidity of soil, etc. involved in the process were investigated into and have since been overcome. More and more areas are brought under this plantation as it was proved paying. Exotics were replaced where casuarina did not thrive.

The first plantation at Konarak was started in 1947. In the year 1950, the Konarak Temple Committee with a view to protecting the Konarak temple, recommended to the State Government to take up casuarina plantations in a large scale around the temple. Although at the beginning it received some amount of set-back due to acquisition of further areas, the scheme started vigorously and till today an area of about 5,520 hectares is under casuarina plantation. Besides, 146 hectares of land are now under cashew-nut plantation.

In Chilka area about 785 hectares are covered by casuarina and 42 hectares by cashew-nut plantations.

The following is an account of the policy of the ex-rulers of Nayagarh, Daspalla and Khandapara with regard to forests prior to merger.

Broad effects
of Govern-
ment Forest
Policy

Nayagarh: Prior to 1881 the forest establishment consisted of one man on a monthly salary of Rs.15. He looked after the forests within a radius of 3 miles to the Garh, the area being known as Garharah. An annual cess of one anna 9 pies was levied on each household. There was no control extended over the forests outside the area, and no management worth the name existed. In 1881 the cess was extended to the whole State. Shifting cultivation or *taila* along with the unrestricted use of forest materials by Kandhas, made serious depredation in the hill forests. In 1891 Raja Raghunath Singh introduced certain forest rules. In 1896 the forests were divided into Vithar and Bahar, and forest staff were appointed. Timber contractors made their debut in the State in 1890, at the time of construction of the East Coast Railway. The following extract from A.H.Mee's report in 1904 is interesting. "The cutting of forest is not regulated or supervised and the contractors have, as might have been expected, done immense damage". The cutting of young sal for conversion into sleepers had caused great loss. It is clear that the forest staff existed solely for revenue collection and that no silvicultural work of any kind was undertaken nor indeed was any effort made to prevent damage done to the forests by the timber contractors" A set of rules was prepared by Mee in 1904 for all the State forests and complete reorganisation of the department followed. Demarcation and survey was taken up between 1905 and 1910. Further revision of rules and reorganisation of the staff were made by A. M. Grieve, I. F. S., the Agency Forest Officer, in 1911. Teak plantation amounted to 83 acres and the credit for the plantation goes to A. C. Mohanty who was Ranger and subsequently Forest Officer from 1907 to 1922. Plantation work was abandoned in 1924 on the advice of Mooney, thinning was prescribed and done which wrought a most remarkable improvement in the plantation.

A very constructive policy was followed between 1910 and 1924 with the object to permit forests to recover from the past ill-treatment and over exploitation.

A sample working plan was prepared in 1930 which incorporated the small felling schemes in force since 1924, and provided for the working of larger block. Under the selection circle further coppice coupes were opened and prescriptions for regular climber cutting and improvements were made. Five working circles were formed in 1940 by H. F. Mooney in his working plan for the period 1941 to 1961. The selection working circle consisted of hilly and inaccessible areas where no clear felling system was applied. The system

of felling adopted was selection to be followed by improvement. The coppice working circle consisting of an area of 4,590 hectares adopted a system of simple coppice with reserves. The reserves being kept with the sole purpose of producing seeds, to supplement coppice regeneration and seedling regeneration. The bamboo working circle covered an area of 7,828 hectares and was divided into 4 felling series. The cutting circle was fixed at 4 years and the annual coupes were equal in area. Definite cutting rules were also prescribed. No definite areas were allotted to the teak working circle. The usual technique of planting and cultural operations were prescribed. The miscellaneous working circle covered an area of 12,793 hectares. No regular felling was prescribed and subsidiary silviculture was adopted. Grazing was permitted in all the working circles except the teak working circle. Adequate precautions were taken to exclude the fire entering into the plantation and all the working circles were kept well protected.

Daspalla : The forests of Daspalla came under the management of Government in 1913 on the death of Raja Narayan Bhanj. The State had a considerable Kandha population who had succeeded in course of centuries in cutting the greater part of the jungle by shifting cultivation. The bamboo forests are supposed to have grown after depredation of the forest area by shifting cultivation. During the time of Raja Chaitanya Deobhanj (1873-1897) forest administration received little attention, and valuable forests were relentlessly exploited. The royalty paid by the contractors from Ganjam and Madras side who exported the sleepers during 1895 to 1900 was rather insignificant. During 1913 to 1924, A. N. Grieve, I. F. S., proceeded to select and demarcate the reserves and introduced some sort of order. Forest rules were first published in 1924, and in 1925 the systematic forest operations were undertaken. In 1931 experiments were made to work in two selected areas for coppice, bamboos were extracted from river side forests by petty contractors for Cuttack market, and concessions were granted to the Titaghur Paper Mills. In 1933 a very great improvement in management of valuable bamboo forests took place. In 1934, 9 blocks were reserved in class 'B' reserves for use by local people. But these blocks remained closed as the village or Khesara forests were adequate. The first working plan was prepared by Mooney for the period 1933 to 1953. Three working circles were formed, the high forest working circles included the bulk of the more important State forests consisting of an area of 49,340 hectares. Unsystematic and irregular fellings were done before merger and no subsidiary silvicultural operations were undertaken, but after merger

matters improved in as much as all irregular fellings and over-fellings were stopped. The coppice working circle covered an area of 2,072 hectares. During 1928 to 1947 only four coupes could be sold, but after merger annual coupes were demarcated and opened for the tenants to remove their requirements and remaining materials were sold to contractors. The bamboo working circle covered an area of 62,916 hectares. Regular felling prescriptions were introduced all over the block allowing old bamboos above 3 years to be removed. Definite cutting rules were also prescribed for the purpose. One forest block, namely Ambalimba, was reserved in the year 1945. It is a fact that prescriptions of the working plans were rarely followed except in coppice. Before merger small patches of forest lands were leased out for extending cultivation. The villages inside the reserves, which had been deserted during Kandha rebellion were resettled. The villagers who were leased out lands inside, had not demarcated their lands from the surrounding forests. It led to cultivation and encroachment of land inside reserve forests. Efforts were made after merger to regularise the matter.

Khandapara : Prior to 1890 the forest establishment consisted of 2 *karjis*. No forest management or protection of any kind appears to have been extended to the forest tracts outside the Garh area. The Garh area was reserved for shooting expeditions of Raja Natabar Singh, a noted Shikari. Boundaries between this State and Nayagarh were demarcated during the reign of Raja Ram Chandra Singh. Mooney visited the State in 1924 when demarcation and survey of the block were taken up and the staff was reorganised. A set of forest rules was published. He also prepared the working plan in 1936 for the period 1936 to 1946 and 4 working circles were formed. The coppice working circles covered 4,760 hectares, the system of working was simple coppice with a few seed bearers. Rotation of the felling series was fixed at a fixed number of years with a view to increasing the proportion of the valuable species in the existing crops and to fill the blanks. Subsidiary silvicultural operations like thinning, clearing and climber cutting were prescribed. Coupes under 10 years old were protected from fire. The high forest working circle covered an area of 6,817 hectares. A felling series was formed and the felling cycle adopted was 20 years. Definite marking rules were prescribed and subsidiary silvicultural operations like improvement in felling were prescribed. Grazing was permitted under restrictions. The miscellaneous working circle covered an area of 1,947 hectares. Climber cutting was prescribed. Rules for protection from fire and from grazing under concessions were introduced. The bamboo working circle overlapped the whole

of the high forest working circle and part of the coppice working circle. The cutting cycle was fixed at 4 years, and definite cutting rules were laid down.

