CHAPTER II.

PRODUCTION.

MINERALS.
Gold.

[1] PARTS of Dhárwár are believed to have formerly yielded a considerable amount of gold. Even now the neighbouring villagers yearly wash small quantities of gold dust out of the sand of the Doni in Gadag and of some of the Kod and Ránebennur streams in the south and south-east. The hills in the neighbourhood of Dambal in Gadag and of Chin Mulgund in Kod are also to some extent gold-yielding. The beds of the Doni and other streams which have their rise in the Kappatgudd hills contain gravel and sand in which gold dust is found associated with magnetic iron sand, gray carbonate of silver, and copper. In 1839 the Collector of Dhárwár forwarded to Government a few pieces of gold and some gold dust from the Kappatgudd hills, and, with the sanction of Government, sent one of his assistants to make further inquiries. The assay master, to whom the gold and sand were forwarded for examination, reported that the two pieces of gold weighed 15½ grains, that their touch was 92·75, that the amount of pure gold was 14·37 grains, and that the alloy was silver. While at Sortur the Collector had two or three pots of gold dust washed which yielded gold worth about 6*s.* (Rs. 3). At the same time he sent to Government about five pounds of dust in which one-sixth of a grain of gold was detected. A further supply of gold dust, except that it contained particles of gold of a richer quality, yielded nearly the same result. In 1852 Lieutenant Aytoun was deputed to make a geological survey and report on the mineral resources of the Bombay Karnátak. He reported an exceedingly great development of iron pyrites in the gold region, and observed that were it not that all the conditions on which the large development of the precious metals depends were here found in conjunction with the pyrites, it might be imagined that the small quantity of gold found in the streamlets was derived from the iron pyrites.[2] Lieutenant Aytoun seems not to have traced the gold to its source though he correctly inferred that the source was among the chlorite slate hills to the west. He mentions that he occasionally found small pepites of gold of a pear shape, but does not name the places where they occurred. In 1854 the Rev. A. B. Clarke, of

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[1] The gold portion is compiled chiefly from a report on the auriferous rocks of the Dambal hills by Mr. R. B. Foote, F.G.S., in Bombay Government Records, General Department, XXII. of 1874.

[2] According to Mr. Foote except in clay schists near Atti-Katti, in which the cubical crystals are found in moderate numbers, the development of iron pyrites is small.

St. Leonard's, New Sydney, applied for information on the subject of gold, and was furnished with the details of previous workings. In 1863 he was informed by Government that though small quantities of gold had been always obtained from the Dambal hills, it had never been found in quantities large enough to repay the regular working of the fields by other than the persons resident in the place. In 1856 Mr. G. W. Elliot, assistant collector of Belgaum, was specially employed in examining the gold-yielding streams of the Kappatgudd hills. In 1858, after making inquiries, he forwarded a bottle containing a quantity of titaniferous sand and also another metal of great specific gravity which had the appearance of platinum. The bottle was sent to the Government Chemical Analyser who said that the sand consisted of silicious particles mixed with crystals of titanate of iron with very minute quantities of gold. There was no lead, platinum, or other metal, and the gold was in too small a quantity to repay the cost of working. In 1861, Mr. C. LeSonef, an Australian gold-digger, who had two years' experience in Victoria, offered to visit the place and make further search. He examined the Kappatgudd hills and wrote to Government suggesting that, instead of exploring the hills on the part of Government as he at first proposed, he might be allowed to examine them on behalf of a joint stock company. This was allowed on the terms usually granted by Government to such companies. In 1862, Mr. LeSonef informed Government through the Collector of Dhárwár that he had discovered gold near Sortur which he could work at a profit, and that he had marked off a tract of land which he wished to secure for the company. In 1865 he asked that a certain block or blocks of waste land lying between Kumta and Hubli might be granted to him for the purpose of gold mining, so that the tract might not be intruded upon by other gold-mining companies, and stated that for all gold obtained he would undertake to pay Government a royalty. In 1866 he was informed that Government would take his application into consideration on his stating precisely the nature of the concessions he required and on his showing that his scheme had some chance of success. Before this letter was sent Mr. LeSonef disappeared. According to Mr. Foote, Mr. LeSonef spent £15,000 (Rs. 1,50,000) of the company's money and obtained no return except a few small nuggets of Australian gold which he sent to Bombay from time to time to allay the fears of the shareholders.[1]

In 1874, Mr. R. B. Foote, F.G.S., was sent to survey the hills. He gave the following account of this gold-yielding region: All the streams said by the people to yield gold rise within the limits of the tract occupied by the Sortur series to the west of the Kappatgudd range about twelve miles south of Gadag, and the upper course of the Sortur stream. The richest tract lies entirely within the area occupied by the pseudo-diorite and associated chloritic schists. Quartz reefs occur in all the rocks of this tract, but those lying within the limits of the Sortur series are the best marked, and, with a few exceptions, have the most promising lie,

[1] Bombay Government Records, General Department, XXII. of 1874.

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their direction being mostly north-west and south-east, or parallel to the strike of the bedding. The surface of the chief reefs has been much broken by gold-seekers. The quartz reefs occurring in the other series are mostly well-marked. With one or two exceptions, they run in different directions, many running in the lines of the strike of the bedding, and many cutting across the strike in various directions. The most remarkable quartz reef in the whole gold-bearing tract lies about a quarter of a mile east of the eastern boundary of the Sortur series, on the eastern slope of a ridge lying north-west by north of Atti-Katti, a small village on the road between Dambal and Sortur. This reef, which runs north-west and south-east, lies in the line of bedding of a series of reddish iron-clay schists with chloritic bands, both containing numerous cubical crystals of pyrites now converted into limonite by pseudo-morphosis. The reef is rather less than half a mile in entire length and only in a small part of this is it a well-marked vein. Both the southern and northern extremities are very irregular in places, thinning to a mere thread or a few parallel threads and then swelling into bunches to thin out again a few feet further on. The reef does not cross the valley of a streamlet to the north, but thins out and disappears on the side of the ridge. The quartz is the ordinary dirty-white variety, and includes a few little scales of chlorite along the lines of jointing together with occasional cubes of pyrites, which, like those in the schists, have been pseudo-morphosed into limonite. Parts of the quartz are iron-bearing, the impure oxide of iron occurring in strings and lumps. A specimen of gold obtained here was imbedded in such an iron-bearing string. Though very small, it is easily recognised, and shows a great resemblance to various pieces of stream-gold obtained by washing. It is of a very rich colour. The piece of quartz containing the gold lay among the remains, beside the top of the reef at its highest part, where it has been much broken by gold-seekers, by whom irregular mining operations have been carried on along the course of the reef. Much of the reef has been completely broken, and the hill-side is thickly strewn with fragments. There remain three rude sinkings, hardly deep enough to deserve the name of pits, and a considerable length of shallow trenching along the course of the vein. Besides these, an old pit is sunk on the east side of the wall-like part of the reef some little distance down the slope, probably with the object of ascertaining the continuity in depth of the reef. This seems to have been sunk by some one having more advanced ideas than the authors of the diggings on the back of the reef; but nothing certain or satisfactory could be ascertained. To the north-west of the reef a number of little short veins and bunches of quartz had been attacked in shallow trenches, and had their surfaces knocked to pieces by the same people, who were either a company of goldsmiths who lived in the now deserted village of Galigatti, or more probably by Mr. LeSonef who carried on the mining operations between 1861 and 1866.

The only positive trace of Mr. LeSonef's workings which Mr. Foote came upon or heard of was a pit about fifteen feet deep, sunk on the south side of a quartz reef belonging to another series lying south of the village of Doni about five miles west of Dambal.

The Atti-Katti reef on the road between Dambal and Sortur has an average thickness of about five feet. The strike is north-by-west and south-by-east, with an easterly dip of 40° to 50°. Much of the reef has been broken, but a length of about thirty-five yards like a cyclopian wall forms a conspicuous landmark from the east.

The only other reefs deserving separate mention form a group lying about a mile to a mile and a half south of Doni village on the north-east flank of the Kappatgudd hill. Unlike the reefs already referred to, the reefs in this group consist not of ordinary milk-white quartz, but of a distinctly bluish or deep gray diaphanous variety, with a varying amount of enclosed scales of white or pale mica. According to their courses, these reefs may be assigned to two subordinate groups, of which the one lies north-west by south-east, the other north-east by east and south-west by west. The members of the latter sub-group are much the best defined and form dyke-like veins five to six feet wide and 400 to 600 yards long. The other set, lying on the east side of the small stream which flows from the north-east side of the Kappatgudd hills into the Doni, a little east of the village of Doni, have less well-marked veins, but are of considerably greater length.

None of the reefs in the Doni series run in the lines of bedding of the chloritic, hornblendic, and micaceous beds which they cross. At the same time a large number of bunchy strings of ordinary milky-white quartz run in the lines of both bedding and cleavage, though too small to show on any but a very large-scaled map. These, as well as the diaphanous quartz reefs, contain remarkably little iron oxide, their superficial staining being mainly due to the decomposition of included portions on the surrounding rock.

The remaining quartz reefs, noticed in the gold-yielding tract on the east flank of Kappatgudd, on the west flank of the ridge running north and north-west from Kappatgudd, and in the valley to the north-west of Doni village, are all of the ordinary variety of quartz running more or less in the strike of the bedding and presenting no noteworthy peculiarity. As in all schistose rocks of the ordinary types, an immense quantity of free quartz occurs throughout their mass in the form of laminæ, strings, and bunches of all possible sizes. From these strings and bunches rather than from the remains of larger veins in reefs, come the innumerable lumps of quartz which cover the face of the country. As most of the country is devoid of any vegetation except grass, all the larger occurrences of quartz are marked objects in the landscape, need but little search, and are easily prospected.

