

CHAPTER IV

AGRICULTURE AND IRRIGATION

INTRODUCTION

Cuttack is predominantly an agricultural district. In the past due to lack of irrigation facility, scanty and erratic rainfall, a frequent phenomenon, and saline inundation of coastal areas the district was subject to recurring droughts, famines and scarcity in several years. The advent of canal irrigation brought big chunks of barren and parched lands under cultivation. A pragmatic approach adopted by way of planning the agricultural production programmes on rational basis was prepared and it started paying quick dividends during the last two decades.

The district consists of three distinct tracts. The first is a marshy strip forming the sea face of the Bay of Bengal covered with low forest and wild growth of canes, reeds and brush wood and intersected by innumerable creeks which are sluggish and silty. This low land is impregnated with salt and unfit for cultivation. The second tract consists of the alluvial plains forming the delta of the Mahanadi, the Brahmani and the Baitarani rivers, where an extensive system of irrigation protects the crops from failure in seasons of drought and enables land to be cultivated that would otherwise remain barren. They present a gradual and steady slope from the high lands of the west to the sea, and a composition varying according to a relative proportion of the sand and silt of which they are formed. The third tract is a hilly region at a distance of 96 to 112 km. from the sea. The hills are not continuous and are small in height averaging 150 metres above the sea-level. It is a region of high sterile land and rocky hills, covered with bamboos and scrub jungles and intersected by narrow, though fertile, valleys.

According to the 1981 Census, 12.70 per cent of the total working force of the district were engaged in agriculture as cultivators and 14.16 per cent as agricultural labourers.

The following statement gives the classification of area by land use in the district during the period between 1986-87 and 1988-89.*

(Area in '000 Ha.)

Classification particulars	1986-87	1987-88	1988-89
(1)	(2)	(3)	(4)
1. Geographical area	1089	1089	1089*
2. Area under forests	157	157	161*
3. Misc. tree crops and groves not included in net area sown	30	30	30
4. Permanent pasture and other grazing lands	23	23	38
5. Culturable waste	61	61	42
6. Land put to non-agricultural uses	100	100	100
7. Barren and unculturable land	10	10	10
8. Current fallows	9	24	22
9. Other fallows	13	13	13
10. Net area sown	686	671	673
11. Total cultivated area	695	695	695
12. Total cultivable area	N.A.	799	780
13. Gross cropped area	1274	1228	1187

* The Survey of India reports the geographical area of the district to be 11,14,282 hectares and the Principal Chief Conservator of Forests reports the forest area of the district to be 1,79,121 hectares.

Soil Conservation

The problem of soil erosion is acute in the district. Wind and water are the main agencies of soil erosion. In the coastal areas the soil erosion is due to sea and strong wind. In the summer season when strong wind blows, the coastal sand dunes are shifted towards the inland arable lands. Besides, frequent inundation of sea water at the time of high tide makes the land saline, causing total failure of the standing crops. In the coastal plain, due to its topography and non-availability of drainage system, water logging is the main problem. In the irrigated area about 10 per cent of the area is severely affected by water logging making the lands unfit for any cultivation. In the inland area like Athagarh, Tigiria, Badamba, Narsinghapur due to undulating topography there is severe water erosion making the land infertile. The hillocks are devoid of forest due to heavy exploitation causing severe erosion. Stream bank erosion of the crop lands specially due to meandering habit of the streams in erosional plains as well as in the basins of big rivers like Mahanadi, Brahmani, Baitarani, etc. poses a serious problem and grab valuable agricultural lands every year. A rough estimate shows that more than 10 lakh hectares of agricultural lands are affected by such erosion every year in the district. It is estimated that about 54 per cent of the area in the district of Cuttack suffers from erosion of some kind or other.

To take up different conservation measures to check the soil erosion as well as conserve the moisture, a Soil Conservation Division was established at Cuttack with two subdivisions, one at Cuttack and the other at Jagatsinghapur. Anti-erosion measures like contour bunding, field bunding, land reclamation, water harvesting, gully control, stream bank erosion control are undertaken by the department.

Plantation Programme

Basically plantation programme aims at two important aspects: (i) protection and (ii) production. Plantation of trees is a good means to protect the land surface from the evil effect of erosion and also produces food, fibre, fuel, fodder for man and his live-stock. Plantations like cashewnut, simoruba glauca, etc. are taken up in the district.

Achievement under different soil conservation measures till 1987-88 is given below:

(i) Plantation Programme

(a) Private land	.. 2,091.48 hectares
(b) Government land	.. 7,015.60 hectares

(ii) Engineering structure

(a) Water harvesting structure	.. 132 Nos.
(b) Farm ponds	.. 178 Nos.
(c) Gully control structure	.. 24 Nos.
(d) Creek control	.. 2 units
(e) Stream bank erosion control	.. 84.70
(f) Spillway	.. 3 units
(g) Land reclamation	.. 867 acres

IRRIGATION

Out of the net cultivable area of 8,05,000 hectares (1980-81) in the district, it has been estimated that 7,67,555 hectares can be brought under irrigation through different sources as under.

Major & Medium Irrigation Sector	.. 5,65,000 hectares
Minor Irrigation (Flow)	.. 66,535 hectares
Minor Irrigation (Lift)	.. 1,36,020 hectares
Total	.. 7,67,555 hectares

The achievement by 31st March, 1982 was the following:

Major & Medium Irrigation	.. 2,04,790 hectares*
Minor Irrigation (Flow)	.. 18,407 hectares*
Minor Irrigation (Lift)	.. 68,620 hectares
Total	.. 2,91,817 hectares

* The Collector reports that the certified ayacut area upto 1990-91 is 1,74,700 hectares for Major projects and 16,050 hectares for Minor projects and there are no Medium projects in the district.

Keeping the irrigation capacity of a particular project in view, it is termed major, medium or minor. A major project irrigates an area beyond 10,000 hectares. Medium Projects & Minor Projects irrigate upto 10,000 hectares and 2,000 hectares respectively. The percentage of irrigated area to cultivated area is about 42.

History of Irrigation

The vast deltaic plain of Cuttack district is frequently visited by floods in the three big rivers of the Mahanadi, the Brahmani and the Baitarani and their innumerable distributaries. The first proposal to utilise the waters of the aforesaid three rivers for irrigation was made in 1858 by General Sir Arthur Cotton who formulated the principles of irrigation and built the Krishna and Godavari canal systems. He recommended the same principles for the Mahanadi with special emphasis on making the canals navigable between Orissa & Midnapur and Calcutta port, especially at a time when the area was completely devoid of any road or train communication. As a sequel to this, the East India Irrigation and Canal Company was formed in 1860 to take up the construction activities. But due to constraint on resource, the company could not show satisfactory progress for the irrigation system to be of any real use during the terrible famine of 1866. With a view to providing relief labour to the distressed people, work had to be geared up. Hence Government of India purchased the entire scheme for a meagre sum of Rs. 1,09'00 lakhs at the then price.

Anicuts were constructed at Naraj on Kathjodi, at Jobra on Mahanadi, at Jagatpur on Birupa, at Jokadia on Kharsuan, at Rudhia on river Budha, at Jenapur on Brahmani and at Akhuapada on river Baitarani to supply irrigation water through a network of canal system known as "coast canal" which was designed to provide navigable trade between Cuttack and Calcutta and also to irrigate the country through which it passed. This great scheme was later abandoned and only three reaches were completed by 1883; reaches I & II being in Cuttack district and reach No. III in Baleshwar district. Reaches I & II of Cuttack district have since been silted up and fallen into disuse.