The working plan drawn up by Mooney for the reserved forests of 3 ex-State areas was neither detailed nor adequate. Proper Topo maps were not prepared. In the absence of proper safeguards heavy fellings were done in some working circles. The felling series was too large to work conveniently. Teak plantation did not succeed as suitable areas were not indicated. No special provision was made in his working plan to meet the requirements of timber for the construction of the car of Lord Jagannath, and of the turnery industries at Khandapara. Systematic management of some important and minor forest produces like canes, Khair etc., were not prescribed. The rules of management have, however, undergone a reorientation after merger, with the application of the provisions of the Indian Forest Act and with the formulation of the comprehensive working plan for the reserved forests of Nayagarh Division for the period 1960, 1961, and 1971 to 1980. Most of the A class reserved forests were declared reserved by the Political Agent and Commissioner, Orissa Feudatory States, from time to time. On the merger of the ex-States on the 1st January 1948, Indian Forest Act was extended to these ex-States. Subsequently section 20 of the Indian Forest Act was amended by the State Government in order to give legal status to these forests without undergoing the formal procedure of reservation as laid down in the Indian Forest Act. The State Government had certified the working plan for the reserved forests of Nayagarh State for the years 1941 to 1961, and the working plan for Daspalla State for the years 1938 to 1953, prepared under the authority of the rules of the respective ex-States. This means that only those reserved forests which have been mentioned in the above working plans will be treated as such and the blocks of the forests reserved after the working plan was sanctioned, will not legally constitute reserved forest and also the reserved forest blocks dereserved after the working plan came into force will not be taken as reserved forests. The working plan for the reserved forests of Khandapara State for the years 1936 to 1946 still remains to be certified. All these lacunae with regard to the legal status of the forest blocks, constituted as reserved during Durbar administration, should be filled in as early as possible.

There were three different sets of forest rules in force in the ex-States of Nayagarh, Daspalla and Khandapara. Though these rules varied slightly in details, in essence, they were the same and

defined mostly the rights and concessions allowed to the local people. In A class reserved forests no rights and concessions were allowed to the local people. The forests were worked according to the prescriptions of the working plan in force from time to time. As per prescriptions of the working plan cuttings had been made from the reserved forests on the sustained yield basis and there were no excessive removals in the past. In fact, there were some inaccessible forest blocks which now contain virgin forests because these could not be worked in the past for want of extraction facilities. At present attention is being given to open up new lines of communications to these inaccessible areas so that these forests could be worked to augment the forest revenue. In the present working plan which came into force with effect from 1960-61 the chief objects of management are—(i) to maintain a permanent vegetative cover in order to conserve soil and water ; (ii) to provide for the needs of the local population i.e., for firewood, bamboos, and grazing; (iii) to meet the needs of the cottage industries as well as the big industries (iv) to meet the annual requirements of timber for the construction of the car of Lord Jagannath at Puri ; (v) to improve the existing growing stock by proper scientific management and the introduction of valuable species and (vi) to obtain the highest possible financial out-turn on sustained yield basis.

In the B class reserved forests of Daspalla and Khandapara ex-States (there were no B class reserved forests in Nayagarh ex-State) the cess paying tenants and other persons were provided, in the ex-State forest rules, the right to remove the reserved species at the concessional rates and the unreserved timber species and other minor forest produces free of cost for their *bona fide* domestic consumption on certain obligations like extinguishing fire, etc. In Daspalla ex-State there was hardly any demand for forest produces in B class reserved forests because of the availability of these produces in the protected forests. In the present working plan annual coupes are laid down and the tenants are permitted to take their requirements after which the materials left are sold to the contractors by public auction. In Khandapara ex-State the same procedure is being followed but here the materials available in the B class reserve are not sufficient to meet the local demand. In the present working plan provision has been made to improve the growing stock by artificial means so that the entire demand can be met.

In the Khesra forests the tenants have the rights to remove all the forest produces except trees of reserved species which can only

be removed on payment of prescribed fees after obtaining a permit. In Nayagarh and Khandapara ex-States these Khesra forests have been more or less depleted because of unregulated and excessive removals in the past. Attention is now being paid to demarcate these forests and declare them as demarcated protected forests so that these forests may be afforested with suitable species to meet the local requirements. In Daspalla ex-State there are sufficient Khesra forests to meet the local requirement.

The object of the present policy of the Government is to have at least one-third of the total land area under forest and to bring these forests under scientific management. In pursuance of this policy the reserved forests have been worked under working plans since 1904 in Puri division, and 1924 in Nayagarh division. During this period annual growth from the forests were taken out keeping the capital in tact and improving the density and quality at various places by rigid protection and plantations. In fact, the extent of plantation of teak and casuarina has gone up by 607 hectares annually. The old scrub forests are now covered with natural tree growth which meet the increasing demand for timber and firewood of the people. The shifting sands of the coast have been covered with casuarina plantations thereby bringing extensive acres along sea coast under cultivation apart from meeting the actual demand of firewood in the coastal plains, and encouraging the local people in raising their own plantations. The large tracts of unreserves have been demarcated and are being worked under scientific management thereby ensuring supply of forest produce in perpetuity. Nature has been very kind to Puri by granting rainfall distributed practically throughout the year. And this aspect has been utilised in extending the forests and developing such areas which contained shrubs only in the past.

It has been recognised that fire protection is the *sine qua non* for efficient and effective recruitment of natural regeneration of forests. Fire protection measures are taken up systematically by clearing and burning fire lines round the reserved and protected forests and through various other methods. A series of fire watchers are maintained to intimate the authorities of any outbreak of fire and to organise immediate fire fighting squads. The result of fire protection measures is evident from the natural regeneration seen in the forests.

The rulers of the ex-States had made their own shooting rules for the preservation of wild life. There were only one set of shooting rules applicable to all the reserved and Khesra forests. Shooting in the forests was the prerogative of the ruler or his few close friends.

Game Laws
and Measures
for the
Preservation
of Wild Life

Shooting rules were very rigidly enforced and the common people found shooting were severely dealt with. As a result, the wild animals were then plentiful even in the Khesra forests. With the merger of the ex-States, the Acts and Rules promulgated in place of the previous shooting rules are Elephant Preservation Act, Wild Birds and Animals Preservation Act, Orissa Reserve Forest Shooting Rules and Indian Arms Act.

Though these acts and rules were enforced, killing of wild animals for crop protection was simultaneously allowed as a result of which in the name of protection of crops many wild animals were killed for meat and hide. Also with the passage of years more wild animals were killed with the aid of fast moving vehicles and artificial lights. Though the acts and rules regulating hunting and shooting were introduced, no effective steps could be taken to enforce them. Unlike under the Durbar Administration, Rules for shooting and hunting were not enforced in the forests other than reserved forests and for this defect in the law many wild animals were killed inside the Khesra forests. It was also difficult to detect many of the illicit shootings inside the reserved forests. All these have led to the wanton destruction of wild life.

Some of the wild life such as black buck (*Antelope cervicapra*), wild buffalo (*Bubalus bubalis*), green pigeon (*Treron phoenicoptera*), Kochilakhai (*Tockus birostris*), mouse deer (*Tragulus meminna*) and porcupine (*Hystrix indica*) are becoming rare in the forests. To protect them from total extinction the whole of the Mahanadi block and a portion of Baishipalli block adjoining it comprising an area of 94.8 sq. km. has been declared as a sanctuary since 1962 known as the Mahanadi and Baishipalli sanctuary. It can be reached by jeep from the Khurda railway station, the most convenient time being November to June.

Puri division is one of the oldest divisions and almost right from the inception game laws were introduced to protect fauna. Shooting permits were issued to a limited extent in due consideration of the incidence. Unfortunately, in spite of the game laws the number of fauna, particularly the herbivorous ones in the Chandaka range, has gone down considerably due to the in-rush of unprincipled poachers from Cuttack. In Chandaka, an area comprising 31 sq. km. has been declared a game sanctuary since 1935. It has now been constituted a zoological park where elephants, tigers, panthers, leopards and other categories are available. In the reservoir recently constructed in the

park, game birds have started coming. The hornbill, which is threatened with extinction due to its high demand in Ayurvedic medicines, rarely occurs. It is recently declared as a protected bird. Black bucks (*Antilope cervicapra*) which are also nearing extinction are found in the newly raised casuarina forests. Since 1935, the Balukhand sanctuary has been established to offer protection to the black buck. The Chilka lake, recently declared a birds' sanctuary, continues to attract birds in innumerable number from far and remote sub-tropical and temperate zones.