On account of the almost invariable association of gold with the different sulphides or iron, lead, and copper in quartz reefs, Mr. Foote, besides searching for metallic gold, paid great attention to the signs of the presence or the absence of sulphides. In only three reefs did he obtain positive evidence of the existence of a sulphide, the sulphide of iron, in the form of cubical pyrites. These three were the Atti-Katti reef and two parallel reefs to the east of Venktápur, but in each case the number of enclosed crystals was very small. It was largest in the Atti-Katti reef. Much of the quartz in the different

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reefs was what Australian miners technically call mouse-eaten, that is full of holes formed by the weathering of enclosed mineral substances. In the majority of cases the form of the holes showed that the enclosed mineral had been chlorite or hornblende. None of the hollows were cubical. In one reef in the Doni group Mr. Foote noticed some small and rhomboidal hollows probably due to the removal of enclosed crystals of calcspar. Free gold is often found left behind in such hollows in good gold-yielding reefs in Australia and elsewhere; none was found in the Doni reefs. As all the reefs observed lay above the surface they had been specially exposed to weather. This might partially account for the absence of sulphides in the reefs; it would not account for the absence of the characteristic hollows which sulphides leave behind. In Mr. Foote's opinion the paucity of sulphides showed a proportionate paucity of gold. Mr. Foote, while prospecting, broke off several hundred pieces of quartz, but not one contained any visible gold; and the quartz found loose at the Atti-Katti reef contained but a mere speck. A number of carefully chosen samples were brought from the most promising reefs to ascertain whether, as is often the case in Australian and Californian reefs, they contained gold in so finely divided a state as to be invisible to the naked eye. These were assayed at the Calcutta mint and in the laboratory of the geological survey, but none of them yielded gold. Mr. Foote noticed that, even if the reefs yielded a fair amount of gold, mining would have serious difficulties to contend against. No timber or fuel was available except at very great distances, and water was very scarce except during the rainy season.

Alluvial Gold.

Washing for gold in the sands of the various streams which flow through the gold-yielding tract is carried on by a class of men called Jálgárs. There were said to have formerly been a considerable number of Jálgárs: but in 1874 when Mr. Foote was in Dhárwár he could hear of only three, two of whom were at Sortur, and the third at Shirhatti in Sángli. He employed the two Sortur washers in the Doni, Sortur, Jilgeri, and other streams on the west flank of the Kappatgudd hills. Of these streams the Sortur was stated to be the richest, and this statement was borne out by the results. Next in productiveness came the Doni stream, but the yield was much smaller, hardly enough to pay the labour. The Jilgeri yielded a still meaner return. In the other streams, including the stream at the foot of the Kappateshvar ravine, only a few exceedingly minute spangles were obtained, just enough to show that gold was not entirely absent. The Jálgárs' mode of working is to take up the lower part of the latest flood deposit from the rocky or clayey bottom of the stream-bed, not from the deepest part of the bed, but from the point at which a strong length of current slacks owing to a change in the direction of the stream. Another favourite place from which to collect wash-dirt is the small alluvial terrace between the low flood and high flood levels. From this they gather the rain-washed surface, and in the case of the washing in the Sortur and Jilgeri, gained much better results than from washing the material obtained in favourable positions from pockets in the

beds of either stream. In the richest washing at which Mr. Foote was present in the Sortur, the wash-dirt chosen was a lime-crust which was deposited on the decomposing surface of a band of chloritic schist. The proceeds were unfortunately mixed with those of another washing which was going on at the same time a little further down the stream. The united results were said by the Jálgárs to be a very good day's work. The second washing was made from stuff collected at the base of the old alluvium bank, which there consisted of a bed of coarse shingle-mixed clay and fine iron-yielding pisolitic gravel (a product of decomposed iron pyrites), overlaid by black clay followed by a second but rather less coarse bed of shingle, on which rested the black soil of that part of the valley of the Sortur. The yield of this washing was rather less than that of the last. For the two washings Mr. Foote had four men at work for three hours at a place of their own choice. Two men washed and two dug and carried the material to the washing place. The quantity of wash-dirt put through the washing-box was about one and a half cubic yards. This yielded a trifle over $6\frac{1}{2}$ grains of gold, worth about 1*s.* 2*d.* ($9\frac{1}{3}$ *as.*) at the rate of £3 $17\frac{1}{2}$*s.* (Rs. $38\frac{3}{4}$) for the Troy ounce of gold. The method of washing was simple and at little expense might be made more effective. The wash-dirt is scooped with a stout broad short-handled hoe, and carried in a basket or large wooden tray to the washing-box which has been fixed at the water's edge and propped with stones to the required slope. The washer sits on a large stone in the water close to the side of the box, which is an oblong construction made of light planks and open at one end. It is three to three and a half feet long, twenty inches wide, and nine inches deep, and is strengthened with clamps. A stick of elastic wood is jammed against the sides and bottom at the lower and open end to form a catch. When this is done the washer begins to ladle water on the wash-dirt kneading it with his left hand and throwing out all the larger pebbles. The ladle or rather scoop used by the Jálgárs was made of a gourd of the calabash tree Crescentia cujete, with one end cut off. It was held by the middle, an oblong hole having been cut into the incurved side, and a couple of small sticks tied across diagonally to the corners and fixed with strings passed through small holes. The elder man preferred to use a tin-pot with cross handle, which had been given him by a former Collector of Dhárwár. This washing and kneading went on till a layer of sand formed in the box, so thick that the stick at the lower end was no longer a sufficient catch and a second stick was jammed in and the washing process begun again till the layer of sand had risen almost level with the second stick. Both sticks were then removed, the washer stirred the layer of sand with a short stout piece of wood, and then swept everything into the large wooden tray held below the open end by the assistant. The washer then took the tray, placed it in the water, and shook and washed it, till nothing remained at the bottom but fine sand most of it black. He then slightly tilted the tray, and, by judiciously dropping water out of his hand on the small layer of sand, drove the lighter particles forward and left the spangles of gold exposed. This small residue was carefully gathered by washing it into a half cocoanut shell, and was

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taken home to be treated with mercury. From the shortness of the washing-box and the very rude way of stopping the open end, and from the evidently careless style of handling, there was considerable waste. Mr. Foote was satisfied that much better results would be obtained by using a box more like the Californian Long Tom, which is generally twelve feet long, and twenty inches broad at the top widening to thirty inches at the open end. In 1874 the Jálgárs plied their trade of gold-washing only after heavy rains during one month in the year in which there is little or no field work. Each man's share of the season's washings ranged from 10*s.* to £5 (Rs. 5 - 50). They affected not to know of any gold in place, and told Mr. Foote that he was wasting time in examining the quartz reefs. This opinion was borne out by the statement of the headmen of Doni and Sortur and of many other villagers. The same opinion was also held by the mámlatdár of Chikodi in Belgaum and by the mámlatdár of Gadag. Captain Newbold found (1842 - 1845) the banks of the gold-yielding streams crowded with Jálgárs. The decline of the industry is probably due partly to the fall in the yield, and partly to the great rise of wages which had followed the inflow of wealth during the American War.[1]

Mr. Foote notices that the Jálgárs did not try to get wash-dirt from deep pockets in the beds of the streams, the places which were generally found most productive in Australian and Californian gold-washings. Constant heavy rain prevented Mr. Foote trying the most promising spots. He thought that the deep pockets might be examined in the dry weather by damming the stream and baling out the hollows. At the same time very little water would be available for washing. It was also probable that the people had already examined these places.

Captain Newbold (1842-1845) estimated the yearly outturn of wash gold from the Sortur, Harti, and Doni streams, after an average monsoon, at about 200 ounces. Mr. Foote was not able to ascertain the average outturn when the place was examined by him; he thought it might safely be set down at less than one-tenth of Captain Newbold's estimate. That so few washers were attracted proved that the return was small. In Mr. Foote's opinion the conclusion was that the prospects of success were not enough to justify an outlay of capital in large mining works. The stream gold was found associated with a black sand consisting mainly of magnetic iron in minute octohedra, and a black residue not affected by the magnet. In the sand washed in the Doni, Mr. Foote found several minute rounded grains of a gray metal, which on examination proved to be metallic silver. A couple of little spangles of a pale yellowish silvery hue were electrum, the natural

[1] Another writer on the Kappatgudd gold tract, Mr. Scholt, formed a very low estimate of the yield of alluvial gold. He stated that in his opinion the alluvial deposits would never pay to work as they were confined to a few small streams and blind watercourses whose bed-rock was almost uncovered and showed a very scanty supply of wash-dirt. Twelve days' work at Sortur yielded Mr. Scholt about a penny-weight of gold worth 4*s.* to 6*s.* (Rs. 2 - 3). Bom. Gov. Rec. General Department XXII. of 1874.

amalgam of gold and silver. Besides these, a few minute bronze-coloured grains proved to be a mechanical mixture of metallic copper and oxide of tin. Captain Newbold found a small fragment of metallic copper, grains of silver, and a few whitish metallic spangles which he took to be platinum. In Mr. Foote's opinion the occurrence of platinum was doubtful. Captain Newbold also found gray silver ore in a fragment of quartz, but did not trace the source from which the quartz came. In a green very traplike part on the pseudo-diorite, about a mile north-west by north of Sortur, Mr. Foote found numerous small but very perfect octohedra of magnetic iron with numerous little lumps of copper pyrites and some iron pyrites. Very white iron pyrites in minute parcels was also widely spread in the neighbouring black variety of pseudo-diorite.

Iron.

Besides gold manganese is found in considerable quantities. In former times when fuel was plentiful in the Kappatgudd hills and English iron was dear, much iron ore was smelted at Doni and other places in these hills. Iron is still (1883) smelted at Tegur on the Poona-Harihar road fifteen miles north of Dhárwár, and at Gulgi in Kalghatgi. The ore is of a darkish brown and has a specific gravity of 3·60. It is found on a hill to the south-west of the village of Tegur in small pebbles and in large masses, both on and below the surface. The process of smelting is simple. The stone is broken into small fragments about a third of an inch cube and smelted in a furnace under the strong heat of a pair of bellows. The metal runs to the bottom while the impurities escape by a hole in the furnace. The crude metal is then removed to a refining furnace where it is made red-hot and beaten on an anvil under the blows of hammers worked by six or seven men by turn at the same time. When cold it is again heated and the process of beating is repeated three or four times. The iron is then pure and malleable enough for use. It is mostly used for making ploughs, sickles, and other field tools, and being soft is much liked by the people. The iron fetches 2*d.* to 3*d.* (1½-2 *as.*) the pound, and the return is sufficient to keep the establishment and leave a small profit. No limestone or *kankar* is mixed with the ore in the smelting furnace which causes considerable waste of material and labour. At Gulgi the daily outturn of iron is about forty pounds.