Construction of Hirakud Dam in the fifties of the current century led to the thinking of using the power house discharge for supplementing irrigation in existing irrigated area under Orissa Canal System in the Mahanadi delta as well as extending the same to new areas of the delta. The Majumdar Committee appointed by Government of India in 1952 examined the prospects of expansion of irrigation facilities in

the delta and gave a number of proposals, basing on which M. G. Hiranadani and M. S. Thirumala Iyengar, Chief Engineer, Hirakud Dam Project, prepared a project report for Rs. 14.92 crores. Work in the new area in the Mahanadi delta started from 1957 in two stages.

(a) Stage-I—The scheme aimed at creation of additional irrigation facility in Birupa-Genguti island, Nuna-Chitrotpala island and Devi-Biluakhai island.

(b) Stage-II—It aimed at construction of a weir at Munduli on river Mahanadi and take out Puri Main Canal along with its branch canals and distributaries, etc. in Cuttack as well as in Puri districts.

From irrigation point of view, the district is divided into Delta Irrigation Systems covering the whole of Mahanadi Delta and Orissa Canal System coming within the limits of Patia-Brahmani and Baitarani rivers. The Delta Irrigation System is again divided into Delta Stage-I and Delta Stage-II. Each stage covers four doabs (the area between two rivers). Under Delta Stage I comes :

- (1) Mahanadi-Kathjodi-Devi doab
- (2) Mahanadi-Chitrotpala-Nuna-Birupa-Brahmani doab
- (3) Nuna-Chitrotpala doab, and
- (4) Area to the east of H. L. C., Range-I

The Delta Stage-II covers the following doabs;

- (1) Kathjodi-Kushabhadra
- (2) Kushabhadra-Bhargavi
- (3) Daya-Bhargavi, and
- (4) Area to the west of Daya

These projects and other projects, both completed and ongoing are discussed in the following paragraphs.

Completed Projects

(a) Delta Stage-I.—The old Delta Irrigation System off-taking from the anicuts at Jobra on river Mahanadi and at Jagatpur on river Birupa comes under Delta Stage-I. Naraj weir on river Kathjodi, although does not throw any canal system also comes under this system. This masonry anicut which is ungated and 1,180 metres long helps in maintaining the level of the artificial pond created due to construction of anicuts at Jobra and at Jagatpur. Naraj weir was constructed in 1865 at a cost of about Rs. 3.00 lakhs only. The crest of the weir is R. L. 72.6 ft. and it has got few sluices on the right flank to regulate and draw water into Kathjodi when required. The anicut pavement connecting both the banks of river Kathjodi also serves as means of communication by pedestrians and cyclists during off season.

Jobra Weir on Mahanadi

The construction of this weir was started in 1864 and completed in 1869 at a cost of about Rs. 10.03 lakhs. The length of the weir between the abutments was 1939.35 metres (6363 ft.) and the crest level was kept at R. L. 67.05 ft. In the year 1959, it was decided to remodel the weir with a view to raising the pond level by 2 ft. and to provide for discharge of larger volume of water into the canals for bringing additional area under irrigation. Automatic falling shutters were also fitted. Later in keeping with growing necessity under World Bank assistance, the weir was replaced by a barrage in a single package with Birupa barrage.

The new Mahanadi Barrage is located 60 m. downstream of the old weir and its length is 1948 metres. It consists of 79 Nos. of spillway bays, 8 Nos. of undersluice bays on right and 8 Nos. on the left side of the spillway. There is also a pre-stressed girder road bridge on the barrage connecting Cuttack city with Jagatpur which now comes within Cuttack municipality. Designed discharge of the barrage is 15,300 cumecs. The H. F. L. including efflux of 0.3 metre is R. L. 23.35 metres, and the pond level is R. L. 21.20 metres.

Birupa weir, on river Birupa at Jagatpur, was constructed during the period 1864—1869 at an estimated cost of about Rs 2.25 lakhs. Its length in between the abutments was 1980 ft. and crest level was R. L. 62.80 ft. Like Jobra weir it had also got falling shutters, but later in course of remodelling in 1959, automatic falling shutters were fitted. Simultaneously with Mahanadi barrage, the barrage across Birupa was also taken up with World Bank assistance in a single package and completed in 1989-90 at a cost of 130 crores of rupees. This barrage

consists of 12 No. of spillway bays and 3 No. of undersluice bays with a designed discharge of 2,070 cumecs. The road bridge on it is T beam girder bridge connecting Jagatpur with Chaudwar.

The road complex on Mahanadi-Birupa Barrage has shortened the distance between Cuttack and Chaudwar. This new link has also opened tourism and picnic avenues in between the twin towns of Cuttack and Chaudwar. This was open to vehicular traffic in May 1990 on payment of tollage under the Indian Tolls Act, 1851 at the following rates:

- | | | |
|------------------------|-------------------------------|--------------|
| 1. Motor car | (a) With trailer | .. Rs. 9'00 |
| | (b) Without trailer | .. Rs. 6'00 |
| 2. Mini Bus/Mini Truck | (a) With passengers/
goods | Rs. 24'00 |
| | (b) Unloaed | .. Rs. 12'00 |

Both the barrages are fitted with vertical lift gates of size 18 m. \times 6'35m. for Birupa spillway and undersluices respectively. All these gates can be operated manually and by remote control system.

The details of the canal systems offtaking from Mahanadi Barrage and Birupa Barrage are discussed below:

Mahanadi Barrage

(i) Taladanda Canal—It takes off from the right head regulator of Mahanadi Barrage at Jobra. It is 82'20 km. long. The canal has a full supply depth of 3'08 m. at head and the bed width at head is 35'36 m. The maximum discharge capacity at head is 76'50 cumecs. Starting from Jobra, the canal falls into the river Mahanadi near Paradeep. There is one escape at Harishpur. Besides, there are six navigation locks at Biribati, Somepur, Tarpur, Tirtol, Taladanda and Paradeep. It has also got a branch canal going to Paradeep and a lock to the sea creek which is presently defunct. This canal is designed to irrigate 28,882 hectares in Cuttack Sadar and Jagatsinghapur subdivisions.

(ii) Machhagan Canal—A distributary of Taladanda canal offtakes near Biribati and is about 52 km. long. It is navigable upto Biribati lock from the head, and it has a discharge of 776 cubic ft. per second. This canal is designed to irrigate 34,426 ha. in Jagatsinghapur subdivision. This canal has got two escapes at Nawada and Nallio and four weirs at Kaijanga, Nawada, Chattra and Padmapur where there is a drop in the F. S. L. of the canal.

Including Machhagan canal, there are altogether nine branch canals of Taladanda main canal with a total length of 484.63 km. The total length of the distribution system upto minimum discharge capacity of 24 cusecs is 785 km. The Gross Command Area (G. C. A.) and Culturable Command Area (C. C. A.) of entire Taladanda canal system is 1,00,000 hectares and 72,611 hectares respectively.

Birupa Barrage

The following canal systems offtake from this barrage.

(i) Kendraparha Canal—Previously it started from the right side of Birupa anicut. Consequent upon construction of Mahanadi-Birupa Barrage, it starts from the left of Mahanadi Barrage. After running for 86.96 km. it falls into the Jambu river and is navigable. For facilitating navigation, there are 7 locks besides the head lock (at Jagatpur) at Barbodia, Kendupatna, Lokanathpur, Bosepur, Kalpara, Marshaghai and Jambu. Its full supply depth and bed width at the head is 2.83 m. and 21.03 m. respectively. Maximum discharge capacity at the head is 87.12 cumecs. This canal is designed to irrigate 50,659 hectares in Cuttack Sadar and Kendraparha subdivisions.

(ii) Gobari canal is a branch of Kendraparha canal, wherefrom it takes off at 45 km. and after flowing for about 25 km. it falls into Gandakia river. This canal is designed to irrigate about 8,000 hectares in Kendraparha subdivision.