The Orissa Forest Act, 1972 (Act 14 of 1972) and the Orissa Forest Shooting Rules, 1973, made thereunder, are recently promulgated in the entire State. They apply to all the reserved and protected forests. The shooting rules repeal the corresponding rules made under the Indian Forest Act, 1927 (Act 16 of 1927) and the Madras Forest Act, 1882 (Madras Act 5 of 1882). They aim at controlling and regulating the hunting, shooting, fishing, etc., of wild life in the reserved and protected forests. Under these rules hunting and shooting any game during the close season are strictly prohibited. In the Schedule III of these Rules are mentioned the protected species throughout the year.

In this district forests are limited to Khurda and Nayagarh subdivisions. In the dense reserved forests one occasionally meets with one or two Royal Bengal tigers (*Panthera tigris*) which actually visit the place covering from nearly Tikarpara forests of Dhenkanal district. Their number is practically depleted due to the diminishing size and density of the forest. Although according to the Census of December, 1968, their figures returned as 28, in the enumeration in May, 1972, it was reduced to 7 only, 5 in Puri and 2 in Nayagarh subdivision. Occasionally these tigers become man-eaters as a matter of chance and necessity. The leopard (*Panthera pardus*) is found in all small or big forests. It sometimes creates havoc by constantly attacking domestic animals. The hyaena (*Hyaena hyaena*) and wolf are present in all parts of the district in forest areas as well as in small bushy tracts. The jackal (*Canis aureus*) is numerous in all parts of the district. The wild dog (*Cuon alpinus*), once very common, is now restricted to very thick forests. They really are very destructive to the game animals. The sloth bear (*Melursus ursinus*) inhabits the small or big forest areas full of little rocky hills. Occasionally there has been cases of bear attack on man leading to fatality even though the bears are nocturnal. Among the herbivorous which are of special interest to man as game animals are Sambar (*Cervus unicolor*), spotted deer (*Axis axis*), barking deer (*Muntiacus muntjak*), mouse deer (*Tragulus meminna*), black buck (*Antilope cervicapra*) and bison (*Bos gaurus*). In the recent past there has been a great attempt to chase and kill these animals for

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food and pleasure and hence their number is greatly reduced. Sambar are found in the thick reserved forests. Spotted deer and barking deer mostly inhabit the forest borders where they get plenty of seasonal crop plants. Mouse deer are found in the stony and hilly parts of forests. The bisons are found in the thick forests of Nayagarh and Banpur. The black buck which is already declared as a protected species is restricted to the casuarina forest belt near the sea coast. The four-horned antelope (*Tetracerus quadricornis*) is found in few herds near the Chilka lake. They are in the list of rare species. In the jungle area wild boar (*Sus cristatus*), porcupine or Jhinka (*Hystrix indica*) and giant squirrels (*Ratufa indica*) in large numbers are met with. The specimens like Civet, Indian ant eater (Bajra Kaptā) and otter (*Lutra perspicata*) are nocturnal animals. In the forest areas as well as in the towns and rural areas the black-faced monkey (*Presbytes entellus*) and the red-faced rhesus monkey (*Macaca mulatta*) are usually met with. The wild elephant (*Elephas maximus indicus*) is common in all the forests and is found in paddy fields in the harvest season. The Nilgai (*Boselaphus tragocamelus*) once found towards the southern boundary of the Khurda subdivision is no longer seen in the forest division of Khurda.

Birds

In game and other birds the district is fairly rich. Various kinds of game birds abound in the Puri and Nayagarh forests. The Chilka lake forms an abode for numerous species of migratory and other birds. Among the game birds mention may be made of the common peafowl (*Pavo cristatus*), red jungle fowl (*Gallus gallus*), red spurfowl (*Galloperdix spadicea*), black partridge (*Francolinus francolinus*), grey partridge (*Francolinus pondicerianus*), common grey quail (*Coturnix coturnix*), Indian button quail (*Turnix tanki*) and bustard (*Otis nigriceps*). These common ground birds generally occur in the forests. The grey hornbill (*Tockus birostris*) and the Malabar Pied hornbill (*Anthracoceros coronatus*) of great medicinal value, are also found in the forests. The racket-tailed drongo (*Dicrurus paradiseus*) and the hill myna (*Gracula religiosa*) are popular for their power of vocal mimicry. The common and fantail snipe (*Capella gallinago*) and painted snipe (*Rostratula benghalensis*) occur in the lake as well as river sites only in seasons.

In winter, besides the indigenous species, flocks of ducks and enormous number of various species of birds visit Chilka every year. The vast blue expanse and the innumerable number of birds of different kinds, forms and hues with their discordant music and unpredictable movements combined together lend the lake a splendid colour and convert it to a spot of lively fine beauty. The hill islands

in Chilka serve as the breeding ground of several species of birds. Among them mention may be made of white-bellied sea eagle (*Haliaeetus leucogaster*), the Panikua or the little cormorant (*Phalacrocorax niger*), the Gendalia or the open-bellied stork (*Anastomus oscitans*), the grey heron (*Ardea cinerea*) and the common herons. The common winter visitors are, the grey duck (*Anas poecilorhyncha*), the cotton teal (*Nettapus coromandelianus*), the greylag goose (*Anser anser*), the barheaded goose (*Anser indicus*), the ruddy sheld-duck (*Tadorna ferruginea*), the blue-winged teal (*Anas querquedula*), the common pochard (*Aythya ferina*), the redcrested pochard (*Netta rufina*), the white-eyed pochard (*Aythya nyroca*), the golden plover (*Pluvialis apricaria*), the little ringed plover (*Charadrius dubius*), the common sheld-duck (*Tadorna tadorna*), the common green pigeon (*Treron phoenicoptera*), the osprey (*Pandion haliaetus*), the eastern golden plover (*Pluvialis dominica*), the kentish plover, the curlew (*Numenius arquata*), the gadwal, the wood sandpiper, the redshank, the greenshank, the great black-headed gull (*Larus ichthyætus*), the black-headed gull (*Larus ridibundus*), the Chakua-Chakoi or the Brahminy duck (*Tadorna ferruginea*) and the lesser whistling teal (*Dendrocygna javanica*). Once extremely common, the bar-headed goose seems to have dwindled very greatly and only a few visit Chilka at present in winter. The Brahminy duck are found on the sandy margins of the lake in pairs and separate themselves at night.

Of the reptiles the crocodiles are restricted to the south-eastern parts of this district in the Devi river, a branch of the Mahanadi. The common ones are the Gharial (*Gavialis gangeticus*) and the species *Crocodylus palustris*. The Gharials are popularly called as Ghadial, Sankhua and Thantia by the local people. The Gharial is primarily a fish-eater. The crocodile attacks domestic animals and occasionally man. Reptiles

A very common animal in the villages of Puri district was the Godhi or monitor lizard (*Varanus monitor*). On account of the use of its skin for lady's hand bags, it has been mercilessly slaughtered. Where there used to be a Godhi almost in every bush, it is now difficult to find one in a village. The type species of the genus *Barkudia insularis annandale* was described from a specimen collected from the Barakuda Island of the Chilka lake by Annandale. It attains a length of $4\frac{1}{2}$ inches (about 11 centimetres) and burrows with great rapidity into the earth. The Pohala Endua or chameleon (*Chamaeleon zeylanicus*) is common in wooded areas.