Stone.

[1] The local building stones are, iron-stone, blue basalt, granite, slate, sandstone, quartz, and flint-stone. Iron-stone is found chiefly at Nigadi, Banadur, Mandihal, and near Dhárwár in the Dhárwár sub-division; at Kalghatgi, Hángal, and Shiggaon in Bankápur; and at Háveri and Timápur in Karajgi. It is found three to six feet under ground in slanting layers two to six inches thick. It is also found on the surface of hills where the layers are four to nine inches thick. The stone does not require blasting. The cost of working in the quarries is about 6*s.* (Rs. 3) the hundred cubic feet. When, as at Hángal, the stone is found in thin layers of two to four inches, the masonry resembles that of burnt bricks and is very strong. Except in Navalgund and Ron blue basalt is found in all

[1] From materials supplied by Mr. G. R. Tilak, Acting Executive Engineer.

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parts of the district. It is sometimes very hard and difficult to work. The only places with regular quarries of blue basalt soft enough to be used for building are Ganjigatti and Devgiri. Including blasting the cost at the quarry is about 10*s.* (Rs. 5) the hundred cubic feet. Granite is obtained either in slabs or blocks by blasting; it is very hard to work. At Mulgund and Mundargi in Gadag it is found in slabs ten to twelve feet long and three to nine inches thick. Small quantities also occur in some fields at Annigeri in Navalgund. The cost is about 8*s.* (Rs. 4) the hundred cubic feet. Slate occurs in the beds and on the banks of streams, about six feet below the surface. The layers are generally sloping and two to six inches thick. The chief places where slate occurs are at Mandihal and Alnávar in Dhárwár, at Háveri and Devgiri in Karajgi, and at Ránebennur. The slabs found at Alnávar are of the best quality and are used for ornamental work. The cost is about 3*d.* (2 *as.*) the square foot. Sandstone can be had in any quantity on the Budangudd hill and is used for the coping of drains and other purposes for which good-sized stones are wanted. In fields near Shirur and Bassápur in Karajgi sandstone is found in limited quantities in boulders. The cost is about 10*s.* (Rs. 5) the hundred cubic feet. Quartz and flintstone are found in irregular shapes on hills at Nargund and Navalgund; it is used but is not a good building stone. The cost is about 6*s.* (Rs. 3) the hundred cubic feet. Mr. Kies notices that potstone occurs with the talc-schists in the Kappatgudd hills and is used by the people in making images and cooking vessels. Here also Tipu Sultán dug (1782-1799) pits for gun flints.

Road Metal.

In making and mending roads three kinds of metal are used, iron-stone, blue basalt, and granite. The cost is about 6*s.* (Rs. 3) the hundred cubic feet exclusive of carriage. The cost of metal made from the hard blue basalt or *vajradundi* metal is about 10*s.* (Rs. 5) the hundred cubic feet. Small loose iron-stones are sometimes gathered from the fields on the roadside for metal and cost about 6*s.* (Rs. 3) the hundred cubic feet on the road.

Sand.

Sand is found in the beds of streams. It often contains small limestone or *kankar* pebbles which are reduced to powder in grinding. The cost of carriage in the west is very heavy. The cost of each hundred cubic feet inclusive of cleaning and carriage ranges from 8*s.* to £1 4*s.* (Rs. 4-12). Good coarse clean sand is not found in any part of the district.

Lime.

Limestone or *kankar* of a yellowish white is found in black soil either in the beds of streams or in fields two to ten feet below the surface. It is sometimes easily gathered on the surface of the banks of country tracks and small streams. For every hundred cubic feet the cost of gathering varies from 10*s.* to £1 4*s.* (Rs. 5-12) and for burning and carriage from £2 10*s.* to £4 (Rs. 25-40). The lime bears a proportion of two of sand to one of lime. The mortar which this limestone yields as a rule is slightly hydraulic and is excellent for all kinds of work. The fuel used in burning the lime comes from the western forests. Including fifteen miles' carriage it costs 17*s.* the ton (Rs. 3 the *khandi* of 784 lbs.). Charcoal costs 2*s.* to 3*s.* the *phara* of seventy-five pounds.

TILES.

The people generally use unburnt or *kacha* bricks. They are moulded from mud prepared of red or brown earth or of gray earth found in old fort-walls in the black soil plain. Burnt bricks are made only at Dhárwár, Hubli, Gadag, and other large towns. The usual price for bricks measuring $12'' \times 5\frac{1}{2}'' \times 2\frac{1}{2}''$, is 16*s.* to £1 (Rs. 8-10) the thousand. Table moulded bricks of a smaller size, $9\frac{1}{2}'' \times 4\frac{1}{2}'' \times 2\frac{1}{2}''$, used in public buildings at Dhárwár cost £1 4*s.* (Rs. 12) the thousand. Tiles are made of the same kind of earth as bricks and also from the clay found in the beds of some of the ponds. They cost 12*s.* to 18*s.* (Rs. 6-9) the thousand. The size used is $12'' \times 15''$ by about 4″ mean diameter.

FORESTS.

[1]A large portion of the district is almost treeless. In 1848, Lieutenant now Colonel W. C. Anderson, of the Revenue Survey Department, complained of the destruction of timber in the western forests of Kod. Teak and blackwood, which were protected by Government, were alone safe; the supply of *matti* Terminalia tomentosa, and *honi* or *hasán* Pterocarpus marsupium, was rapidly disappearing. Not a tree of more than a few inches in diameter was to be found within miles of the edge of the forest. To obtain logs about twelve feet long one foot wide and three and a half to four inches thick, which were then in great demand, the Vadars used to fell a tree a foot or thirteen inches in diameter and chip away till it was reduced to the required size. Ten or twelve logs were put on one cart drawn by two buffaloes, and when taken to Kalghatgi in the north sold for 8*s.* to 9*s.* (Rs. 4-4½) the load. In the fair season strings of ten to fifty carts passed daily out of the forests.[2] In 1857, within three miles of Dhárwár, many parts of the country were thickly covered with dense forests, the haunts of tiger, bison, and other wild animals. Now the cover is hardly enough for jackals, and some parts are under tillage. The black soil sub-divisions in the north and east have few trees of any kind and depend upon the western forests for building timber and fuel. Efforts are now being made to grow large *bábhul* plantations, and as the *bábhul* grows well in black soil, it is hoped that, in a few years, the north and east will produce their own fuel.

On the 31st of March 1883 the area of forest land was 426 square miles, of which 155½ miles were reserved and 270½ miles were protected forests. The whole area may be divided into two divisions, the moist forest in the western sub-divisions of Dhárwár, Kalghatgi, Bankápur, and Hángal, covering 200 square miles of which 108 are reserved and ninety-two are protected; and the dry forests in the eastern and southern sub-divisions of Gadag, Karajgi, Ránebennur, and Kod, covering 224 square miles of which forty-seven are reserved and 177 are protected forests. Hubli and Navalgund are bare of trees; they have only two square miles of forest between them.

The choice and the marking of the Dhárwár forest reserves which began in 1871 is not yet (1883) completed. For the portions of the forest which are settled maps on a scale of four inches to the mile

[1] The sections on forests and trees have been compiled from materials supplied by Mr. H. Barrett, District Forest Officer. [2] Bom. Gov. Sel. LX. 191.

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have been prepared. The boundaries of the reserves have been marked by rough stone pillars, or by cairns four and a half feet high, tapering from six feet at the base to two feet across the top.

The moist forests which lie between the Kánara border and the eastern plain include a large and valuable forest belt to the south-west, some scrub forest on low hills, and plantations near the main roads. The extreme north limit touches and is bounded by Kánara and Belgaum and the south by Maisur. The moist forests are divided into the four circles or divisions of Dhárwár, Kalghatgi, Bankápur, and Hángal. Within the forest area there are four chief varieties of soil, light, red, black, and sandy. Where teak prevails the soil is light, loose, and veined with quartz. Some of the rocks are ironstone or sandstone, but most are granite. In Dhárwár, Kalghatgi, and Bankápur the forest lands are hilly and waving, but the Hángal reserves are mostly flat. The finest trees are generally found in valleys, which in some parts are thickly wooded, while the hill-tops are generally thinly covered with trees. Teak prevails throughout the whole of the Dhárwár, Kalghatgi, and Bankápur forests; towards Hángal it almost disappears. The best teak is found in Kalghatgi where in suitable places it grows extremely well and promises to reach a considerable size. As a rule the forests do not yield large timber except in the form of poles. With this exception the reserves are fairly covered with a superior crop of trees capable of giving a large yield of building materials and fire-wood. Many kinds of bamboo also occur whose strength, lightness, and elasticity make them most useful and well suited to the wants of the people. Of the four circles or divisions the forests of the Dhárwár sub-division, with twenty-nine square miles of reserved and twenty-one square miles of protected forests, are of great value and supply timber and firewood to the town of Dhárwár and to the treeless black-soil country to the east. The Marmagaon-Bellári railway which will pass through the heart of these forests and then run through a woodless country to Bellári, will depend on the Dhárwár forests for a large part of its fuel. In this division two good roads run through the northern and southern parts of the main belt of forest, joining it with the town of Dhárwár at distances of ten to fifteen miles. The Kalghatgi forest, with fifty-one square miles of reserved and twenty-nine square miles of protected forests, is the most important in the district. On its western side it is in character very like the neighbouring forests of Yellápur and Haliyál in North Kánara, and is well stocked with rich trees. A large number of the villages included in this belt of forest are entirely deserted, their sites being overgrown with trees and dense underwood. In other parts of this belt the villages are merely a few huts, in small forest clearings. At certain seasons the climate of the whole tract is unhealthy and in parts the water supply is scarce and bad. Most parts of these forests can be reached by carts, and the main road from Yellápur to Dhárwár passes through the southern portion of the forest area. Of two good local fund roads, one runs through the heart of the northern half, and the other through the centre of the division. From these forests the town of Hubli is mostly supplied with fuel, and from

the ease with which timber can be sent to Hubli and Dhárwár, this forest will be able to supply the Marmagaon-Bellári railway with a large quantity of firewood. In the northern part of this forest belt the surface rock is very rich in iron ore, and iron is still smelted in the village of Gulgi. The forest divisions of Bankápur and Hángal are much alike. The Bankápur forests, with an area of eighteen square miles of reserved and nineteen square miles of protected forests, are stocked with useful wood, and the vigour and value of the stock will increase as the forest lands become fully guarded from fire. They are easy to work as they lie along the Kánara frontier. Their value is a good deal lessened by mixture with large alienated forests. The forests of Hángal include ten square miles of reserved and twenty-three square miles of protected forests. They are the fringe of the grand Kánara forests, but the growth of the timber is slower and much less vigorous as the rainfall is much lighter. The Hángal forests will never produce such large timber as is grown in Kánara. They have also suffered much from careless cutting from which they are now slowly recovering. With time and care, the Hángal forests will yield much small wood fit for building native houses and for making field tools. They also contain some fine sandalwood. As they are crossed by good cart roads they can be easily and cheaply worked. The value of these forests is great, and will become greater as their produce will always find a ready market eastwards in the wide forestless tract of eastern Dhárwár, the Nizam's territory, and Bellári.