(iii) Gobari Extension Canal runs from Alava to Gandakia river in form of a connecting link over a distance of 9 km. This canal is designed to irrigate 7,572 hectares in Kendraparha subdivision. Navigation locks are there at Chokarda, Kendraparha and Gandakia on Gobari canal and at Alava on Gobari extension canal. The Gross Command Area and Culturable Command Area of Kendraparha canal system as a whole is 1,27,000 hectares and 96,600 hectares respectively.

(iv) Pattamumundai Canal—It takes off from the Kendraparha canal about 0.8 km. below its head and after flowing along Birupa river upto Indupur and then along Brahmani river, it meets the Gobari canal at Alava. The whole length of 75 km. of canal embankment functions as a flood embankment. Unlike Taladanda canal and Kendraparha canal it is not navigable. It has a discharge capacity of 14.16 cumecs together with Gobari extension canal. It has been designed to irrigate 20,925 hectares in Cuttack Sadar and Kendraparha subdivisions.

Weirs have been constructed at Rameswar, Balichandrapur, Charpada and Pattamundai to provide drops in the F. S. of the canal.

(v) High Level Canal

There are three ranges of the High Level Canal. Each is a contour canal initially designed to provide navigable route between Cuttack and Calcutta and also to irrigate adjoining lands. Under Delta Stage-I comes High Level Canal Range-I only which runs from the left side of Birupa Barrage upto Brahmani river at Jenapur. The total distance is 53 km. It is navigable. Full supply depth and bed width of the canal at the head is 1.88 m. and 2.95 m. respectively. Maximum discharge capacity at the head is 18.63 cumecs and the canal has got a G. C. A. of 23,000 hectares and C. C. A. of 14,000 hectares.

Besides the head lock, there are two navigation locks, one at Imamnagar and another at Jenapur.

The Delta Stage-I canal system taken together was irrigating an area of 78,721 hectares before remodelling work under Stage-I of Delta Development was taken up in the late fifties. Until construction of Hirakud dam, there was practically no Rabi irrigation in the delta. But thereafter and after replacement of the Mahanadi weir and Birupa weir by two barrages, the ayacut under Delta Stage-I has been extended upto 1,83,700 hectares Kharif and 91,000 hectares Rabi.

(b) Delta Stage II

Construction of Hirakud dam, besides providing irrigation in Sambalpur and Balangir districts, enabled the state in enriching its power supply. Lower down, especially in the delta areas, it also moderated flood to a great extent. In addition to this, there was availability of water to irrigate land which was mostly dependent upon rainfall. This opportunity prompted the engineers and planners to extend irrigation facility to additional areas in Mahanadi Delta under the name Delta Stage-II.

Delta Stage-II Irrigation system consists of a diversion weir at Munduli, across the river Mahanadi and new canal system in Cuttack and Puri districts at a total cost of 63.50 crores excluding the share of Hirakud dam, but including the remodelling cost of old Jobra and Jagatpur anicut (not replacement of anicuts by barrages). The location of the weir is about 5 km. upstream of existing Naraj weir. It is about 1,366 metres long. There was a system to provide double locks

upstream and downstream the weir connected by a channel for passing of boat traffic both ways. Construction of the weir was completed in 1965-66 at a cost of Rs. 334.77 lakhs. But since the lock channel has not yet been opened due to non-completion of downstream lock chamber, inland water communication could not be established so far.

Puri Main Canal takes off from the right side of the Munduli weir and after crossing rivers Kuakhai, Kushabhadra and Bhargavi through three major syphons, it travels a total distance of 42 km. Its full supply depth and bed width at the head is 3.23 m. and 53.34 m. respectively. Maximum discharge capacity at the head is 186.36 cumecs. The canal has got seven branches with a total length of 542 km. Due to several constraints in providing irrigation as designed, full potential is never achieved. The stage-II Delta System has potential of irrigating 1,52,606 hectares Kharif and 1,08,800 hectares Rabi out of which 17,097 hectares in Kharif and 10,258 hectares in Rabi relates to Cuttack district and the balance to Puri district. Thus Delta stage-I & stage-II have a total Kharif potential of (1,83,700 hectares + 1,52,606 hectares) 3,36,306 hectares Kharif and (1,04,440+1,08,800) 2,13,240 hectares Rabi as detailed below.

Doab benefited	Kharif ayacut	Rabi ayacut
Stage-I		
(i) Mahanadi-Kathjodi-Devi ..	80,630 hectares	} 1,04,440
(ii) Nuna-Gobari-Birupa-Brahmani ..	90,860 hectares	
(iii) Nuna-Chitrotpala ..	12,210 hectares	
Total ..	1,83,700 hectares	1,04,440
Stage-II		
(i) Kathjodi-Kushabhadra ..	51,340 hectares	} 1,08,800
(ii) Kushabhadra-Bhargavi ..	38,510 hectares	
(iii) Daya-Bhargavi ..	53,900 hectares	
(vi) West of Daya ..	8,856 hectares	
Total ..	1,52,606 hectares	1,08,800
Grand Total ..	3,36,306 hectares	

But the entire potential of 3,36,306 hectares could not be created due to sudden closure of the Delta Stage II Project. Balance potential of 29,680 hectares Kharif is targetted to be created under I. A. P. to be discussed under ongoing schemes.

Orissa Canal

It has been discussed earlier that the great Bengal famine of 1866 paved the way for creating a canal network in the then Orissa. The State was then under the Bengal presidency. The canal system that was created in the coastal area offtaking from different anicuts across rivers was, therefore, named the Orissa Canal System.

The canal systems offtaking from the erstwhile anicuts at Jobra and Jagatpur under Delta Stage I also came under Orissa canals. The other schemes which came under Orissa Canals were High Level Canal Range II, Range III, Jajpur canal and Dudhei canal. H. L. C. Range III does not cater to the requirements of Cuttack district. It does so in Baleshwar district. All these schemes were constructed between the years 1864 and 1910 for both navigation and irrigation purposes in the deltaic region of Brahmani and Baitarani. The scheme envisaged construction of four numbers of weirs at Jenapur, Jokadia, Rudhia and Akhuapada to create ponds interlinked with each other.

(f) High Level Canal Range II—It offtakes from the Patia weir across river Patia (Kharsuan), a divided arm of river Brahmani at Jokadia. Its other name is Jokadia anicut, which is 218 m. long. It runs from the left side of the weir over a distance of 19.6 km. and flushes into the pond at Akhuapada weir on Baitarani river. The canal was navigable and has got 47 km. of distributaries and minors.

The Patia or Jokadia weir caused problems from the very beginning of its operation on account of considerable efflux in its upstream. Hence the shutters were removed. Later there were some modifications made in 1928. But the canal mostly remained in disuse. Consequently the structures in the canal were destroyed. Since the area was frequently visited by severe flood, no importance was also paid to improve the irrigation system. After construction of Rengali dam across Brahmani river, the floods have been moderated greatly and there is a proposal to restore and renovate this canal and Jokadia anicut to give Kharif as well as Rabi irrigation over an area of 3,371 hectares.

(ii) Jaipur Canal—The Budha weir on river Budha (an arm of river Baitarani which ultimately merges into river Kharsuan) at Rudhia is 160 m. long. Jajpur canal with a discharge capacity of 17 cumecs runs for about 10 km. from Rudhia to Jajpur and is designed to irrigate an area of 13,098·70 hectares Kharif and 3,237 hectares Rabi.

(iii) Dudhei Canal—The weir at Jenapur on river Brahmani is 1,219 m. long. Dudhei canal offtakes from this weir. Presently the canal is defunct. Under proposed Jokadia Irrigation Project, there is a proposal to remodel the Dudhei canal to carry its designed discharge of 5·20 cumecs at head for irrigation.

(iv) The Baitarani Weir at Akhuapada and the H. L. C. Range III offtaking from it, were executed to serve the people of Baleshwar district.