Various species of snakes occur in the district. Death due to snake-bite is fairly high. In the plains as well as in hill tracts the Ahiraja or king cobra (*Naja hannah*) is common. Both the varieties of cobras

locally known as Tampa (*Naja naja kaouthia*) and the Naga or Gokhara (*Naja naja*) are quite common. The Kaudia Chiti or the common krait (*Bungarus caeruleus*) and the Rana or banded krait (*Bungarus fasciatus*) are also found. Besides, many other poisonous snakes are also met with. Principal among the non-poisonous snakes in the district are the Ajagara (*Python molurus*), the Dhamana (*Ptyas mucosus*) and the Dhanda (*Natrix piscator*). The python occurs on the rocky areas.

Fish

The Chilka lake forms a storehouse of fishes abounding in mullets, pomfrets, besides many other varieties. Shoals of hilsa are found to migrate upstream the river Daya. Besides these, the lake also abounds in prawns and crabs which form delicious dishes for the consumers. The whole of the sea-shore lining the southern boundary of the district attracts Nolias and fishermen to catch fish by netting. The Fisheries Department of Government also have started deep sea fishing in the sea. Sardines, pomfrets, and soles form the greater share of the fishes. In the net collection one can see the variety of invertebrate fauna including sponges, jellyfishes, corals, molluscan shells, star fish and arthropods like crabs and prawns. Sharks and rays caught in the net are processed chemically for collection of shark liver oil by the Government departments.

A list of fishes found in Puri district arranged according to the habitation in fresh, brackish or marine water is given below. Their local names are also indicated against each.

Fresh water : *Catla catla* (Bhakur), *Labeo rohita* (Rohi), *Labeo calbasu* (Kalabainsi), *Cirrhina mrigala* (Mirkali), *Cirrhina reba* (Pohala), *Labeo bata* (Raj pohala), *Wallago attu* (Balia), *Mystus aor* (Adi), *Ophicephalus striatus* (Seula), *Notopterus chitala* (Chitala), *Anabas scandens* (Kau), *Clarius batrachus* (Magur), *Barbus* species (Kerandi), *Barbus tor* (Baisali), etc.

Brackish water : *Mugil cephalus* (Khainga), *Liza troschelli* (Dangala), *Chanos chanos* (Seba khainga), *Lates calcarifer* (Bhakti), *Sciaena russelli* (Boraga), *Penaeus carinatus* (Bagda chinguri), *Penaeus indicus* (Kantal chinguri), *Hilsa ilisha* (Ilishi), etc.

Marine Fish : *Sciaena glaucus* (Borai), *Sciaena indicus* (Borai), *Sardinella fimbriata* (Kabla), *Kowala coval* (Kabla), *Thrissocles* species (Chowli), *Carcharhinus gangeticus* (Munda Magara), *Carcharhinus limbatus* (Mota Magar), *Pristis* species (Khanda Magar), *Galeocerdo rayneri* (Baghua magara), *Trygon sephen* (Sankucha), etc.

Formerly the district got rare visits of swarms of locusts. The number was also not so high as to destroy substantial quantity of crops. In the year 1960 swarms of desert locusts in incalculable number visited the whole of Orissa including this district and damaged the rice and pulse crops.

Locusts and Butterflies.

W. C. Taylor, I.C.S., Settlement Officer, had in the year 1888 compiled a small booklet on the butterflies of Khurda subdivision. A list of the rare and important species from the booklet is reproduced in Appendix II.

Mortality from reptiles and wild animals occurring during the period 1968 to 1973 is given in the table below * :

Year	Death due to snake bite	Death due to attack of wild animals				Total
		Elephant	Tigers/leopards and others	Bears and wolves	Other wild animals	
1968	48	3	1	..	2	54
1969	37	2	..	..	3	42
1970	39	1	1	..	1	42
1971	26	2	..	..	1	29
1972	35	1	..	..	2	38
1973	31	..	..	..	1	32

The deltaic regions of the district enjoy an equable temperature all the year round. In the inland hilly tracts, the climate is comparatively drier with higher temperatures in the hot months and a slightly cooler winter. The cold season is from December to February followed by the hot season from March to May. The period from June to September is the monsoon season while October and November constitute the post-monsoon transition period.

CLIMATE

Records of rainfall in the district are available for 15 stations for periods ranging from 25 to 70 years. Details of the rainfall at the 15 stations and for the district as a whole are given in Tables 1 and 2. The average annual rainfall in the district is 1488 mm. (58.58"). The

Rainfall

SOURCE—Superintendent of Police, Puri.

(8 Rev. 7)

rainfall generally decreases from the north-east to the south-west. Pipli and Gop in the north-eastern part of the district get respectively on an average 1923 and 1693 mm. of rain in a year, while Banpur in the south-west gets 1361 mm. of rain. The monsoon arrives over the district by about the second week of June and withdraws early in October. About 74 per cent of the annual rainfall is received during the monsoon months from June to September, July being the rainiest month. The variation from year to year of the average rainfall in the district is not large. During the fifty year period from 1901 to 1950, the highest annual rainfall in the district amounting to 140 per cent of the normal occurred in 1936. The lowest annual rainfall which was 78 per cent of the normal fell in 1905. Considering the district as a whole, there were only two years in which the rainfall was less than 80 per cent of the normal. At a few individual stations rainfall below 80 per cent of the normal has occurred in two or three consecutive years. At Kakatpur, the five year period from 1926 to 1930 was one with rainfall less than 80 per cent of the normal in each of the five years. It will be seen from Table 2 that in 36 years out of 50 the rainfall was between 1200 and 1700 mm.

On an average there are 71 rainy days (days with 2.5 mm 10 cents or more of rain) in a year in the district. This number varies from 83 at Daspalla to 60 at Kakatpur.

The highest rainfall in 24 hours which fell at any station in the district was 480.1 mm. (18.90") at Puri on 1862 October, 21.

Temperature

Records of temperature and other meteorological conditions available for Puri and Bhubaneswar have about seven years of data. The conditions at Puri may well be taken as representative of the deltaic region while these at Bhubaneswar, of the interior of the district. The period from March to May is one of continuous increase of temperature and May is the hottest month. The mean daily maximum temperature in that month is 31.9°C (89.5°F) at Puri and 38.0°C (100.4°F) at Bhubaneswar. On individual days the maximum temperature sometimes reaches 42°C (108°F) at Puri and 45°C (113°F) at Bhubaneswar. With the arrival of the monsoon by about the middle of June, temperature drops considerably in the interior of the district, but the drop is small in the coastal areas. With the withdrawal of the monsoon towards the end of September, the coastal areas experience a slight increase in the day temperatures. In the interior of the district both day and night temperatures begin to decrease gradually till December which is the coldest month. The mean daily minimum temperature in that month at Puri is 17.1°C (62.7°F) and 15.7°C (60.3°F) at Bhubaneswar. On some days the minimum temperature goes down to 10.6°C (51°F) in December and January at Puri and to 9.4°C (48.9°F) at Bhubaneswar.

Relative humidities are generally high throughout the year in the coastal areas but in the interior of the district they are slightly lower especially in the non-monsoon months. Humidity

Skies are clear or lightly clouded in the cold season. In the summer months clouding is moderate. Heavily clouded to overcast skies prevail during the monsoon season and clouding decreases thereafter. Cloudiness

Winds are fairly strong particularly in the coastal regions in the summer and monsoon months. The wind speeds are less in the post-monsoon months and the cold season. In the post-monsoon and the cold seasons winds blow from a northerly or north-easterly direction in the mornings and veer to a southerly or south-easterly direction in the afternoons. In the summer and monsoon months winds are mainly south-westerly or southerly, the afternoon winds being more southerly than in the mornings. Winds

Depressions and cyclonic storms originating in the Bay of Bengal in the pre-monsoon, monsoon and post-monsoon months pass through or in the neighbourhood of the district. The storms, particularly those in the pre and post-monsoon months, cause heavy rain and high winds in the district. Thunder-storms, sometimes violent, occur in the pre-monsoon months of April and May and in October. During the monsoon period also the rainfall is associated with thunder. In the winter months fog occurs occasionally. Special Weather Phenomena

Tables 3, 3a, 4, and 4a give the temperature and humidity and mean wind speed respectively for Puri and Bhubaneswar. Tables 5 and 5a give the frequency of special weather phenomena for Puri and Bhubaneswar respectively.