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The dry forests are included in the sub-division of Gadag, Kod, Ránebennur, and Karajgi. These forest lands are upwards of fifty miles east and south of the Kánara forests, and are mostly dry stony hills. In this part of the district the existing forest or wood-bearing area is extremely small. At present the bulk of the reserves is in a very poor condition, bare or at best with a covering of scrub and thorn. The rewooding of these hills must be slow, but there seems no reason to doubt that with care and time the attempt will succeed. The forest lands of Gadag, with forty square miles of reserved and thirty-three square miles of protected forests, are chiefly in the Kapatgudd range which has a total length of about thirty miles. A large tract in the centre of the range is alienated, and both on the north and south side several alienated villages hold large tracts of hilly country. The soil of these hills is almost everywhere scanty. Even at the base of the hills it is stony and barren. The north half of the chain has no scrub, the hills being covered with fine spear-grass. Along the banks of a few streams near Doni are some stunted date-palms and a few other trees. At the base and sides of the hills from Chik-Vuduvati to the Tungbhadra is some stunted scrub; but it gradually disappears about the middle. The tops of the hills are bare rock. Among the scrub the chief trees and bushes are *bandurbi* Dodonæa viscosa, which covers large tracts and is the most common shrub in the range. Next in commonness come the Acacias and Cassias: *khair* Acacia catechu, *phuláte bábhul* Acacia latronum, and *bábhul* Acacia arabica. With these a little teak is mixed in the plains near Chik-Vuduvati. Teak also occurs in several of the small valleys near Kulkera, the vigorous shoots seeming to show that teak was

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formerly common. According to the people twenty-five to thirty years ago the hills were covered with trees. The Cassias are *tarvad* C. auriculata, and *báya* C. fistula. The C. fistula is not plentiful; it is found chiefly along the banks of a few rivulets. An Albizzia and a Bignonia are also fairly common at the base of the hills to the south of the range. A few stunted *nim* trees Melia azadirachta also occur. Altogether the vegetation is very poor, and much care and many years will be required to rewood these hills.

The greater part of the Kod forest area, with seven square miles of reserved and thirty-four square miles of protected forests, consists of two parallel ranges of hills in the south of the sub-division. Between the two ranges lies the populous and highly tilled Masur valley. The northern or front range is a narrow strip of bare hill, whose skirts are tilled to the base. East of the point where the Masur road crosses them the hills are extremely bare. To the west of the Masur road a little scrub occurs on the slopes and along the base. The Maisur frontier which runs along the crest of the southern or rear range comes down to the plain about the centre of the line, so that only part of the northern face is in British territory. A great part of the area of both ranges has been assigned as free-grazing land for the neighbouring villages. As grazing ground these hills are of great importance to the people during the south-west rains and the cold weather months, that is from June to February. After March the yearly fires sweep through the whole area, and there is nothing for cattle to eat till the next south-west rains in June. The southern range is better wooded than the northern. At both ends is a considerable area of woody hill country, some of which has been set apart as reserved forests. Besides these two hill ranges, in the northern half of the sub-division two isolated patches of waste have been taken for forest. One of these is the deserted village of Bábápur which in parts is thickly covered with thorny scrub fit for fuel. The other includes portions of three villages and is well covered in parts with *matti* Terminalia tomentosa and other inferior wood. The nature and conditions of this forest area are similar to those of the Kapatgudd range in Gadag, and it is managed in much the same way. Here, as in Gadag, a certain area of valuable wood-bearing land is mixed with much waste, mostly wanted for grazing. It is hoped that in time the whole will be covered with trees. The forest land of Ránebennur includes seventy square miles of protected forests. Within the area of forest land are large tracts of unproductive waste and three blocks of naked brown hills. The Budpanhalli block to the north of Ránebennur consists mainly of low stony hills. Parts of the village lands of Budpanhalli and Nukapur are thickly covered with low thorn bushes, but much is stony and almost utterly bare. The only trees are a few scattered *bábhul* Acacia arabica, *palas* Butea frondosa, and *nim* Melia azadirachta bushes. The Airáni-Medleri block, on the east side, is of irregular shape. It stretches from Ránebennur nine miles to Kudrihal, long downs bare except for scattered brushwood one or two feet high and near Airáni a sprinkling of small trees. In the village lands of Eklaspur is about a square mile of *anjan* Hardwickia binata forest. This is the only place in the district where the tree occurs. The people say the trees were

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not planted and are increasing in number and size. At present the only growth in the lands of Hanshikatti and Chalgeri are a few small low bushes called *paorki*, *bandurbi* Dodonæa viscosa, and *revdi*. At present much of this reserve is extremely bare, but there is no reason why, as at Badpanhalli, thorny scrub should not grow. The prospects of this block are better than those of some of the stonier tracts, as before the 1876 famine most of the forest land was marked into fields and was occasionally under tillage. The third or Halgeri block lies in the south-west of the sub-division. It is chiefly a low range of stony hills, with a little waste at the base and on the sides. The whole is almost utterly bare; only at Anhirvalli and a few other places are there small patches of *bábhul* and other thorn bushes. In the whole forest land of Ránebennur the only trees are in and near the village of Eklaspur.

The best-covered forest lands in Karajgi are in the Katenhalli block about eight miles south of Karajgi and in the village of Gutal about twelve miles to the east. With these exceptions the Karajgi forest lands are extremely bare. The small area to the north of the Varda and the detached lands in the centre of the sub-division are fairly covered with low brushwood, but the lands of Basápur, Ipikop, and Párápur have large areas of bare downs. Nowhere in the sub-division are there trees of any size. Much of the land seems closely to resemble the *anjan*-growing lands of Eklaspur, but there are no *anjans* in Karajgi.

Forest Rights.

In cultivated lands the only trees over which Government have reserved their rights are teak, blackwood, and sandalwood. Besides teak blackwood and sandalwood, the only reserved trees on waste lands suitable for tillage are *matti* Terminalia tomentosa and *honya* Pterocarpus marsupium. The people of forest villages are allowed to cut and remove grass free of charge, and also to take from the protected forest land headloads of dry firewood and thorns for field fencing. No *kumri* or coppice-burning prevails in the forest lands, the tops and slopes of the hills being too stony and bare for this kind of tillage. The chief stores for the sale of wood are at Dhárwár, Kalghatgi, Bankápur, and Hángal, where timber can be bought at auction sales. During the working season which lasts from November to June, at branch stores along the line of forests, timber is gathered and sold by public auction. Most of these stores are temporary and are liable to be changed yearly for more convenient sites. The retail stores for the sale of wood at Dhárwár and Kalghatgi have been abolished and the timber and fuel required for the large towns are now supplied from departmental cuttings. Departmental firewood cuttings were begun in 1879 on the principle of coppice under standards instead of clean cuts as in Belgaum. The practice is to cut away for firewood and other purposes, such growth as, owing to injuries from fire and other causes, seems unlikely to improve, leaving such sound hard wood trees for standards as are likely to flourish for thirty years. So far the departmental cuttings have been a success, and give satisfaction to the people. Under this system the Government rate for a stack measuring $4' \times 4' \times 6'$, equal to a large cartload of firewood drawn by two bullocks is only 2*s.* (Re. 1),

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for a beast-load $1\frac{1}{2}d.$ (1 *anna*), and for a head-load for a man $\frac{3}{8}d.$ ($\frac{1}{4}$ *anna*), for a woman $\frac{1}{4}d.$($\frac{1}{8}$ *anna*), and for a child $\frac{1}{8}d.$ ($\frac{1}{12}$ *anna*). The net proceeds of the yearly departmental firewood cuttings show a gradual rise from £309 (Rs. 3090) in 1880-81 to £500 (Rs. 5000) in 1881-82 and £1238 (Rs. 12,380) in 1882-83.

Before 1881 the right of grazing in forest lands was sold to contractors. Under this contract system there was no check on the number or the kind of animals admitted into the forests, and the cattle-owners could not well be held responsible for damage done by fires or by branch-lopping. Besides a fee of 6*d.* to 2*s.* (Re.$\frac{1}{4}$-1) a head of cattle, the contractors used to extort money from the cattle-owners and otherwise oppress them. Under the system introduced in 1881 the people are allowed to graze their cattle and flocks in certain parts of the forest lands by paying a yearly fee of 3*d.* (2 *as.*) for every head of horned cattle and of $\frac{3}{4}d.$ ($\frac{1}{2}$ *anna*) for every sheep and goat. The people greatly prefer the new system, and it has also proved a financial success. In 1881-82, under the new system, the receipts amounted to £1298 (Rs. 12,980). After deducting fifty per cent credited to land revenue the balance exceeds what was obtained under the old system.

Minor Produce.