Ongoing Schemes

(i) I. A. P. (Irrigation Advancement Programme)

With a view to boosting up agricultural production in the country, Government of India launched a special programme for two years (1988-89 & 1989-90). Irrigation being the major input of agriculture, the State Government took up Irrigation Advancement Programme for this purpose during the period with plan funds. Under this special scheme, 15 different canals were taken up in the district which were previously left incomplete due to closure of Delta Irrigation Project to create additional irrigation potential of 8,820 hectares Kharif and 6,430 hectares Rabi mostly in Jagatsinghapur and Kendraparha subdivisions. The works are still ongoing.

(ii) Mahanadi-Chitrotpala Project

Irrigation works in Mahanadi-Chitrotpala island which forms a part of the Delta Stage I Project was deferred for being taken up later, with the approval of Central Water Commission and Planning Commission. Work was started from 1990-91 at a cost of Rs. 93·07 crores. The scheme aims at construction of a syphon at village Harichandanpur to convey the water from Kendraparha canal underneath Chitrotpala river and another at Krishnanandapur to cross the Paika river. There will be main canal of 51·50 km. and distributaries minors, etc. of 158 km. to serve the G. C. A. of 27,920 hectares and C. C. A. of 19,540 hectares respectively.

(iii) Birupa-Genguti Island Irrigation Project

A scheme for irrigating the area bounded by Birupa and Genguti rivers in Mahanadi Delta was made in original 'Orissa Canals' of 1860 implemented by the East India Irrigation Company. But it was thought to be improper to close the Genguti branch, which would otherwise increase the flood problem in the Birupa river. Syphoning a large river was also then not to be considered an easy task. However, with availability of modern technology and keeping the irrigation need of the island area, it was decided to take up the irrigation project by taking out an offtaking canal from the existing Pattamundai canal through a syphon across the Birupa river along with a cross regulator in Pattamundai canal and distribution system in the island to provide irrigation over 5,160 hectares G. C. A. and 3,870 hectares C.C.A. Work commenced in 1988-89 and its revised cost stands at Rs. 10'00 crores.

(iv) Creek Irrigation

The rivers in the delta have thrown innumerable creeks into the Bay of Bengal. Besides, there are a number of drainage channels. During monsoon months, water in the creeks and channels is sweet and useful for utilisation. In the rest part of the year water is saline especially due to tidal action. In order to prevent tidal inundation, structures are constructed across these creeks with provision for shutters. Thus the water in the upstream area of the structures remains sweet for irrigation purpose. Farmers nearby lift their water either manually or through water pumps to irrigate their land. No water rate is charged for such irrigation. This scheme was adopted in Orissa in 1984-85 on the line of the scheme introduced in the coastal belt of Gujarat. In Cuttack district the following eight creek projects have been executed to irrigate about 2,500 hectares of land:

1. Gobanga-Betunasi Nalla
2. Gopalpur-Brahmani Mahara
3. Kalikapur Nalla
4. Godamahara
5. Baghuni Nalla
6. Chandi Baunsanali to Gupti
7. Baruna Nalla
8. Budhia Mahara

(v) Rengali Irrigation Project

Rengali Irrigation Project is under execution with its head works at Samal in Dhenkanal district. The right main canal system of this project when completed will irrigate 63,812 hectares in the district alone (Cuttack Sadar and Athagarh subdivisions). Further the left canal system will irrigate 51,617 hectares in Jajpur subdivision.

(vi) Delta Development Plan

A study conducted by the Chief Engineer, Delta and Flood Control in 1992 indicates that out of 2,843 km. and 2,636.71 km. of canals, distributaries, minors and sub-minors, 213.17 km. and 552.84 km. are defunct in Delta Stage I and Delta Stage II respectively. Consequently 18,863 hectares and 35,232 hectares of area respectively remain deprived of irrigation facilities. Restoration of these channels by way of reconstruction of structures and channels, strengthening of canal embankments, resectioning of canal bed, etc. is very much necessary. The maintenance grant of Rs. 200 per hectare as recommended by the 9th Finance Commission is not adequate to meet the requirement especially when a major portion of the allotment is spent on the staff employed for the purpose. However, within the available plan resources and pending clearance of the comprehensive Delta Development Plan Project Report, the State Government have made a beginning in 1990-91 in taking up restoration works in selected patches under the name of Delta Development Plan. Although this scheme will not create any additional irrigation potential, it is likely to stabilise the potential already created.

(vii) N.W.M.P. (National Water Management Project)

As in other disciplines, there are various deficiencies also in irrigation sector. Consequently full potential created for Kharif and Rabi irrigation is not achieved. This is not only peculiar to Orissa but also elsewhere. These deficiencies are mainly the followings:—

- (i) Outlets are either very large or very small to meet the water demand of the area the outlet feeds. They are also not located at the appropriate places.
- (ii) There are inadequate number of cross regulators to maintain the canal level.
- (iii) There are no measuring devices.
- (iv) Shutters in the outlets are either damaged or not existing.
- (v) Structures are either damaged or inadequate.
- (vi) Carrying capacity of the channels has been reduced due to siltation, weed growth, etc.

With a view to overcoming these deficiencies, the N.W.M. Project has been taken up in the State with World Bank assistance since 1991-92. Cuttack district is one of the beneficiaries. The scheme aims at increasing productivity by providing a more reliable and equitable irrigation service after removing some major deficiencies like proper outlets, cross-regulators, repairs/replacements of shutters/structures and de-siltation/de-weeding, etc. In other words it means system improvement. The irrigation systems under N.W.M.P. which comes within Cuttack district are (i) Distributary No. 8½, ex-Kendraparha Canal (Pundalo branch canal and Karandia branch canal) and (ii) Phulnakhara distributary over an area of 4,623 hectares, 7,102 hectares and 2,880 hectares respectively.

Drainage

Irrigation is one of the most important inputs of agriculture. But irrigation without adequate drainage facility is harmful instead of becoming beneficial. Shri B. Sivaraman, I. C. S., Deputy Chairman, State Planning Board, Orissa addressed in August 1990 the Ministry of Agriculture, Government of India expressing his concern over the low productivity of crops with particular reference to rice in Mahanadi Delta, due to improper water arrangement practices. On his suggestion, the Ministry of Agriculture, Government of India constituted an Expert Team under the Chairmanship of Shri Bhagat Singh, Joint Secretary (Fisheries), Ministry of Agriculture, with Members from other disciplines and organisations. The team went into the details of the constraints which hinder the increase in rice production in the Delta and felt that "one of the major constraints for low productivity of rice in the State in the districts of Cuttack and Puri is the drainage congestion. An area of around 2.3 lakh hectares out of 5.1 lakh hectares of Kharif rice area in Cuttack and about 2.0 lakh hectares out of 3.3 lakh hectares of Kharif rice area in Puri district is low lying. Out of this about 20,000 hectares in Cuttack and 56,000 hectares in Puri are badly affected due to drainage congestion /water-logging. In these low lying areas/pats, water remains stagnant upto a depth ranging from 0.3 m. to 2 m. In most of the water logged areas, water depth remains more than 1 m. even upto November".

The causes of water-logging and drainage congestion in Mahanadi Delta are:

(a) The alluvial deltaic plain is very flat in topography and the high flood level of the rivers almost overhang the flat land.

(b) The delta is criss-crossed by innumerable distributaries which fall either into the sea or into the lake Chilika. There are also dozens of creeks. The beds of most rivers have been silted up. In the result

bed level of the river appears higher than the level of the adjoining fields. Although there are embankments at several places, the flow of water towards the fields continues through seepage, even if there is no breach in the embankment.