TABLE I
Normal and Extremes of Rainfall

Station	No. of years of data	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
				Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual rainfall as % of Normal	Highest annual rainfall as % of Normal	Lowest annual rainfall as % of Normal	Heaviest rainfall in 24 hours	Date
Puri	50 (a)	12.2	22.6	11.4	16.0	63.0	186.4	281.7	268.5	227.8	192.8	60.8	9.4	1372.6	141 (1936)	57 (1926)	480.1	1862 Oct. 21.		
	(b)	0.8	1.2	0.9	1.2	3.0	8.4	11.9	12.4	12.4	7.6	2.4	0.6	62.8						
Khurda	48 (a)	18.8	26.7	15.7	28.7	81.0	231.7	379.5	343.7	279.9	147.3	50.0	7.4	1610.4	186 (1936)	57 (1921)	243.8	1900 Oct. 7.		
	(b)	1.0	1.5	1.1	1.9	4.5	10.8	15.7	15.5	13.3	6.8	1.8	0.4	74.3						
Bampur	50 (a)	13.5	26.9	18.8	36.3	57.4	174.2	254.0	288.3	241.3	170.4	69.2	10.2	1361.2	156 (1933)	67 (1934)	232.4	1942 Nov. 17.		
	(b)	1.0	1.7	1.3	2.2	3.6	9.5	13.5	14.6	12.7	7.5	2.3	0.6	70.5						
Gop	50 (a)	15.2	27.4	16.3	21.8	74.4	231.7	367.3	349.8	282.7	207.5	86.1	12.5	1692.7	157 (1943)	64 (1935)	355.6	1891 Nov. 6.		
	(b)	0.8	1.4	1.0	1.3	3.3	9.6	13.6	14.0	13.2	8.2	2.2	0.6	69.2						
Kanas	50 (a)	10.9	23.6	14.0	19.8	70.1	198.4	317.5	308.1	238.3	172.2	58.2	6.9	1438.0	130 (1925)	68 (1907)	191.3	1900 Oct. 7.		
	(b)	0.7	1.3	0.9	1.2	3.1	8.2	12.6	13.5	12.2	7.0	1.7	0.5	62.9						
Tangi	44 (a)	14.2	28.7	16.5	20.3	56.9	223.0	287.0	314.5	261.1	173.2	49.0	8.6	1453.0	131 (1946)	70 (1911)	254.0	1912 June 20.		
	(b)	0.8	1.6	1.0	1.6	3.7	9.3	14.2	14.6	13.6	7.9	1.9	0.6	70.8						
Jankia	39 (a)	17.5	27.2	19.6	18.3	64.5	220.7	309.9	329.7	265.7	175.8	56.1	5.1	1510.1	143 (1936)	71 (1918)	279.4	1919 Aug. 31.		
	(b)	0.9	1.5	1.1	1.4	3.5	9.6	15.4	15.5	13.3	7.6	2.2	0.4	72.4						

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
Bakatpur ..	36 (a)	11.2	25.1	13.5	10.9	75.4	192.0	279.9	266.7	217.4	181.4	88.4	6.6	1368.5	207 (1917)	64 (1935)	268.0	1919 Aug. 23
	(b)	0.8	1.1	0.7	0.7	3.0	8.4	12.2	11.6	11.4	7.2	2.5	0.3	59.9				
Daspalla ..	49 (a)	15.5	34.8	37.3	39.9	66.8	226.6	316.7	317.5	245.4	118.6	36.6	6.3	1462.0	132 (1933)	62 (1920)	273.1	1945 July 3
	(b)	1.1	2.1	2.5	3.4	4.7	12.0	17.4	17.4	13.9	6.4	1.8	0.5	83.2				
Dolgath ..	35 (a)	18.3	19.6	16.3	27.7	71.1	186.4	297.7	282.2	211.8	149.3	48.5	4.1	1333.0	135 (1919)	67 (1920)	254.0	1919 Aug. 31
	(b)	1.1	1.3	1.3	2.1	4.9	9.6	14.6	14.5	11.8	6.9	1.8	0.3	70.2				
Ghubaneshwar ..	33 (a)	14.5	23.6	16.0	23.4	67.3	216.7	336.8	320.0	248.2	158.0	53.3	4.8	1482.6	166 (1936)	67 (1932)	264.2	1937 July 24
	(b)	0.8	1.5	0.7	1.4	3.9	9.7	14.5	14.6	12.1	5.9	1.3	0.2	66.6				
Dipli ..	28 (a)	12.5	28.2	23.1	23.6	82.3	270.8	463.0	388.1	314.2	234.7	73.9	8.9	1923.0	151 (1925)	63 (1939)	322.6	1925 Jun. 27
	(b)	0.7	1.4	0.8	1.1	3.2	9.1	15.5	14.2	12.8	8.0	1.7	0.4	68.9				
Ghandaparagarh ..	17 (a)	17.0	23.1	34.8	46.7	68.6	214.4	334.0	323.6	206.8	155.2	30.2	7.4	1461.8	135 (1944)	80 (1935)	180.3	1948 Aug. 15
	(b)	1.6	2.0	2.5	3.7	4.9	11.4	16.6	16.8	13.3	6.8	1.3	0.8	81.7				
Nayagarh ..	48 (a)	14.0	29.5	27.9	46.7	66.5	207.5	280.7	265.9	224.5	122.9	36.3	7.6	1330.0	169 (1946)	59 (1948)	190.5	1910 July 3
	(b)	0.9	2.1	2.0	3.0	4.9	10.3	15.0	15.3	12.7	6.8	1.6	0.5	75.1				
Banpur ..	49 (a)	15.7	13.0	23.6	35.8	70.4	219.2	326.4	293.4	275.6	167.4	58.7	6.3	1522.5	136 (1933)	67 (1918)	243.8	1899 Oct. 15
	(b)	1.0	1.7	1.7	2.5	4.3	10.3	15.3	15.4	13.7	7.1	1.7	0.4	75.1				
Puri (District)	(a)	14.7	26.5	20.3	27.7	69.0	213.3	322.1	310.7	249.4	168.4	58.4	7.5	1488.0	140 (1936)	78 (1908)	--	--
	(b)	0.9	1.6	1.3	1.9	3.9	9.7	14.5	14.7	12.8	7.2	1.9	0.5	70.9				

(a) Normal rainfall in mm.

(b) Average number of rainy days (days with rain of 2.5 mm. or more). • Based on all available data up to 1950. ** Years given in brackets.

TABLE 2

Frequency of Annual Rainfall in the District
(Data 1901—1950)

Range in mm.	No. of Years
1101—1200	5
1201—1300	8
1301—1400	7
1401—1500	10
1501—1600	8
1601—1700	3
1701—1800	5
1801—1900	3
1901—2000	0
2001—2100	1

TABLE 3

Normal of Temperature and Relative Humidity

PURI

Month	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest ever	Maximum recorded	Lowest ever	Minimum recorded	Relative Humidity	
							0830	1730*
	°C.	°C	°C.	Date	°C.	Date	%	%
January	26·8	17·7	32·8	29-1-1946	10·6	12-1-1893	76	69
February	28·3	20·6	35·0	14-2-1954	11·7	8-2-1955	75	71
March	30·2	24·3	38·9	16-3-1899	15·6	2-3-1906	77	79
April	30·9	26·2	41·1	26-4-1947	18·9	18-4-1946	80	84
May	31·9	27·4	42·2	30-5-1943	16·7	25-5-1893	81	85
June	31·7	27·2	39·4	16-6-1949	19·4	25-6-1908	81	85
July	30·7	26·6	36·7	26-7-1938	21·7	31-7-1944	82	85
August	30·9	26·5	36·7	8-8-1899	21·7	20-8-1898	82	84
September	31·5	26·5	36·1	19-9-1901	17·2	23-9-1893	80	81
October	31·4	25·0	36·1	11-10-1957	16·7	24-10-1901	77	74
November	29·2	20·7	33·9	10-11-1914	13·9	30-11-1926	72	63
December	26·9	17·1	32·8	1-12-1896	10·6	28-12-1895	72	62
Annual	30·0	23·8	..	..	..	..	..	..