The most important minor forest products are honey, charcoal, and bamboos. Bamboos are in great request as they have many uses. In Dhárwár a great trade is done in bamboo baskets and mats which are sent to various parts of the country. The timber trade is mostly in the hands of wealthy merchants who live in Dhárwár and Hubli. These men buy the greater part of their wood in Kánara and retail it to the people of the plain country.

The permanent residents near the forest are Muhammadans and Lingáyats, and the tribes who cut or carry timber or fuel are Bedars, Golars, Lambánis, and Vadars. The people employed in the forest are mostly taken from the resident castes, but in Kalghatgi and Bankápur about half of the day labourers are Lambánis. The daily pay of forest labourers varies according to the demand. The usual rates are $5\frac{1}{4}d.$ ($3\frac{1}{2}$ *as.*) for a man, $4\frac{1}{2}d.$ (3 *as.*) for a woman, and 3*d.* (2 *as.*) for a boy or girl.

Till 1871 the Dhárwár and Belgaum forests together formed the charge of one European forest officer. In 1871 the Dhárwár forests were separated and a district officer with protective staff was appointed. At present (1883) under the European forest officer, who receives a monthly pay of £90 (Rs. 900), is a permanent establishment of five foresters and two clerks whose monthly pay varies from £2 to £3 (Rs. 20-30); twenty forest guards on a monthly pay varying from 14*s.* to £1 4*s.* (Rs. 7-12); and two peons on a monthly pay of £1 12*s.* (Rs. 16). Including pay and travelling allowances, the whole fixed establishment costs £1731 (Rs. 17,310) a year. In addition to the fixed establishment temporary forest guards and foresters are employed. During the year ending March 1883 the establishment, both permanent and temporary, cost £2254 (Rs. 22,540). Of the permanent staff one forester and seven forest guards are for the Dhárwár sub-division, two foresters and seven forest guards are for Kalghatgi, and one forester and three forest

guards each for Bankápur and Hángal. Of the temporary staff there are one forester and six forest guards each for Gadag, Ránebennur and Karajgi, and Kod. Each sub-division is divided into two beats under the head forest guard. The duties of the guards are to patrol the forests within an average beat of twenty-six square miles, to protect the reserves from damage, and to watch the removal of bamboos and firewood from the forests. Each forester in charge of a division visits the forests from time to time and sees that the men under him do not shirk their work.

During the eighteen years ending 1883 forest receipts have risen from £1710 (Rs. 17,100) in 1865-66 to £8291 (Rs. 82,910) in 1882-83. Except during the 1876 and 1877 famine, when the receipts fell to £1707 (Rs. 17,070), this increase has been gradual. On account of the reorganization of the establishment charges have risen from £704 (Rs. 7040) in 1865-66 to £4195 (Rs. 41,950) in 1882-83. During the last three years the net revenue has averaged £2511 14*s.* (Rs. 25,117) a year :

DHÁRWÁR FOREST REVENUE, 1865-1883.

YEAR.	Receipts.	Charges.	Surplus.	YEAR.	Receipts.	Charges.	Surplus.
	£.	£.	£.		£.	£.	£.
1865-66 ...	1710	704	1006	1874-75 ...	5484	3416	2068
1866-67 ...	3028	1272	1756	1875-76 ...	4299	3154	1145
1867-68 ...	3279	1979	1300	1876-77 ...	3103	2279	823
1868-69 ...	2288	1638	650	1877-78 ...	1707	2067	...
1869-70 ...	4663	2854	1809	1878-79 ...	2529	2023	506
1870-71 ...	5343	3993	1355	1879-80 ...	4608	3004	1604
1871-72 ...	4866	3790	1076	1880-81 ...	4440	3721	719
1872-73 ...	5857	4521	1355	1881-82 ...	5980	3260	2720
1873-74 ...	5240	3373	1867	1882-83 ...	8291	4195	4096

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The most useful trees and plants are : *Alale* (K.) *hirda* (M.), Terminalia chebula, yields a yellowish hard and heavy wood used for field tools but not valued as it is apt to suffer from the attacks of white ants. The bark and berries are useful in tanning and in medicine ; they also make excellent black ink and a black dye. *Attirumdi* (K.) or *umbar* (M.), Ficus glomerata, yields a wood which is often used in the body of carts, into which the iron axle fits. The fruit like the common fig is eaten by the poorer classes and by cattle. *Banne* (K.) *ápta* (M.), Bauhinia racemosa, has a very strong and hard heartwood; the bark is used for making rope and its gum as a medicine. *Belpatri* (K. and M.) Ægle marmelos, is sacred to Shiv ; the timber is not used ; the inside of the fruit is scooped out and made into snuff boxes. *Bilenandi* (K.) *nána* (M.), Lagerstræmia macrocarpa, has a light serviceable wood which is used for building though it is apt to suffer from white ants. *Bite* (K.) *sisu* (M.), Dalbergia latifolia, the blackwood, yields a valuable strong tough wood which is much used in cabinet-work and for other purposes. *Burla* (K.) *shevri* (M.), Bombax malabaricum, the silk-cotton tree, though worthless as timber is used by wood-carvers or Jingars in making scabbards and toys; its cotton is valued for stuffing quilts and pillows. *Dindal* (K.) *dhávda* (M.), Conocarpus latifolia, has a white and very hard wood used in building and for cart-axles and ploughs and any tool for which strength is required ; it also yields a good gum. *Dikámali* (M), Gardenia lucida, has close-grained wood good for making

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combs; it yields an ill-smelling gum resin which is much used in healing wounds and sores. *Gandha* (K.) *chandan* (M.), Santalum album, furnishes the well-known sandalwood of commerce; it is used for carving incense and perfume and in making sect brow-marks; from the root a valuable oil is prepared. *Kera mara* (K.) *bibva* (M.), Semecarpus anacardium, the marking-nut tree is useless as timber, the oil of the nut is used as a blister and fomenter in rheumatism and in making ink. *Halasu* (K.) *phanas* (M.), Artocarpus integrifolia, the jack-tree, is used in carpentry and furniture. *Haldi advi bhende* (K.) Erinocarpus nimmonii, has a very soft wood and fibrous bark which is twisted into rope. *Hunab* (K.) *kindal* (M.), Terminalia paniculata, is like *matti* Terminalia tomentosa; it is used almost as much as *matti* but is not nearly so good or lasting being very liable to attacks from insects; it is generally soaked in water for three or four months before being used. *Hunase* (K.) *chinch* (M.), Tamarindus indica, the tamarind, has a very hard and lasting heartwood, which is used for sugar and oil mills and for mallets and rice-pounders. *Jzale-gida* (K.) *bábhul* (M.), Acacia arabica, is used for ploughs, carts, and sugarcane mills and in other work in which great strength is required; the bark is useful in tanning. *Kakkai* (K.) *baya* (M.), Cassia fistula, is notable for its long pods and beautiful hanging clusters of primrose yellow flowers; the bean is a medicine and an article of commerce. *Karegida* (K.) *gehela* (M.), Randia dumetorum, is a small shrub with close-grained wood used for walking sticks; the fruit is a fish-poison. *Karemuttal* (K.) *tivas* (M.), Dalbergia oojeinensis, has very valuable hard wood of great strength and toughness used for carts, ploughs, and carriage poles. *Matti* (K.) *ain* (M.), Terminalia tomentosa, yields a much valued and generally used hard brown-black timber; the bark is valued in tanning. *Murgala* (K.) *bhirand* (M.), Garcinia purpurea, the wild mangosteen, whose fruit by boiling yields the concrete oil known as *kokam*, is used in baking cakes and heals chaps, sores, and wounds. *Muttala* (K.) *palas* (M.), Butea frondosa, yields strong fibrous wood which is not used locally for building; the leaves are used by Bráhmans and others as plates. *Raktahoni* (K.) *asan* (M.), Pterocarpus marsupium, yields a good strong reddish brown timber suited for furniture and house-building; it is also much used for ploughs, harrows, and carts. A red kind like resin oozes from the tree. *Shendhi* (M.), Phœnix sylvestris, the wild date-palm, yields palm beer and spirit; from its leaves mats and baskets are made. *Shivani* (K.) *shivan* (M.), Gmelina arborea, yields a good timber used in building and for field purposes; it stands weather and water. *Shiris* (K.), Albizzia odoratissima, furnishes a very strong hard wood which is used for the rollers and crushers in sugarcane mills, and in cart-making; it is a useful roadside tree growing fast and giving good shade. *Tadsal* (K.) *dháman* (M.), Grewia tiliæfolia, has a white and pliant wood that would make good bows, arrows, and lances; its only local use is for axe-handles: the small elongated red berry is eaten by the people. *Tegina* (K.) *ság* (M.), Tectona grandis, teak, yields the well-known very durable timber.

Roadside Trees.

The shade trees that thrive best along roadsides are the *karanj* Pongamia glabra, *shiris* Albizzia odoratissima, *nim* Melia azadirachta, mango Mangifera indica, *ápta* Bauhinia racemosa, Millingtonia

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hortensis, Ficus cordifolia, Ficus nandrook, and others of the fig species. On the roads which cross the black-soil and plain country to the east of Dhárwár, the *bábhul* Acacia arabica has been found most suitable. Pithecolobium saman or rain-tree, a native of Jamaica, only lately introduced into Dhárwár, grows so readily, wants so little water, and gives such excellent shade, that it is certain to become a favourite roadside tree.

Field Trees.

The chief trees found in fields and gardens and grown for their fruit are *anjura* Ficus carica the fig, *bále* Musa sapientum the plantain, *begpura* Citrus indica the citron, *bor* Zizyphus jujuba the jujube, *geru mavu* Anacardium occidentale the cashewnut, *halasu* Artocarpus integrifolia the jack, *hunase* Tamarindus indicus the tamarind; *jambu* Syzygium jambolanum the jambool, *mavu* Mangifera indica the mango, *nimbu* Citrus bergamia the lime, *pyara* Psidium pomiferum the guava, *rámphal* Annona reticulata the sweet sop, *sitáphal* Anona squamosa the custard-apple, and *tengu* Cocus nucifera the cocoa-palm. These are all grown largely and much used.