(c) Excessive irrigation and excessive rainfall—The Indian Irrigation Commission as long ago as in 1901-03 specified two reasons as to why Orissa canals have fallen short of expectations. They are (i) small area in which irrigation water is supplied and (ii) low water rate. The Commission observed that in Krishna-Godavari Delta, irrigation has become quite successful because in those areas, rainfall did not exceed 40", whereas in Orissa it is about 60" per annum. It is only in the year of uneven distribution and low rainfall that irrigation is felt necessary. Further in the canal systems of Krishna-Godavari, field channels are responsible for the growth of irrigation which are almost absent in Orissa canal system. It is from field to field resulting thereby in wastage of water. This unsatisfactory state of affairs continues even today, resulting thereby in wastage of irrigation water in Rabi season and water-logging in the Kharif season. No doubt under the Command Area Development Programme, some field channels have been constructed but much remains to be done in this regard.

(d) The Delta is divided into eight numbers of doabs. Each doab has got several drainage systems, each with one outfall drain. Secondary drains discharge into these outfall drains. There are altogether 23 drainage systems with 920 km. of outfall drains and 1,880 km. of secondary drains. The important drainage systems in Cuttack district are (i) Hansua Barnala-Brudhanai, (ii) Alaka, (iii) Madhusudanpur-Gobari, (iv) Singarpur-Nagpur-Alaka-Baruna, (v) Gobari, (vi) Baghuni, (vii) Chhota Genguti and (viii) Matagunjar. Most of these drainage channels are open ditches. For lack of proper maintenance, they are either silted up or infested with weeds mostly water hyacinth and Ipomoea cornes. During dry spells, nearby farmers block the drains by erecting cross bunds for taking out water for irrigation. Temporary roads and bridges constructed indiscriminately also cause hindrance to the free and smooth flow of drain water. The lands along the drainage channels being fertile and having easy access to water for irrigation have also been encroached upon at several places.

(e) Although the existing drainage system was developed to drain the normal areas under irrigation command, the 'Pat' lands are not connected to any natural drainage system. Consequently water continues to stagnate in those areas even during Rabi season.

(f) Almost uninterrupted irrigation is another cause of drainage problem. Outlets are open in most places as the shutters are removed by miscreants. Hence there is no controlled irrigation too. 'Warabandi' has not made much impact so far. Whether irrigation is necessary or not, the canals system operates in full during Kharif season too. As a matter of fact there is practically no lean period even for repair works.

The Central team under the chairmanship of Bhagat Singh observed that multipronged attack has to be launched to tackle the problems thrown up by overwatering and water-logging and simultaneous and phased action is required to overcome the difficulties. The suggested measures in this regard are:

- (a) There should be rotational irrigation supply.
- (b) Existing drains should be maintained properly and kept fully functional by regular maintenance of bunds, pericidal de-silting and treatment of water weeds, etc.
- (c) In Kharif season, if there is adequate rainfall, there should be no irrigation. Instead, water should be released into the river in lieu of canals. When rainfall is inadequate, irrigation water may be supplied for nursery raising, transplanting and protective irrigation.
- (d) All canal outlets and structures should be restored as per designs.
- (e) Field channels where not present, may be constructed and maintained properly, so that field to field irrigation is avoided.
- (f) Low-lying water-logged lands should be drained by digging field drains to take excess water to the natural drainage facility. On the other hand deep depressions wherefrom water cannot be drained out by open drains, may be utilised for Rabi irrigation by pumping.
- (g) There should be planned conjunctive use of surface water and ground water. Surface water irrigation in Delta Command is without proper surface drainage. The ground water potential has also not been tapped to the desired extent. Consequently there is rise in the ground water table leading to water-logging and salinisation and affecting crop growth severely. With increasing intensity of irrigation and tendency

on the part of the farmers to over apply irrigation from surface water, the problem has aggravated. Hence simultaneous development of ground water especially through dug-wells and shallow tube-wells will lower the water table, provide vertical drainage and thus can prevent water-logging and salinisation. Areas already water-logged can also be reclaimed by this.

(h) Recycling of drainage water into tail-end canals by means of pumps will be useful.

(i) Clearance of weeds and water-hyacinth from drains should be made at intervals to maintain adequate waterway.

Minor Irrigation (Flow)

A Master Plan of Minor Irrigation Projects in Orissa has been prepared in 1989. It aims at bringing out an inventory of Minor Irrigation (Flow) Projects having C. C.A. from 24 hectares upto 2,000 hectares. The M. I. sector which was previously administered by the State Irrigation Department is presently being administered by the Rural Development Department.

The following is the abstract of M. I. potential of the district as brought out in the Master Plan:

Categories of Project (1)	No. of Projects (2)	Designed Ayacut in hectares		
		Kharif (3)	Rabi (4)	Total (5)
1. Existing projects				
(a) Completed	79	15,084.30	3,847.75	18,932.05
(b) Partly derelict	71	2,370.95	66.75	2,437.70
(c) Completely derelict	209	7,197.02	80.92	7,277.94
(d) On-going	13	4,092.53	1,296.74	5,389.27
Total	372	28,744.80	5,292.16	34,036.96
2. Projects under investigation				
(a) Projects under investigation and approved by T. A. C.	42	15,955.46	5,141.70	21,097.15
(b) Projects investigated and approved by T. A. C.	42	17,372.47	3,303.64	22,676.11
Total	84	33,327.93	10,445.34	43,773.27
3. Projects to be investigated	14	4,161.94	1,502.02	5,663.96
Grand Total	470	66,234.67	17,239.52	83,474.19

The Minor Irrigation Project may be a reservoir project or a diversion weir project. Of the completed 79 projects in the district, 47 are small reservoir projects, 28 are diversion weirs and 4 are tanks. Of the 71 partly derelict projects, 45 are small reservoir projects, 17 are diversion weirs and 9 are tanks. The important completed minor irrigation projects having irrigation potential of 500 hectares Kharif and above are Sapua (1,016 hectares) in Athgarh Block, Kusumpur (890 hectares) in Tangi-Chaudwar Block, Hadua (850 hectares) in Badamba Block, Kalkala (728 hectares) in Badchana and Mangalpur in Sukinda Block, Gandhanali (677 hectares) in Tangi-Chaudwar Block. Of the ongoing projects, Suhagi (2,000 hectares) in Narasinghapur Block, is one of the most efficient minor irrigation projects in the State. Its available water can irrigate more extent of land than its designed ayacut. Most of the completely derelict projects have got less than 25 hectares commanding capacity, excepting Kanjiapal in Sukinda I Block which had an ayacut of 485 hectares. It is programmed to renovate the partly derelict and completely derelict projects in a phased manner.

Minor-Irrigation (Lift)

Cuttack district because of its location within Mahanadi Delta is rich in ground water resources. It has been observed that on an average, the fluctuation on water level from maximum level during summer is 2.34 metres. Further the ground water table during rainy season approaches the ground surface and remains just below it within 0 to 1 metre depth. In low-lying areas it comes above ground surface causing thereby submergence to standing crops and water-logging. Although rainfall is the principal contributor of ground water-resources, seepage from the canal distribution system and deep percolation from irrigation fields contribute substantially to the recharging of the ground water.

The history of development of ground water resources especially for irrigation is quite old in Cuttack district. It started with open dug-wells and manually operated lifting devices. But drafting of ground water through this means is not high. On account of small land holding, discontinuous and low investment capacity, the farmers did not set up pump sets for drafting. Of late NABARD, State Bank of India, Orissa State Co-operative Bank and Orissa State Co-operative Land Development Bank have supported the minor irrigation schemes in the private sector by way of advancing loans. By the end of 1987-88, 19,140 hectares and 7,370 hectares of land were irrigated in the district through various dug-wells and filter point tube-wells respectively.