* Hours I. S. T.

TABLE 3 (a)

Normal of Temperature and Relative Humidity

BHUBANESHWAR

Month	Mean Daily Maximum Temperature	Mean Daily Minimum Temperature	Highest ever	Maximum recorded	Lowest ever	Minimum recorded	Relative Humidity	
							0830	1730*
	°C.	°C	°C.	Date	°C.	Date	%	%
January ..	28·7	15·9	33·6	17-1-1958	9·4	13-1-1952	71	51
February ..	31·9	18·5	37·2	26-2-1953	10·6	9-2-1956	69	49
March ..	35·2	22·3	40·6	28-3-1958	16·1	4-3-1952	69	48
April ..	37·9	25·8	43·9	26-4-1954	19·4	27-4-1952	68	58
May ..	38·0	27·3	44·9	28-5-1958	21·8	4-5-1954	68	61
June ..	35·3	26·4	45·0	15-6-1952	21·7	8-6-1955	77	71
July ..	31·6	25·6	36·1	9-7-1952	21·7	3-7-1952	84	81
August ..	31·4	25·4	35·0	3-8-1952	21·7	3-8-1953	85	83
September ..	31·3	24·9	35·0	29-9-1957	22·2	22-9-1955	85	84
October ..	30·9	23·0	35·1	11-10-1957	16·1	30-10-1954	80	78
November ..	29·3	17·9	35·0	18-11-1952	12·8	20-11-1953	70	62
December ..	28·3	15·7	32·7	13-12-1957	9·4	28-12-1955	68	53
Annual ..	32·5	22·4	..	..	..	..	..	..

* Hours I. S. T.

TABLE 4

Mean Wind Speed in km./hr.

PURI

January	February	March	April	May	June	July	August	September	October	November	December	Annual
10.3	13.8	17.5	20.9	22.2	20.1	19.3	16.7	13.5	10.6	9.3	9.5	15.3

TABLE 4 (a)

Mean Wind Speed in km./hr.

BHUBANESHWAR

January	February	March	April	May	June	July	August	September	October	November	December	Annual
8.2	11.1	17.1	25.3	26.7	19.6	15.6	14.0	10.8	8.7	7.7	6.6	14.3

TABLE 5
Special Weather Phenomena
PURI

Mean No. of days with	January	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Thunder	..	0.1	1.1	2.0	3.0	5.0	5.0	5.0	7.0	4.0	0.3	0.0	37.0
Hail	..	0	0	0	0.1	0	0	0	0	0	0	0	0.1
Dust-storm	..	0.0	0.5	0.3	0.4	0.9	1.5	1.9	0.3	0.4	0.0	0.0	6.8
Squall	..	0	0	0	0	0	0	0	0.1	0	0	0	0.1
Fog	..	1.1	0.9	0.9	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.5	3.6

TABLE 5 (a)
Special Weather Phenomena
BHUBANESHWAR

Mean No. of days with	January	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Annual
Thunder	..	0.3	1.7	3.4	4.0	6.4	10.4	14.4	15.7	8.3	0.7	0.2	76.8
Hail	..	0.0	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.4
Dust-storm	..	0.0	0.0	0.0	0.0	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.8
Squall	..	0.0	0.1	0.7	0.1	1.6	0.0	0.4	0.0	0.3	0.0	0.0	3.3
Fog	..	2.7	2.4	1.3	0.3	0.0	0.0	0.0	0.0	0.5	0.2	0.3	7.7

APPENDIX I

List of the principal vegetable products of the Puri district

Flowering Plants—Rangban (Indian shot); *Canna indica*, Gangsiuli (night flowering Jasmine); *Nyctanthes arbor-tristis*, Mallik (Jasmine); *Jasminum sambac*. Mach-mach (Indian cork-tree); *Millingtonia hortensis*. Rangani (scarlet *ixora*); *Ixora coccinea*. Hatisura; *Heliotropium indicum*. Lal-chitta *Plumbago rosea*. Banbanka (Moon-flower); *Calonyction grandiflorum*. Kansarinata (goat's-foot creeper); *Ipomoea pes-caprae*. Duda-tarak (Elephant creeper); *Argyrea speciosa*. Haraguara (Indian balsam); *Impatiens balsamina*. Ainskata. *Vinca alba* and *rosea*. Kaniyari (Oleander); *Nerium odoratum*. Malatiphul (a clove-scented creeper); *Echites caryophyllata*. Katchampa; *Plumieria acuminata*. Khamhsiju; *Cereus phyllanthus*. Saptpheniya (prickly pear bush); *Opuntia vulgaris*. Phurusli. *Lagerstroemia indica*. Golab; *Rosa centifolia*. Asharuya; *Capparis acuminata*. Barun; *Crataeva trifolia*. Rangkain (red water-lily). *Nymphaea rubra*. Dhabala-kain (lotus); *Nymphaea lotus*. Subd-kain (blue water-lily); *Nymphaea cyanea*. Padam (rose coloured lotus); *Nelumbium speciosum*. Broad-leaved water-lily: *Euryale ferox*. Ponang (Alexandrian laurel); *Calophyllum inophyllum*. Champa; *Michelia champaca*. Pandhuya; *Erythrina indica*. Simli (red-cottontree); *Bombax malabaricum*. Aparajita; *Clitoria ternatea*. Solo; *Aschynomene aspera*. Bayajanti; *Sesbania egyotiaca*. Dayana; *Artemisia indica*. Gendu; *Tagetes patula*. Kesarda; *Eclipta prostrata*. Surjyamukhi (Sunflower); *Helianthus annuus*. Manikchanni (Indian camomile); *Chrysanthemum indicum*. Ansarisha; *Cleome pentaphylla*. Keya (fragrant screw-pine); *Pandanus odoratissimus*. Kanchan; *Bauhinia acuminata*. Chin-champa; *Artabotrys odoratissimus*. Krishna-chura; *Poinciana pulcherrima*. Mandar (Shoe-flower); *Hibiscus rosa sinensis*. Muljuyati (Henna); *Lawsonia alba*. Anguti. *Clerodendrum phlomoides*.

Dyes—Surbuli (Indian Madder); *Hedyotis umbellata*. Achhu; *Morinda tinctoria*. Gulbas and Vilayati Haldi (Arnotto); *Bixa orellana*. Kamulgundi; *Rottlera tinctoria*. Manjista; *Rubia Mungista*. Raktachandan (red sandal-wood); *Pterocarpus santalinus*.

Fibres—Nalita (jute); *Corchorus olitorius*. Chhani (Sunhemp) *Crotolaria juncea*. Kanuriya; *Hibiscus cannabinus*. Barabarshi (American Aloe); *Agave Americana*. Kapa (Indian cotton); *Gossypium indicum*.