Fibre Plants.

The chief fibre-yielding trees and plants are *ambada* Hibiscus cannabinus hemp, *ananas* Ananassa sativa pine-apple, *bambugala* Bambusa arundinacea bamboo, *bále* Musa sapientum the plantain, *bhát* Oryza sativa rice, *bhendi* Abelmoschus esculentus, *jangli rui* Abroma augustum devil's cotton, *kabbu* Saccharum officinarum sugarcane, *kalnar* Aloe vulgaris aloe, *kanghi* Abutilon indicum country mallow, *madi* Caryota urens bastard sago-palm, *musk bhendi* Abelmoschus moschatus the musk mallow, *náriel* Cocos nucifera cocoa-palm, *supári* Areca catechu betel-palm, *támbda ambáda* Hibiscus sabdariffa roselle.

Hedge Plants.

The hedge plants are *adsal* Adhatoda vasica, *daba-galli* Opuntia dilleni prickly-pear, *dunda-galli* Euphorbia antiquorum triangular surge, *hala-galli* Euphorbia tirucalli milk-bush, *jzale-gida* Acacia arabica, *kadandla* Jatropha curcas physic-nut, *kalnar* Aloe vulgaris aloe, *lekkigide* Vitex trifolia Indian privet, *mada rargi* Lawsonia alba henna plant, *nuggi mara* Moringa pterygosperma horse-radish tree, *pángara* Erythrina indica coral tree, *sikekai* Acacia concinna soapnut, *yele-kalli* Euphorbia nerrifolia candle-cactus.

Water Plants.

The chief water plants some of which have magnificent blossoms are of lotuses or *kamals* the Nymphœa stellata with rose-coloured scentless flowers, Nymphœa rubra with large brilliant red flowers, Nymphœa pubescens with white flowers, and the water-bean Nelumbium speciosum. All of these are common near Dhárwár.

Weeds.

The chief climbing shrubs, plants, and weeds growing on waste lands and hills are *dhaturi* Datura alba the thorn-apple, *tottal balli* and Caparis horrida a thorny shrub with large white flowers. There are three kinds of *dhaturi* plant, *kakigida* Solanum indicum Indian nightshade, Solanum jacquini, and Solanum trilobatum. Other plants are the *utrani* Achyranthes aspera, and the yellow thistle or Mexican poppy Argomone mexicana.

Among the wild climbing plants in the forests and hedges are

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the *tondeballi* Coccinia indica, the Memordica charantia, Cocculus cordifolius, and Cissus discolor. Many convolvuluses yield exquisite flowers among them the Bryonia collosa, Argyreia malabarica, and the Elephant creeper Argyreia speciosa.

GRASSES.

The most useful grasses for fodder, volatile oils, and thatching are *madi hullu* and *geddali gen hullu* varieties of Andropogon, and *chapparigen hullu, herati hullu, maraharti hullu,* and *ubina hullu,* all considered good fodder and apparently belonging to the Graminaceæ family. *Hariáli* Cynodon dactylon is one of the best fodder grasses especially for horses. The Andropogon martini has a very strong aromatic and pungent taste, and cattle are voraciously fond of it. The *akya ghás* Andropogon citratum or lemon grass, the *bálada beru* Andropogon muricatum Cuscus grass, and the *darbhe* Cyperus rotundus are fragrant grasses from which oil is made.

FERNS.

Except those which have been introduced into gardens few varieties of ferns are found in Dhárwár. The only local ferns noticed in the forest are the common Pteris, two varieties of maiden hair or Adiantum, and Ligodium scandens a climbing fern with graceful drooping filigree-like fronds. None of the lovely mosses and lichens which adorn the Kánara forests are found in the comparatively dry forests of Dhárwár.

EXOTICS.

The chief exotic trees and plants which have been introduced into Dhárwár are the rain tree Pithecolobium saman a native of Jamaica, the logwood tree *divi-divi* Cæsalpinia coriaria which grows in black and red soil and the pod of which yields valuable tanning, the Australian acacias, the mahogany tree Swietenia mahogani, the Casuarina equisetifolia, the American Bastard cedar Guazuma tomentosa, the Millingtonia hortensis, and the Eucalyptus obliqua. Some Eucalyptus trees planted a few years ago in damp lowlying ground are thriving. Two trees eight inches in diameter at the base and more than thirty feet high will probably grow to a large size.

Many exotic plants flowers and vegetables are grown in the gardens about Dhárwár. In the garden attached to the Nawáb of Sávanur's residence a few apple and pear trees have been planted, and the apple trees bear fruit. Strawberries are also grown, and with care and rich soil would yield well. The Cape gooseberry thrives and bears quantities of fruit from which one of the best Indian preserves is made. Pine-apples succeed well and of late years have been grown equal in flavour and size to fine English hot-house pine-apples. The plants require great care and very rich manure. The following ornamental shrubs and plants thrive well: Acalyphas, Achimenes, Aralias, Arums, Begonias, Bignonias, Caladiums, Coleus, Crotons, Dahlias, Draccenas, Gardenias, Gladiolus, Hoyas, Iris, Ivy, Jasminum, Panax, and Plumbago. With care nearly all English flower and vegetable seeds grow well in Dhárwár. The chief varieties of flowers are the Amaranthus, Antirrhinum, Aster, Balsam, Calliopsis, Candy tuft, Cockscomb, Convolvulus, Dianthus or Pink, Geranium, Heliotrope, Hollyhock,

Marigold, Mignonette, Portulaca, Rose, Sweet Pea, Sunflower, and Verbena. The chief vegetables are Artichoke, Beetroot, Cabbage, Capsicum, Carrots, Cauliflower, Celery, Cress, Cucumber, French Beans, Knolkhol, Lettuce, Marrow, Mustard, Onions, Parsley, Peas, Radish, Spinnach, Tomato, and Turnip.

Domestic Animals.

Dhárwár is not a cattle-breeding country. No one wanting a good pair of bullocks or a good buffalo would buy an animal of the Dhárwár breed. The local breed is decidedly poor. The demand for good cattle is supplied from Sholápur, Pandharpur, Maisur, and Bellári. The chief cattle-marts are Dhárwár, Hubli, Navalgund, Kalghatgi, and Alur in Hángal. The cattle-breeders are Dávri Gosávis, Dhangars, Gaulis, Airgaulis, and Lambánis. Formerly the abundance of cheap grazing encouraged the people to keep a number of miserable beasts which could never do a day's work. The average animal has of late somewhat improved in quality and as it now costs money to feed cattle none are kept which cannot earn their keep.

The chief domestic animals are oxen, cows, buffaloes, sheep, goats, horses, and asses. Of oxen the 1882-83 returns show a total of 258,510 head. These are principally of three kinds: *hoslál* or from the river country that is the banks of the Krishna, *mudlia* or from the south-east that is from Maisur and Madras, and *jóári* or local. Of these the finest are the large white Maisur bullocks which cost £10 to £30 (Rs. 100-300) or even more; the *holsál* or Krishna bullocks cost £5 to £10 (Rs. 50-100); and the local bullocks, which are smaller, cost £3 to £6 (Rs. 30-60).[1] All three kinds are used for ploughing, for riding, and for drawing carts, but the Maisur bullocks are said to be best suited for carts. The larger bullocks last about sixteen or even twenty years and the smaller about twelve years. Of cows the total is returned at 151,379 and of buffaloes at 123,975, of which 83,452 were she-buffaloes. The best buffaloes come from the black-soil country in Navalgund, Ron, and Gadag on the east and north. A cow costs 16*s.* to £3 (Rs. 8-30) and a she-buffalo £3 to £6 (Rs. 30-60). Sheep and goats, returned at 231,125, are kept chiefly by the Kurubars or shepherds in flocks of 100 to 1000. They are not reared for export but entirely for local use, and the numbers are not very large. They are found chiefly in the centre and east of the district. They feed on the small grass that grows on the banks of the streams and in waste numbers, on tree and shrub leaves, and on the leaves of the cotton plant after the cotton crop is picked. The price of sheep is said to vary from 2*s.* to 8*s.* (Rs. 1-4), and of goats from 4*s.* to 8*s.* (Rs. 2-4). Horses are returned at 5478. They are generally owned by Bráhman village accountants and some of the former district revenue officers. Dhárwár was once famous for its breed of ponies running up to fourteen hands high; they are not now so good as they were. The breed is small under thirteen hands, and often ill-shaped and vicious but hardy. The Persian and

[1] During the American War (1864-1866) when there was a glut of money extravagant prices were paid for cattle at the Hubli market. For a pair of bullocks Rs. 300-400 was a common price and Rs. 1200 were paid for a bullock which distinguished himself by uprooting a large stone buried in the ground which no other beast could move. Bom. Gov. Sel. CLXVIII. 104.

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Domestic Animals.

Abyssinian campaigns took away numbers of the best. The mail cart service also knocks up hundreds every year. No pains seem to have been taken to improve the breed until some years ago Government allotted a few good stallions to accompany the camps of some of the English district officers on their yearly tours. Asses are returned at 6819. Almost every washerman keeps some female and one male ass for breeding and for carrying clothes. The male colts are sold either to potters whose clay and earthenware they carry, or to some classes of Vadars who use them to carry firewood and millstones. The Korvás also and some other wandering tribes keep asses to carry their little camps. Except in the town of Dhárwár there are no ducks. Hens are scarce, and since the 1877 famine difficult to buy. They vary in price from 6*d.* to 1*s.* 6*d.* (4-12 *as.*).

Wild Animals.

[1]The district is fairly off for game. Almost every kind of game that is found in Southern India occurs in Dhárwár. The belt of forest from one to six miles broad, which forms the western and part of the southern boundary of the district shelters the larger animals.[2] Between this belt of forest and the eastern plain are considerable tracts of scrub as well as isolated scrub-covered hills which are all more or less stocked with pig, hares, and the smaller deer. In the plain antelopes are still found but not in such numbers as formerly. During the eight years ending 1882 the total number of wild animals reported as destroyed was thirty of which four were tigers, twenty-two leopards and panthers, and two were hyænas and two other animals; the amount spent in rewards was £28 (Rs. 280). The number of persons killed was fourteen of whom two were by tigers, two by panthers and leopards, and ten by other animals. There were also eighty-two head of cattle killed, thirteen by tigers, sixty-one by leopards and panthers, and eight by wolves.