On the public sector side, the Orissa Lift Irrigation Corporation is in exclusive charge of development of minor lift irrigation schemes including public tube-wells since 1973. This Corporation has estimated that out of the ultimate irrigation potential of 8,87,310 hectares in the State (2,37,310 through tube-well and 6,50,000 through river lift), Cuttack district alone has got the potential of 1,36,020 ha. (86,920 hectares tube-well potential+49,100 ha. river lift potential). By the end of 1991-92, 68,620 hectares of irrigation potential was created through 1,236 numbers of tube-wells and 1,887 numbers of river lift points. Most of the lift points are located in areas which are not served by surface water irrigation supplies. Want of electric supply stands on the way of large scale development of lift irrigation schemes.

Consequent upon construction of Munduli weir, two major lift distributary systems were executed; one is the Jayapur distributary and the other is the Bamra-Godisahi distributary with potential of about 1,455 hectares and 670 hectares respectively along the right bank territory of river Mahanadi. But the defective construction of these distributaries makes them unable to bring the designed area under command of irrigation.

Efficient land and water management depends on striking a balance between surface irrigation and lift irrigation. The conjunctive use of ground water with surface canal water has got the following advantages:

- (i) Ground water can be used for raising nurseries when canal water is not available.
- (ii) Canal water supply can be augmented by ground water at the time of stress and in the areas of stress,
- (iii) There can be more diversification of Rabi crops in choosing higher water demanding crops and cash crops.
- (iv) Ground water can work as a second line of defence in the period of drought.
- (v) Simultaneous development of ground water will lower the water table and prevent water-logging and salinisation.

Unfortunately, these advantages have not been given due attention so far. The comprehensive Delta Development Plan among other works also aims at developing the ground water potential in the district.

Embankments

Though canals were of recent construction in Orissa and owned their origin to the private enterprise of the East India Irrigation Company, the embankments had existed from the earliest times. There is a long gap in history which makes it difficult to trace when and how the miles of earthen embankments were constructed at the vulnerable places so as to train the course of rivers in the delta areas. It is believed that some of these embankments existed during the reigns of the Hindu kings and in the Maratha period. In the Final Report on "The Survey and Settlement of the Province of Orissa (1980—1900)" S. L. Maddox writes for Cuttack district "for protection from inundation a portion of the district has from time immemorial been guarded by embankments and under the British Rule that protection has been systematised and large sums have been expended on the perfecting of embankments". He adds "under the Marhatta Government the zamindars were bound to maintain embankments and for this purpose were allowed certain deductions from their Jama. On account of the failure of this system the British Government undertook itself the maintenance and repairs of the embankments."

In 1866-67, W. C. Taylor was deputed to make an accurate record of all existing Government and zamindari embankments. He reported that there were about 5,10½ miles of Government embankments and 248 miles of zamindari embankments in Cuttack district. He considered that another 498 miles were required to complete the system but his proposals were not accepted. In 1872, R. H. Rhind mentioned in his report about existence of 658 miles of embankments and he considered that this total length should be increased to 707 miles. In 1881, it was decided to maintain the embankments as they were, until expiry of settlement proceedings (1890—1900). In 1894 C. W. Odling, the Chief Engineer of Irrigation Department prepared a complete list of embankments to be maintained and abandoned. He divided the embankments into five classes. Class I embankments were connected with the canals and were to be kept intact, Class II embankments on large rivers above high flood levels were to be maintained permanently, Class III embankments were to be abandoned in future after abandoning the Class IV and V, Class IV embankments were of no real use and Class V were practically abandoned as the tract they supposed to protect were already covered by Class I embankments.

Nowadays there exist three types of embankments, viz., (i) Capital Embankments, (ii) Orissa Agricultural Embankments and (iii) Test Relief Embankments in the district. The total length of 51 capital embankments is 730.42 km., 98 O. A. E. embankments is 755.60 km. and 219 Test Relief embankments is 732.33 km. Besides, there are 61 numbers of saline embankment with a total length of 708 km. along the coast. The canal embankments and some capital intensive embankments like those around Cuttack town are categorised as capital embankments. The O. A. E. embankments and saline embankments are those constructed chiefly as protective embankments for protecting the lands and houses from flood water and saline water respectively during floods and tides. These embankments also serve as road communication in the interiors for vehicular traffic. The Test Relief Embankments are constructed mainly out of flood relief (FDR) grants released by the Revenue Department and are not broad enough for vehicular traffic. They also serve as protective embankments in small floods. About 90 per cent of such embankments are maintained by the Irrigation Department and the rest by the Revenue Department. All C. E. and O. A. E. embankments are maintained by the Irrigation Department. Names of some important embankments of each category are given in Appendix I of this chapter. A map showing the embankment system including saline embankments is given at the end of this book.

Out of 11,000 sq. km. liable to flood in this district about 7,500 sq. km. were provided with protection embankments by the end of 7th Plan period. Sluices are provided in embankments to release discharges from drains or nallas falling into the rivers. When there is high flood or high tide they are closed and therefore drain water inundates surrounding areas. The channels of river Mahanadi have a fairly strong embankment system but the river Brahmani and the Baitarani doabs are still vulnerable. Master Plans for flood protection works in Baitarani and Brahmani rivers are under preparation by the Irrigation Department.

Hirakud dam and Rengali dam constructed on the Mahanadi and Brahmani rivers respectively are operated in such a way that river-discharge at the head of the delta does not exceed the maximum flood discharge for which embankments are designed. But when it is not possible, flood forecasting-warning is given in advance to people to vacate low-lying areas which are likely to be affected by the flood (for example, 1980, 1982, 1991 high floods of Mahanadi).

They created breaches even in C. E. & O. A. E. embankments causing sand casting and tremendous devastation in cultivated land. Besides embankments, revetments and spurs have been constructed on the banks of rivers to arrest erosion which brings about failure of embankments by scouring.

The opinion expressed by the Pexpert Committee of 1927 on the utility of the flood protection embankments may be seen in the paragraph on flood remedies appearing elsewhere in this chapter.

SOILS

Occurrence of different soils in the district are closely related to broad physiographic divisions and their genesis is dependent on micro topographical situation and geomorphology of different land types. Taking the differences in nature and characteristics into consideration, the soils of the district are classified into four prominent broad groups, the description of which is given below.

(i) Coastal Alluvium and Saline Inundated Soil

The soluble salts of this soil are due to presence of saline rivers and being submerged by the tidal waves. The character of soluble salts are generally neutral and the elements of sodium, magnesium, chloride and sulphates are found in it. Besides, some chlorides and sulphates of calcium and potassium are also present. Sometimes bicarbonates and carbonates are also found in the soil. The salinity of the upper level as well as in the lower level of the soil changes from time to time during the year. In rainy season the salinity is deteriorated being washed away by gravitational flow and percolation of rain water. As a result, the soil becomes suitable to some extent for the production of crops in rainy season, but when the rain ceases the salinity of lower level comes up by capillary rise which makes the soil unsuitable for cropping during December to June. So only paddy cultivation is possible in this soil in rainy season and in the rest of the year it remains fallow.

The cultivation of barley, safflower, linseed, cotton, chilly, bitter gourd and pumpkin, etc. can be grown in this type of soil. Entire Rajanagar and a part of Kujanga Block and eastern parts of Balikuda, Ersama, Mahakalapada, Pattamundai come under this soil class.

(ii) Deltaic Alluvial Soil

This kind of soil is found in western side of Balikuda, Ersama, Mahakalparha, Pattamundai. The entire Nuagan, Raghunathpur, Jagatsinghapur, Marshaghai, Garadapur, Kendraparha, Derabish, Aul Rajkanika and Niali Blocks also coming under this class of soil.