Wood—Kendu (ebony); *Diospyros melanoxylon*. Sal; *Shorea robusta*. Piyasal; *Buchanania latifolia*. Sisu; *Dalbergia sissoo*. Gambhari; *Gmelina arborea*. Panas; *Artocarpus integrifolia*. Jeut; *Artocarpus lacoocha*. Kadamba; *Nauclea cadamba*. Kelikadamba; *Nauclea parviflora*. Deb-daru (mast-tree); *Guatteria longifolia*. Tiniya; *Acacia speciosa*. Jhau; *Casuarina muricata*. Bat (Banyan-tree); *Ficus indica*. Dimri; *Ficus glomerata*. Pipal; *Ficus religiosa*. Mandakaich; *Adenanthera pavonina*. Baghankura; *Alangium decapetalum*. Baul; *Mimusops elengi*. Charkuli; *Mimusops hexandra*. Oao; *Dillenia speciosa*. Heinjal; *Barringtonia acutangula*. Indramai; *Odina wodier*. Karanj; *Pongamia glabra*. Ita; *Sapindus detergens*.

Fruits, vegetables, etc.—Haldi (turmeric); *Curcuma longa*. Saru; *Colocasia antiquorum*. Pani-saru; *Colocasia indica*. Ada (ginger); *Zingiber officinalis*. Pan (betel-leaf); *Chavica betle*. Baigan(brinjal); *Solanum melongena*. Lankamarich (chili); *Capsicum annum*. Golapjam (rose-apple); *Eugenia aquea*; *Syzgium jambolanum*. Bhunyar; *Cordia myxa*. Barkuli (jujube-tree); *Ziziphus jujuba*. Lanka-Am; *Anacardium occidentale*. Amba (mango); *Mangifera indica*. Kadali (plantain); *Musa paradisiaca*. Nichu (litchi); *Nephelium lichi*. Karmanga; *Averrhoa carambola*. Belambi; *Averrhoa bilimbi*. Kandmul; sweet potato. Sajina (horseradish tree); *Moringa pterygosperma*. Karenda; *Carissa carandas*. Anakuli; *Carissa diffusa*. Pitasag; *Mollugo spargula*. Pichu (peach); *Amygdalus persica*. Mahul; *Bassia latifolia*. Mekhuya (custard-apple); *Anona squamosa*. Ata; *Anona reticulata*. Mula (radish); *Raphanus sativus*. Parbatkauriya (Roselle, or red sorrel); *Hibiscus sabdariffa*. Bhendi (esculent okro); *Abelmoschus esculentus*. Tentuli (tamarind); *Tamarindus indica*. Mug (green gram); *Phaseolus mungo*. Birhi; *Phaseolus roxburghii*. Koloth (horse gram); *Dolichus biflora*. Lobhiya-chhai; *Dolichus simensis*. Khoriya; *Lablab vulgaris*. Pathasim; *Lablab cultratus*. But (chick-pea, or Bengal gram); *Cicer arietinum*. Harar; *Cajanus indicus*. Maka or Buta (Indian corn); *Zea mays*. Kagjinebu (acid lime); *Citrus bergamisa*, Kamlanebu (sweet orange); *Citrus aurantium*. Batabinebu (Shaddock); *Citrus decumana*. Turanja (lemon); *Citrus limonum*. Notiya; *Amarantus*

campestris. Khara; *Amarantus frumentaceus*. Puruni-sag; *Portulacca oleracca*. Methi (fenugreek); *Trigonella foenum-groecum*. Nariyal (cocoa-nut); *Cocos nucifera*. Tal (Palmyra palm); *Borassus flabelliformis*. Khejuri (Indian date); *Phoenix sylvestris*. Guya (Betel-nut palm); *Areca catechu*, Narkuli (country gooseberry); *Cicca disticha*. Anyala; *Emblica officinalis*. Amra (hog-plum); *Spondias mangifera*. Chhachhindara (snake-gourd); *Trichosanthes anguina*. Karena; *Momordica charantia*. Janhi; *Luffa acutangula*. Ksharbuj (melon); *Cucumis melo*. Phuti; *Cucumis momordica*. Kakuri (cucumber); *Cucumis sativus*. Tarbuj (water-melon); *Cucurbita citrullus*. Baitakharu (red-gourd); *Cucurbita maxima*. Pani-kakharu; *Cucurbita pepo*. Lau (bottle gourd); *Lagenaria vulgaris*. Khamb-Alu (yam); *Dioscorea alata*. Amrita-bhanda (Papaw); *Carica papaya*. Sanpuri (pine-apple); *Ananassa sativa*. Agasthi; *Agati grandiflora*. Piyaj (onion); *Allium ascalonicum*. Rasun (garlic); *Allium sativum*. Pui (Malabar nightshade); *Basella alba*. Kaith (wood-apple); *Feronia elephantum*. Bel; *Aegle marmelos*. Bhursunga (curry-leaf tree); *Bergera koenigii*. Rang-chauliya (red-guava); *Psidium pomiferum*. Dhaba-chauliya (white guava); *Psidium pyrifera*. Pal (arrowroot); *Curcuma augustifolia*. Jankuli (blackberry); *Eugenia Jambolana*. Sapta (sapodilla); *Achras sapota*. Sakarkand (Tapioca); *Janipha manihot*. Rasi (rae-seed); *Sesamum indicum*. Rai-sarisha (white mustard-seed); *Sinapis alba*. Sarisha (black mustard-seed); *Sinapis nigra*.

Drugs — Ghikumari (Indian Aloe); *Aloe indica*. Dhabla-Dhutura (white-flowered thorn-apple); *Datura alba*. Kala Dhutura (yellow-flowered thorn-apple); *Datura fastuosa*. Bheji-begun; *Solanum jacquini*. Akranti; *Solanum diffusum*. Nabhi-ankuri; *Solanum trilobatum*. Phutphutiya; *Cardiospermum halicacabum*. Kuchila (strychnia-tree); *Strychnos nux vomica*. Katak; *Strychnos potatorum*. Arksha; *Calotropis gigantea*. Mendi; *Tylophora asthmatica*. Uttururi; *Daemia extensa*. Chimrinaimul (country sarsaparilla); *Hemidesmus indicus*. Khaeya (catechu-tree); *Acacia catechu*. Baba (Babool-tree); *Acacia arbica*. Ursmaru (yellow thistle, or Mexican poppy); *Argemone mexicana*. Podina (Mint); *Mentha sativa*. Gais; *Phlomis zeylanica*. Dhala tulasi (sweet basil); *Ocimum basilicum*. Kala-tulasi (holy basil); *Ocimum sanctum*. Rukuni-Hatpocha; *Plectranthus aromaticus*. Beguniya (five-leaved chaste-tree); *Vitex negundo*. Halim; *Lepidium sativum*. Palas (bastard teak); *Butea frondosa*. Gokshura; *Pedaliium murex*. Chita; *Plumbago zeylanica*. Kainch (wild liquorice);

Abrus precatorius. Kaladana *Pharbitis nil*. Isvarjata; *Aristolochia indica*. Pitakaruya; *Wrightia antidysenterica*. Gab (Castor-oil plant); *Ricinus communis*. Ganjai (gunja or common hemp plant); *Cannabis sativa*. Tundapora; *Toddalca aculeata*. Bach (sweet flag); *Acorus calamus*. Sunari; *Cassia fistula*. Panmauri; *Anethum panmori*. Barjuyan (Bishop's weed-seed); *Ptychotis ajowan*. Maruya (rue); *Ruta graveolens*. Gugul; *Boswellia thurifera*. Dalim (pomegranate); *Punica granatum*. Gila (Bonduc nut); *Guilandina bonduc*. Nim (Neem-tree); *Azadirachta indica*. Badam (almond-tree); *Terminalia catappa*. Bahara; *Terminalia bellerica*. Harira; *Terminalia chebula*. Guluchi; *Cocculus cordifolius*. Baigab; *Jatropha curcas*. Harbhanga; *Vitis quadrangularis*.