Large Game.

Of large game, the Tiger, *huli* or *hebbuli*, Felis tigris, is not so common as in former years but still occurs in the Dhárwár, Kalghatgi, Hángal, and Bankápur forests, bordering Kánara on the west of the district. Tigers more frequently appear in these places during the rains than at any other time, as in the great Kánara forests herbage springs so slowly that the wild pig, deer, and cattle, which form the tiger's usual food, desert Kánara for the thinner forests of west Dhárwár. The Panther, *kera kalla*, Felis pardus, has been killed in the Dhárwár, Gadag, Hángal, Bankápur, and Kod subdivisions. They also occur in the western forests. The hill fort of Nargund, about thirty miles north of Dhárwár, is a notorious place for panthers, the caverns or hollows in the fort and the dense mass of prickly-pear on the hill-slopes offering them excellent hiding places. The Leopard cat, *hongia*, Felis bengalensis, is found in all the western forests and is also known to inhabit the Dambal hills, the hills of

[1] Contributed by Mr. R. S. Wingate, Assistant Superintendent Revenue Survey Southern Marátha Country.

[2] In 1846 the parts of Kod on the North Kánara border were subject to the ravages of wild elephants. They used to enter the district from North Kánara about the beginning of October when the rice ear begins to form. In 1845 three or four herds of about thirty or forty elephants appeared in Kod. It was said that seven or eight elephants in a single night would eat or trample under foot two or three acres of standing rice. Bom. Gov. Sel. CLX. 191.

Mulgund, and the hills in the south of Kod. It also occasionally turns up most unexpectedly near villages in the middle of the plains where it generally takes refuge in old temples and is easily disposed of. The Hunting Leopard, *chita* or *chircha*, Felis jubata, is common in the Kod and Gadag hill ranges. Some years ago when the Dhárwár plains abounded with black antelope, hunting *chitás* were kept by the Nawáb of Sávanur and the chief of Mudhol. The Indian Black Bear, *ar* or *karadi*, Ursus labiatus, is fast disappearing. They are now occasionally met in the Kalghatgi, Bankápur, and Hángal forests, and in the hills to the south of Kod. Formerly they used to inhabit the Dambal hills, but, as their haunts were easy of access, the bears have all been shot within the past few years. The Bison, *advikona*, Gavæus gaurus, may be found in the Hulginkop, Sangatikop, and Badnigatti forests, which they frequent in June soon after the beginning of the south-west rains, when the young grass is a few inches high. Wild cattle, by all accounts the descendants of the same breed, are found in wide grassy and scrub-covered plains in Sávanur. These Sávanur cattle greatly resemble tame cattle except that their movements are more active and deerlike. They are very difficult of approach and the print of the hoof is longer and much more sharply cut than the print of tame cattle, much resembling the track of the bison, though smaller. The whole number of these wild cattle does not exceed forty or fifty head. The Striped Hyæna, *kati girab*, Hyæna striata, is not common. They are occasionally seen in the west and a few have taken their abode in the Nargund hill, and no doubt may be found in the Dambal hills, the Budangudd hill, and in Kod. The Indian Wolf, *tola*, Canis pallipes, though now scarce, occurs in Kalghatgi, Kod, Karajgi, Ránebennur, the Itigatti forests near Dhárwár, and in the Dambal hills. Wolves are generally seen in parties of two or three. A few years ago a wolf entered the enclosure of the house belonging to the German Mission at Dhárwár and attacked and mauled a man. The Jackal, *kunni nari* or *kappal nari*, Canis aureus, and the Indian Fox, *chendkinnari* or *sanna kempu nari*, Vulpes bengalensis, are common throughout the district. The Wild Dog, *kadu nái*, or *chirnái*, Cuon rutilans, is found in the Kánara forests and doubtless occasionally passes within Dhárwár limits. They go in packs and kill large numbers of deer and wild pig. Even the tiger is said to fear the wild dog and to leave a part of the forest in which a pack of wild dogs have taken up their quarters. They are in appearance like a large pariah dog having coarse reddish hair; the tail is bushy and almost all black. The Wild Boar, *kadu handi* also called *mikka*, Sus indicus, is found in all the western forests and in the Dhárwár, Nargund, and Shrimantgad hills. Immense boars are often found in the forests which would delight the hog-hunter in anything like a riding country. In Bankápur and from Lakshmeshvar and Shirhatti, west of the Kappatgudd, the country is perfectly rideable and first-rate sport may be got in the cold weather. Hog may also be ridden in parts of Kod.

WILD ANIMALS.
Large Game.

Of the Deer tribe, the Indian Stag, *kadavi*, Rusa aristotelis, is scarce, occasionally coming across the border from Kánara into the Sangtikop and Hulginkop forests of Kalghatgi. The Spotted Deer,

Deer.

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WILD ANIMALS.

Deer.

sárga, Axis maculatus, is found especially during the rains in the forests of Kalghatgi, Bankápur, and Hángal. The Ribfaced or Barking or Muntjac Deer, *advikuri,* Cervulus aureus, is very scarce. The Black Buck or Antelope, *chiggari,* Antelope bezoartica, at one time found in great numbers from one end to the other of the plains, is growing scarce. A solitary herd of eight or nine is now and then met in the black soil plains in Nargund and Hubli, a larger number are found in Ránebennur, Karajgi, Kod, and Gadag, and a few in Hángal, Bankápur, and Kalghatgi. The longest horns come from the Dambal hills. The Ravine Deer or Indian Gazelle, *budri* or *mudari,* Gazella bennettii, is far from common; a few are found in the Dambal hills and in parts of Sávanur, Karajgi, and Kod. In the Kod and Gadag hills herds of seven and eight have been seen, but they are shy and difficult to get at if they once see the sportsman. The Four-horned Antelope, *kondguri* or *gondkuri* or *kánu kuri,* Tetraceros quadricornis, is found in all the forests of the sub-divisions bordering on Kánara where they are numerous. A few are also found in the Dhumvar hills. The Mouse Deer, *pisai,* Memimna indica, is found in the forests south of Kalghatgi and may occasionally be met in the west of Bankápur and Hángal. It is far from common.

Small Game.

Of small game, the common Wild Cat, *kád beku,* Felis chaus, is found everywhere. A larger and spotted variety is also occasionally met. The Tree Cat, *manori* or *mántbekku,* Paradoxurus musanga, which prowls at night, seems very fond of fruit trees. It is common in Dhárwár itself, and often takes up its abode in the roofs of houses. The River Otter, *niru nai,* Lutra nair, is found in most large rivers and streams. It is also occasionally met in some of the large ponds throughout the district. The Porcupine, *yedi,* Hystrix leucura, and the Hare, *mala,* Lepus nigricollis, are very common in the hilly and forest parts. The Malabár Squirrel, commonly known as the Red Squirrel, *kyásulali,* Sciurus elphinstonei, is found in all the forests bordering on Kánara. The common Squirrel, *alulí* or *analu,* Sciurus palmarum, is met everywhere.

BIRDS.

Of GAME BIRDS,[1] the common Sand Grouse, Pterocles exustus, is common in the redsoil sub-divisions. The Painted Sand Grouse, Pterocles fasciatus, is rare. The Peacock, *naul,* Pavo cristatus, is found in all the forests bordering on Kánara and in most large gardens in Hángal, Kod, and along the banks of the Tungbhadra and Varda. The Gray Jungle Fowl, *káda koli* or *advi koli,* Gallus sonneratii, and the Red Spur Fowl, Galloperdix spadiceus, are found in all the western forests. Two kinds of Partridge or *kavjga,* the Painted *huvju* Francolinus pictus, and the Gray *kauljal-hakki* Ortygornis ponticerianus, occur in the district, the painted plentifully on the water-shed and to the west of it and the gray only to the east. Of Pigeons, the Southern Green Pigeon, *hasarpáriválu,* Crocopus chlorigaster, is found in the western sub-divisions and occasionally in the plains. The Malabár or Gray-fronted Green Pigeon, Osmotreron malabarica, is found only in the thick forests on the

[1] Contributed by Lieutenant L. L. Fenton, Assistant Survey Superintendent.

borders of Kánara. The Blue Rock Pigeon, *párivála*, Columba intermedia, occurs in the plains and is very fond of old temples and wells.

BIRDS.

Seven kinds of Quail or *burl* are found in the district, the Jungle Bush Perdicula asiatica, the Rock Bush Perdicula argondah, the large Gray Coturnix communis, the Blackbreasted or Rain Coturnix coromandelica, the Blackbreasted Bustard Turnix taigoor, the Button Turnix joudera, and the small Button Quail Turnix dussumieri. The gray quail is far from common. Quail-shooting is very uncertain, in some years it is good, in others bad.

The Indian Bustard, *yeriladdu*, Eupodotis edwardsi, is found in the black-soil tracts and also in Karajgi and Ránebennur, but not in large numbers. The Lesser Florikin, *kannavilu*, Sypheotides aurita, though scattered throughout the district, is never found anywhere in large numbers. The Golden Plover, Charadrius fulvus, is only a cold-weather visitor. The Demoiselle Crane, *korakanche*, Anthropoides virgo, also a cold-weather visitor, is found mostly near the Tungbhadra. Occasionally a few may also be seen on the borders of the large ponds that are scattered over the district. The Curlew Numenius lincatus is also found.

The best Snipe or *ullangi* shooting is to be had in the Dhárwár, Kalghatgi, Bankápur, Hángal, and Kod sub-divisions. The best shooting season is the beginning of the cold weather just before the rice is cut, when some good sport may generally be had in fields below and watered by a pond. The varieties met with are, the Pintailed Gallinago sthenura, the Common Gallinago cœlestis, and the Painted Rhynchœa bengalensis. The Spotted Rail, Porzana maruetta, is often put up in rice fields while beating for snipe. The other water birds are the small Godwit, Limosa ægocephala, met in some large ponds in Hángal, and the Blackbacked Goose, Sarcidiornis melanonotus, which is found in Hángal, Bankápur, Kalghatgi, and probably in Kod, but it is scarce.