The texture of this soil is generally sandy, sandy loam, silty loam, clay loam to heavy clay. On the whole this alluvial soil is fertile. In some places deficiency of nitrogen and phosphorus is marked. The soil is slightly acidic to neutral. The cultivation of paddy, wheat, jute, sugarcane, pulses, groundnut and other oilseed crops are grown in this soil.

(iii) Laterite Soil

This group of soil is found in Jajpur, Banki and Athagarh agricultural districts except Badamba and Narasinghapur Blocks. In this soil lateritic stone is generally found within two metres. This lateritic zone is hard and having small pores inside depending upon the location. Generally, it is made up of quartz and oxides of iron and aluminium. This soil is porous and powdery in dry conditions. It is generally infertile, acidic and deficiency in nitrogen, phosphorus, potash and calcium. The cultivation of paddy, wheat, ragi, pulses and vegetable crops can successfully be grown under application of recommended doses of fertiliser.

(iv) Red Soil (Sandy and Loam)

This soil is generally found in Narasinghapur and Badamba Blocks of Athagarh Agricultural District. This type of soil is light textured, porous, well drained and low in water holding capacity. The production capacity of this soil is restricted to the crops grown under rainfed condition. This soil is free from salinity. Due to presence of iron oxide in the soil the colour is generally red. The soil is moderately acidic and deficient in nitrogen, molybdenum and boron. The phosphorus is not available to the crops as it is present in binded condition due to presence of free iron and aluminium oxide. The cultivation of upland paddy, millets, wheat and pulses can successfully be grown in this soil.

CROPS

The staple crops of the district are paddy, wheat, maize, Mung, Biri, Arhar, groundnut, sesamum, castor, mustard, sugarcane and potato. The important fruit crops are coconut, mango, cashew-nut and banana. Among fibre crops jute and mesta are grown.

Rice

Rice which is the principal crop was grown in 5,15,000 hectares in 1988-89 and the break up is as follows:

	Area in '000 ha.	Production in '000 tonnes	Yield rate per hectare in quintals	
			Rice	Paddy
1. Autumn rice (Biali)	58	64	11.04	16.72
2. Winter rice (Sarad)	457	647	14.15	21.44
3. Total Kharif ..	515	711	13.80	20.93
4. Summer rice (Dalua)	23.86	50.61	21.21	32.14
5. Grand Total ..	538.86	761.61	14.31	21.70

High yielding varieties of paddy (H.Y.V.) are not generally grown in Autumn rice and normal varieties are not grown in Summer rice. Out of the Kharif acreage, H.Y.V. paddy was grown in 2,81,900 hectares and normal variety in 2,33,100 hectares. The entire acreage in Summer paddy was covered with H.Y.V. giving a production of 50,610 tons with a yield rate of 21.21 quintals of rice per hectare.

The reports of the Directorate of Statistics & Economics on the yield rate of rice in 1988-89 as follows:

		(Conversion to paddy at 66%)
(a) Autumn rice (clean)	15.33 Qtls./ha.	23.22
(b) Winter rice (clean)	16.93 "	25.65
(c) Summer rice (clean)	22.56 "	34.18
(d) Total rice (clean)	16.95 "	25.68

Mr. James Settlement Report shows that in the crop cutting experiments conducted in 1899 and 1911, the average yield rate of paddy was 23 maunds 18 seers (8.75 Qtls.) on irrigated land and 17 maunds 36 seers (6.70 Qtls.) on un-irrigated land per acre which worked out 21.62 Qtls. and 15.56 Qtls. per hectare respectively.

The experiments conducted from 1917 to 1929 (vide Dalziel's Settlement Report) shows the same to be 23 maunds 33 seers (21.96 Qntls. per hectare) on irrigated land and 17 maunds 16 seers (16.05 Qntls. per hectare) of paddy on un-irrigated land. The results of experiments done by the Attestation Officers of 1922—32 Settlement showed an average outturn of 19 maunds 21 seers (18 Qntls. per ha.) on irrigated land and 15 maunds 28 seers 11 chks. (14.47 Qntls. per ha.) of paddy on un-irrigated land per acre. The mean figures of random sampling experiments in Sadar Subdivision in the years 1928-29, 1929-30 and 1930-31 were 21.03 maunds (19.36 Qntls. per ha.), 22.47 maunds (20.72 Qntls. per ha.), 25.10 maunds (23.26 Qntls. per ha.) of paddy per acre respectively. The experiments in some principal flooded areas of the district produced the following results per acre respectively:

	Md.	Seers	Chks.
1925-26 Jajpur ..	13	34	15 (12.79 per ha.)
1926-27 Dharmashala ..	12	14	10 (11.38 per ha.)
1927-28 Kendraparha ..	14	17	10 (13.29 per ha.)

However, the average of Cuttack district in the last Settlement period (1922—32) was 17 maunds 9 seers 3 Chks. (6.43 Qntls.) per acre, i.e., 15.90 Qntls. of paddy per hectare. So the present yield rate gives an average increase of about 60% over the average of 1922—32 over a period of about 60 years. There are, of course, several constraints for substantial increase in average productivity, the chief among them being a large area subjected to water-logging, salinity, want of proper drainage and non-adoption of dry land farming practices to ward-off erratic rainfall, etc.

The varieties grown are very numerous. There are three regular paddy crops viz., (1) *biali* or early rice, sown in May or June and reaped in August and September; (2) *Sarad* or Winter rice, sown or transplanted in June and July and harvested between October and January; and (3) *Dalua* or Summer rice which is sown after the floods have subsided and is harvested in March and April.

Wheat

Wheat is the next important cereal crop of the district. It is grown on upland fields after rice and generally on loamy or silt-covered soil. During 1988-89 it was cultivated over an area of 4.31 thousand hectares. The production was 8.45 thousand tonnes and the yield was 19.60 quintals per hectare. The high yielding varieties like Sonalika are now popularly cultivated by the farmers of the district.

Maize

The other important cereal crop grown in the district is maize. It was cultivated over an area of 3.93 thousand hectares in 1988-89. The production was 5.25 thousand tonnes and the yield was 13.36 quintals per hectare. The introduction of high yielding variety viz., Vijaya, Ganga-5 and Jawahar has helped the cultivators in getting a higher yield by using their own seed stock. An area of 1.98 thousand hectares was put under high-yielding (Kharif) maize, whereas the common local varieties were cultivated in 1.48 thousand hectares.

Ragi

The area under ragi was 8.69 thousand hectares during 1988-89, the production being 8.39 thousand tonnes and the yield rate being 9.65 quintals per hectare. This crop is grown in both Kharif and Rabi season. Improved varieties of ragi are AKP-2 and Dibyasingha.

Pulses

Green gram (Mung), black gram (Biri), Arhar and cowpea are cultivated in the district. The total area under pulses was 311.60 thousand hectares in 1988-89. Production was to the tune of 188.76 thousand tonnes with an average yield of 4.29 quintals per hectare. *

Among the pulses Mung is the most important covering 125.39 thousand hectares followed by Biri, which covered 120.54 thousand hectares in 1988-89. Pusa Baisakhi, a short duration (65 days) Mung variety has been introduced in this district. The short duration high yielding varieties like Jyoti, Sujata, K-851 and T-44 are also popular among the farmers of the district.

* The Directorate of Statistics & Economics reports the yield rate of pulses and oilseeds in 1988-89 as follows:

(a) Mung	5.44 Qntls./ha.
(b) Biri	6.55
(c) Groundnut	15.62
(d) Til	5.09
(e) Mustard	5.32

Oil-seeds

Groundnut, sesamum, mustard, cowpea and linseed are the major oil-seeds cultivated in the district. Among minor crops mention may be made of castor, sunflower and safflower. During 1988-89, the total area under oil-seeds was 114.98 thousand hectares and the production figure was 146.02 thousand tonnes. The yield rate was 12.70 quintals per hectare. Groundnut was the most important oil-seed which covered 87.23 thousand hectares. Sesamum was cultivated in 13.34 thousand hectares followed by mustard in 12.30 thousand hectares, castor in 1.02 thousand hectares. Among the improved varieties of groundnut AK-12-24 Kisan, J-11, ICGS-44 and Jawan are cultivated and short duration mustard variety M-27, Barum, Pusabold is popular.