Miscellaneous — Bet (rattan cane); *Calamus rotang*. Bhuin Bet; *Calamus reticulatus*. Sarenga Bans (Bamboo); *Bambusa arundinacea*. Belengi Bans; *Bambusa tulda*. Dhan (paddy); *Oryza sativa*. Durbbaghas (hay grass); *Cynodon dactylon*. Akshu or Akhu (sugarcane); *Saccharum officinarum*. Ankshuya; *Saccharum spontaneum*. Bena (sweet-scented grass); *Andropogon muricatum*. Samu (a famine grain); *Panicum frumentaceum*. Agarjatha; *Panicum coromandelianum*. Kakuriya ghas; *Eleusine egyptiaca*. Mandiya; *Eleusine coracana*. Barjhanjhe; *Pistia stratiotes*. Pani-sioli (tank-weed for cleansing water); *Menyanthes cristata*. Muyamuya; *Sagittaria sagittifolia*. Rakta Pitta; *Ventilago madraspatana*. Chakanda; *Cassia tora*. Pisina; *Maba buxifolia*. Dumduma; *Monetia tetracantha*. Kanti; *Caesalpinia sepiaria*. Gokshra; *Tribulus lanuginosus*. Hatiankusa; *Pisonia aculeata*. Dokana-siju; *Euphorbia anti-quorum*. Patra-siju; *Euphorbia morila*. Ksharisiju; *Euphorbia tirucalli*. Kainchi-Kakuri; *Cocoinia indica*. Sahara; *Epicarpurus orientalis*. Bainch; *Flacourtia sepiaria*. Chaldbriya; *Antidesma pubescens*.

APPENDIX II

The Butterflies of Khorda in Orissa *

Family

NYMPHALIDAE

Sub-family

DANAIDAE

[Genus]	[Species]	[Remarks]
Danais (Parantica)	.. Aglea, Cramer	Rare
Danais (Tirumala)	.. septentrionis, Butler	Very rare
Danais (Salatura)	.. hegesippus, Cramer	Not common
Euploea (Trepse chrois)	.. kalinga, Doherty	Seen, but not taken
Euploea (Narmada)	.. coreoides, Moore	Rare

Sub-family

SATYRIDAE

Mycalesis (Orsotriaena)	.. medus, Fabricius	Occurs only in the rains; not common
Mycalesis (Samanta)	.. rudis, Moore	Rare. The wet season form of this species, which is named M. malsara, Moore, has yet to be obtained in Orissa
Ypthima	.. philomela, Johanssen	Rare
Ypthima	.. huebneri, Kirby	Not common
Melanitis	.. duryodana, Felder	Rare
Melanitis	.. zitenius, Herbst	Rare
Elymnias	.. undularis, Drury	Not common

Sub-family

NYMPHALINAE

Atella	.. sinha, Kollar	Rare
Cethosia	.. cyane, Drury	Very rare. One female in October
Neptis	.. viraja, Moore	Rare
Hypolimnas	.. misippus, Linnaeus	1st form mimics Danais chrysippus, 2nd form mimics D. klugii, Butler 1st form of common, 2nd form very rare
Limenitis (Moduza)	.. procris, Cramer	Not common
Athyma	.. perius, Linnaeus	Not common
Athyma	.. inarina, Butler	Not common
Euthalia	.. lubentina, Cramer	Very rare ; only two taken
Cyrestis	.. cocles, Fabricius	including C. formica and C. earli
Charaxes (Eulepis)	.. fabius, Fabricius	Not common
Charaxes (Haridra)	.. imna, Butler	Rare

* Compiled in 1888, by W. C. Taylor, F. C. S.

Family

LEMONILDEA

Sub-family

MEMEOBILINAE

[Genus]	[Species]	[Remarks]
Curetis	.. bulis, Doubleday and Hewitson	Very rare
Spalgis	.. epius, Westwood	Not common
Chilades	.. trochilus, Freyer	Not common
Azanus	.. gamra, Lederer	Not common
Megisba	.. thwaitesi Moore	No tail to hindwing
Pathalia	.. albidisca, Moore	Tail to hindwing; probably dimorphic form of preceding
Tarucus	.. plinthus, Fabricius	Not very common
Castalius	.. ananda, de Niceville	Rare
Castalius	.. decidia, Hewitson	Not common
Castalius	.. etna, Hewitson	Not common
Castalius	.. interruptus, de Niceville	Probably winter form of preceding. Rare
Nacaduba	.. ardates, Moore	Has both a tailed and tailless form. Both forms common, but locally distributed
Catochrysops	.. pandava, Horsfield	Not common
Polyommatus	.. boeticus, Linnaeus	Not common
Loxura	.. atymnus, Cramer	Not common
Lycaenesthes	.. lycaenina, Felder	Not common
Lycaenesthes	.. orissica, Moore	Not common. Probably variety of preceding
Lycaenesthes	.. emolus, Godart	Not common.
Catapœcilma	.. elegans, Druce	Very rare
Horaga	.. onyx, Moore	Very rare
Spindasis	.. ictis, Hewitson	Not common
Spindasis	.. elima, Moore	Not common
Spindasis	.. Khurdanus, Moore	Not common
Spindasis	.. orissanus, Moore	Not common
Spindasis	.. trifurcatus, Moore	Not common
Spindasis	.. lilacinus, Moore	Not common
Tajuria	.. longinus, Fabricius	Not common
Tajuria	.. jehana, Moore	Not common
Virachola	.. isocrates, Fabricius	Common in some localities. Larva feeds on growing fruit of pomegranate, and is attended by <i>Formica nigra</i> , who clear away their droppings and act as sweepers, as well as guard the pupa

[Genus]	[Species]	[Remarks]
Sithon	.. indra, Moore	Rare
Hypolycaena	.. etolus, Fabricius	Uncommon
Iraota	.. timoleon, Stoll	Uncommon
Rapala	.. schistacea, Moore	Uncommon
Rapala	.. orseis, Hewitson	Uncommon
Vadebra	.. petosiris, Hewitson	Uncommon
Doudorix	.. epijarbas, Moore	Uncommon
Nilasera	.. amantes, Hewitson	Butterfly frequents the nest of the red mango tree ant, Formica smaragdina. Common, but very locally distributed.
Amblypodia	naraboides, Moore	Larva said to be protected by Formica smaragdina. Not common.
Surendra	.. quercetorum, Moore	Rare

Family

PAPILIONIDAE

Sub-family

PIERINAE

Terias	.. harina, Horsfield	Uncommon
Terias	.. drona, Horsfield	Not common
Hebomoia	.. glaucippe, Linnaeus	Not common
Teracolus	.. surya, Moore	Not common and very locally distributed
Catophaga	.. paulina, Cramer	Rare

Sub-family

PAPILIONINAE

Papilio	.. telephus, Wallace	Not very common
Papilio	.. antiphates, Cramer	Not common

Family

HESPERILDAE

Suastus	.. gremius, Fabricius	Rare
Suastus	.. aditus, Moore	Rare
Parata	.. chromus, Cramer	Rare
Parata	.. alexis, Fabricius	Not common
Parnara	.. bada, Moore	Not common
Parnara	.. plebeia, de Niceville	Not common
Parnara	.. bevani, Moore	Not common
Telicota	.. augias, Linnaeus	Not common
Padraona	.. dara, Kollar	Not common

[Genus]	[Species]	[Remarks]
Padraona	.. gola, Moore	Not common
Padraona	.. maesa, Moore	Not common
Padraona	.. maesoides, Butler	Not common
Padraona	.. pseudomaesa, Moore	Not common
Cupitha	.. purreca, Moore	Not common
Taractrocera	.. sagata, Moore	Not common
Halpe	.. ceylonica, Moore	Rather common in jungly place
Tagiades	.. obscurus, Mabilie	Not common
Tagiades	.. Khasiana, Moore	Not common
Plesioneura	.. alysos, Moore	Not common
Plesioneura	.. leucocera, Kollar	Uncommon
Coladenia	.. indrani, Moore	Rare
Satarupa	.. bhagava, Moore	very rare
Hesperia	.. galba, Fabricius	Rare
Isoteinon	.. satwa, de Niceville	Rare