Of Ducks there are the Ruddy Shieldrake, *jaddu vakki*, Casarca rutila; the Shoveller, Spatula clypeata; the Spotted Billed Duck, Anas pœcilorhyncha, which is very common and breeds in the district; the Whitebodied Goose or Cotton Teal, Nettapus coromandelianus, found in all the western sub-divisions; the Whistling Teal, Dendrocygna javanica; the Gadwall, Chaulelasmus streperus, which is scarce; the Pintail Duck, Dafila acuta, found in Kalghatgi and probably in Kod and Hángal; the common Teal, Querquedula crecca; the Bluewinged Teal, Querquedula circia, which is the first to arrive and the last to leave the district; the Golden Eye or Tufted Duck, Fuligula cristata, which is scarce; and the Widgeon, Mareca penelope. The best duck-shooting is in the Kalghatgi and Kod sub-divisions where there are many ponds. But duck-shooting in Dhárwár is poor sport as the ducks are far from numerous and as soon as a shot has been fired they either take to the middle of the lake or fly to some other piece of water.

INSECTS.

The Cochineal insect, *kirionanchi*, Coccus cacti, has been successfully reared in some parts of the Dhárwár tableland on the

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INSECTS.

common cactus or prickly-pear. In rearing cochineal insects branches laden with young insects ought to be put on new cactus hedges immediately after the close of the rainy season. In six months they will have increased so much that they may begin to be gathered and a year more will pass before the whole plants are consumed. In the course of the year whenever a leaf is fully loaded, it ought to be cut, and the insects scraped from it with a small stick and gathered in a basket, and killed by pouring boiling water over them. They are then well shaken in the basket to remove the hair with which they are covered and dried for two days in the sun when they are fit for sale. In 1855, under some special conditions the cochineal insect spread so rapidly as to consume all the cactus hedges near Annigeri, Gadag, and some other towns and villages in Navalgund and Gadag. The people not knowing that it was the cochineal insect thought their cactus hedges were dying from some disease.[1]

Silkworms.

Silkworms or *reshmehulla*, till stopped under Government orders, were successfully raised in the Dhárwár jail. Details of the experiments are given under Agriculture. Bees gather honey from the blossoms or flowers of the many kinds of timber trees, but as there are very few trees the quantity of honey is small. In 1881-82 the revenue from honey amounted to £23 (Rs. 230).

SNAKES.

The chief kinds of snakes which in the opinion of the people are poisonous are the Cobra, *nágarhávu*, Naja tripudians; *kiúrihávu* the harmless *dháman* or Indian Rat Snake Ptyas mucosus; *balivadakhávu*, literally the Broken Bangle Snake, probably the Chain Viper or necklace snake, Cobra manilla; *chinagihávu*, literally the jumping snake, probably the Tree Snake Dipsas trigonata or Dipsas gokool; *urimamdalahávu*, literally fire snake from the burning pain produced by its bite, *mandala* is probably the same as *mandul* the Deccan name for the Sand Snake or *dutonde* Eryx johnii; *netragodchihávu*, the *phursa* Echis carinata, the part of the body bitten by it oozing out blood or *netra* after sixteen days followed by death; *bilahávu*, literally the Bow Snake, possibly the name is analogous to the fabulous hoop snake of Europeans in India; *manerahávu*, probably the same as Manyár a term applied in the Marátha country to numerous harmless snakes but which are commonly believed to cause death by a touch of the tongue, or by casting their shadows over their victims; and *nirahávu*, the chequered Water Snake Tripidonatus quincunciatus.[2] During the eight years ending 1882 the number of snakes killed is returned at ninety-five and the number of persons killed from snake-bite at 144.

FISH.

The rivers streams and lakes are fairly stocked with fish.[3] In Navalgund and Ron the chief source of the fish-supply is in the Malprabha, which skirts the north of these sub-divisions. In Dhárwár fish are taken in some of the large lakes which hold water all the year round, and in a few the fish are large and plentiful. In Hubli

[1] Kies' Southern Marátha Country, 109. [2] Mr. G. W. Vidal, C. S.
[3] Mr. J. Elphinston, C. S. and Mr. F. L. Charles, C. S.

there are no streams but some of the large lakes are well stocked. In Gadag fish are obtained from the Tungbhadra and also from some of the large lakes. In Kalghatgi they are found in one or two small streams and also in the Devikop, Badgnigatti, Tambur, and other large lakes, which always contain a large supply of fish. In Bankápur numerous lakes contain fish, but only in the largest which holds water throughout the year are large fish found. In Karajgi, the Varda and the Tungbhadra and a few of the lakes are well stocked with fish. In Hángal, the Varda and numerous lakes contain fish. In Kod and Ránebennur, besides in the lakes, there is a large quantity of fish in the Tungbhadra, which skirts their southern and eastern boundaries. In addition to the fresh-water fish, the markets in the west and south and in Dambal are well supplied with dried sea-fish from Goa, Kumta, and Bellári. The only private right of fishing is in the Bankápur sub-division at Nagnur, which in 1882 was declared by the Collector to belong exclusively to the hereditary headman Husan Ága. In Karajgi, the fisheries in some of the lakes and in the Tungbhadra river used to be sold by Government auction, but of late this practice has ceased. It is believed that about 20,000 people are to some extent employed in catching fish. The chief fishing classes are Musalmáns and Ambigers or Kabers, a class of Hindu ferrymen. Besides the Ambigers many castes catch fish in addition to their usual employment. In the larger rivers, the Varda and the Tungbhadra, fishing goes on throughout the year, except when the rivers are in flood. In the smaller rivers which soon dry fishing is carried on only during the rains. Fishing is also continued all the year round in the large lakes that do not run dry, though these are rare in the black-soil sub-divisions of Dhárwár, Navalgund, Ron, and Gadag. The red-soil tracts with their more certain rainfall are better supplied with fish. Besides by the rod and hook or *gana*, and by netting, fish are caught by damming streams, by stupefying them with the juice of the milk-bush or the powdered *mungarikai* nut, and by basket-traps called *kunis*. The nets used are of two kinds, drag-nets called *tataballi* and *khadelballi*, and casting-nets called *bisballi* and *topatti*. The *bisballi* is a small meshed circular net about six feet in diameter, having lead weights round the edge and a rope tied to the centre. The rope is fastened to one arm of the fisher, who gathers the net in his hand and along his arm as far as his elbow, and with a circular sweep throws it clear of his arm so that it falls in a broad circle on the water, some feet from the fisher. He lets it gradually sink where it falls and then slowly pulls it towards him by the rope attached to the centre. This causes the lead weights to contract the circle, till, on pulling the net ashore, all the lead weights have come close to each other in one heap entirely closing the mouth of the net. This net is chiefly used in shallow water from one to four feet deep and the fish caught are usually small from a few inches to a foot in length. The *topatti* is triangular in form with very minute meshes. The minimum size of the mesh is so small, $\frac{1}{10}$ to $\frac{1}{18}$ of an inch between the knots, that the tiniest fry cannot escape. The rod or *gana* is of two kinds, *vant gana*, a pole to which a line having a hook and bait is hung, and *davani gana* two poles fixed in the

Chapter II. Production. Fish.

water at some distance apart with a line of hooks drawn between them. Long nets and cast nets are used in the rivers. In the lakes, besides nets, night lines are laid down and examined by the fishers every morning. In some cases the ponds are drained dry or nearly dry and everything that can be caught is taken, thousands of fish, not one and a half inch long, being caught in nets or by the hand.

The chief kinds of fish found in ponds wells and rivers are, the *ahvi*, a large eel-like river fish. The sticky substance on the outside of its body is eaten as a tonic. The *andhi machi* or blind fish is a river fish which is said to grow to 120 pounds weight (3 *mans*). Its flesh is eaten only by Mhárs and Mángs as even when fresh it is said to be full of maggots. It is so easily caught, as its name the blind fish shows, that of late years it has become somewhat uncommon. The *bám* or eel is well known and is said to grow to as much as six feet long. The *bárh* or *param* is a fish that grows to three or to three and three-quarters feet long. The *chádvi* is found in rivers. It is two and a quarter feet long and is said to be excellent eating, except that a prick from one of its bones pricks like a scorpion's sting. The *dok*, which is found in ponds wells and rivers, is considered delicious eating, but never grows to more than a foot or fifteen inches long. The *ghagra* is a river fish which is said to vary from nine to eleven inches in length and to be nearly round. The *gojal* is a tasteless fish which grows about eighteen inches long. The *gojra* varies in length from nine to eleven inches. The *hargi* is much esteemed by epicures. It is found in ponds and rivers and grows to eighten inches long and two *sers* in weight. The *jhám*, a river fish, is said to grow to forty pounds weight. The *khavali* or *khawli* is full of bones, but especially the head is said to be good eating. It varies in length from nine inches to three feet. The *kuch*, a rather flavourless fish, varies in length from a foot to a foot and a half. The *kolas* is a small flavourless fish of about nine inches long. The *kongyai* is said to be short and about as broad as the palm of the hand. It is believed to be the same as the *ghagra*. The *katurna* is a small little esteemed fish which grows about nine inches long. The *marah* or red mullet is a well known palatable fish, which lives in ponds and grows about three feet long. The *muchála* is also esteemed by epicures. It is found in ponds and rivers and varies in length from about nine inches to three feet. The *murangi* or *merangi*, a small fish found in ponds and wells, is about two inches and a half long. It is much eaten by the people. The *murgole munia*, a small fish six and three-quarters to nine inches long, is found in ponds and wells and is not much esteemed. The *phatar chátu*, a small fish nine inches long, is found in rivers and takes it name from hovering about stones and rocks. The *ráhu* is a river fish which is said to grow to forty pounds weight. The *rupchal* is a small silver-coloured fish, nine inches long. The *sursal* is a small fish nine inches long. The *zinga* or *jhinga* is a small fish not much esteemed, which is found in ponds and wells. It varies in length from nine to twelve inches.