Commercial Crop

Sugar-cane, mesta and jute are grown as commercial crops in the district. Cotton and tobacco are also cultivated on a limited scale. Sugar-cane was grown over an area of 4.70 thousand hectares in 1988-89, the production being 33.84 thousand tonnes (in terms of Gur) with an yield rate of 72.00 quintals per hectare. The improved varieties of sugar-cane grown in the district are Co. 997, Co. 527, Co. 419, Co. 975, Co. 6304, Co. 62175 and Co. 740.

Mesta was cultivated in 1.49 thousand hectares during 1988-89 and 8.87 thousand bales * were produced with an yield of 5.85 bales per hectare. Jute was cultivated in 21.49 thousand hectares in 1988-89 and 196.20 thousand bales were produced with an yield of 9.13 bales per hectare. Some improved varieties of jutes like JRO-878 have been introduced in the district.

Condiments and spices

Chilli, coriander, garlic, ginger, onion and turmeric constitute the main condiments and the spices grown in this district. Chilli is the most important. This crop covered an area of 12.22 thousand hectares in 1988-89 and the production was 10.64 thousand tonnes with an average yield of 8.71 quintals per hectare. Onion was grown over an area of 3.98 thousand hectares during this year and the production was 28.73 thousand tonnes with an average yield rate of 72.18 quintals per hectare. Coriander covered an area of 3.62 thousand hectares followed by garlic 2.34 thousand hectares, ginger 0.98 thousand hectares and turmeric 0.71 thousand hectares. During 1988-89 there were 19.87 thousand hectares of

* One bale—180 kg.

land under cultivation of different condiments and spices and the production was 21.91 thousand tonnes with an average yield of 11.03 quintals per hectare.

Vegetables

The main vegetables cultivated in the district are potato, sweet potato, brinjal, cowpea, lady's finger, pompink, spine gourd, Kundru, cauliflower, cabbage and arum. The area under cultivation of total vegetables in the district was 110.43 thousand hectares and the production was 838.26 thousand tonnes. The yield rate was 75.91 quintals per hectare. During 1988-89, potato was cultivated in 3.74 thousand hectares with an average yield of 121.69 quintals per hectare. Sweet potato was grown over an area of 3.19 thousand hectares during 1988-89 and the production was 32.53 thousand tonnes with an average yield of 101.97 quintals per hectare. Much importance has been given for cultivation of potato in a wide scale. For production of improved variety of seed potatoes, breeder, foundation and certified variety are grown in the cultivators fields and departmental farms.

Fruits

Cultivation of different fruits like papaya, banana, pineapple, guava, citrus, Sapeta, Litchu, pomegranate, mango and jack-fruit are mostly adopted by the farmers of the district. 45.340 hectares were covered in 1988-89 under different fruit crops.

AGRICULTURAL IMPLEMENTS

Improvement in agricultural implements is the pre-requisite for any improvement in agriculture. The traditional implements commonly used by cultivators are plough, ladder, leveller, spade, sickle and several other big or small implements. But gradually the farmers are adopting modern implements according to their purchasing power and the suitability of the implements for their use. Improved implements of various sizes and uses are popularised by the Government through different schemes. About 30 per cent of the farm families use improved agricultural implements. Improved agricultural implements at 50 per cent subsidised rate are being sold to small farmers and marginal farmers. But the most useful and effective improved agricultural implement, i.e. tractors are not in use mostly due to scatteredness of holdings, high cost and general poverty of the cultivators. Throughout the district only 68 tractors and trailors are used by some big farmers.

ROTATION OF CROPS

Keeping in view the suitability of land, irrigation resources, restoration of soil fertility and socio-economic status of the farming community suitable cropping patterns are advocated for better utilisation of land, labour, water and capital. In irrigated conditions three to four cropping pattern and in non-irrigated lands two or rarely three crop cropping pattern have been adopted. The farmers have been advised to grow short and medium duration high yielding varieties of paddy and other medium as well as light duty crops as second and third crops.

The cropping patterns in general use are paddy—pulse—vegetables, jute—paddy—vegetables, paddy—oilseed—pulses under irrigated conditions and paddy—pulses (paira) and paddy—mustard in non-irrigated conditions. In improved method of cultivation with short duration high yielding varieties like early paddy—pulses—wheat, early paddy—groundnut—pulses, jute—paddy—groundnut, jute—paddy—pulses cropping patterns are being followed. In command area of the district multiple cropping pattern are being adopted. Among the cropping pattern the cultivator mostly adopt jute—paddy—groundnut, jute—paddy—pulses, paddy—groundnut—pulses, paddy—mustard—pulses rotation.

SEEDS

Good seeds considerably enhance the agricultural production. Much publicity and efforts are made by the Agriculture Department to popularise the use of improved seeds among the farmers. The department also undertakes the multiplication and distribution of improved seeds to the farmers.

For preservation of quality seeds the farmers of the district follow different practices. The cultivators after harvesting, dry the crop thoroughly. Then the crop is threshed and cleaned. It is further dried in the sun for a few days and then stored. Some farmers are keeping seeds in earthen vessel (Mathia) after sealing the mouth. Some farmers are also preserving the seeds in earthen container (Ghuma) or in straw beans (Olia) after proper sealing. Leaves of some indigenous plants and ashes are mixed with the seeds as a precaution against pest attack. The cultivators are also being advised to use metal storage bins for preservation of seeds.

The Agriculture Department is supplying foundation seeds from the Agriculture University, Central Rice Research Institute (C. R. R. I.) and Orissa State Seeds Corporation (O. S. S. C.) for multiplication in the Departmental farms under proper supervision of technical personnel and the Seed Certification Officer to produce quality seeds. Quality seeds are also supplied to the cultivators directly by the Orissa State Seeds Corporation, National Seeds Corporation and the Central Rice Research Institute (C. R. R. I.), Cuttack. More than 65 per cent area of the district is covered under high yielding and improved seeds. During the year 1989-90, 3,054 quintals of quality paddy seeds and 1,870 quintals of quality groundnut seeds were supplied to cultivators, besides small quantities of other seeds, according to demand.

MANURES AND FERTILISERS

In recent years, the use of manures and fertilisers has considerably increased. With the change of social and economic attitudes, the farmers are using not only compost of cowdung and other wastes but also chemical fertilisers. Green manuring has been found to be quite cheap and the chemical fertilisers applied with it, give better results. Rural compost is prepared from the cowdung and other waste materials. The farmers are guided in the preparation of the compost by the extension workers. Several steps have been taken for large-scale production of compost and organic manures. Every year the Compost Production Week (1st week of October and last week of February) is being observed in villages by the extension agencies and farmers are imparted training in preparation of organic manure. About 8.7 lakh tonnes of urban and rural compost are being produced annually on an average.

Green manuring

Green manuring is very useful for raising the fertility of the soil as it directly adds nitrogen to the soil. It also improves the texture of the soil by addition of organic matter. The addition of organic matter improves both heavy and sandy soils for it has a binding effect on the loose particles of sandy soil and makes the tough and heavy soil friable. It creates better conditions for increase of useful bacteria in the soil. The area under green manuring crops is roughly 1 lakh hectare per year.

Chemical Fertilisers

Among the chemical fertilisers, generally nitrogenous, phosphatic and potassic fertilisers are in use. During the year 1987-88 the fertiliser consumption of the district was 17 kg. per hectare. During the year 1988-89 to 1990-91 the fertiliser consumption has been increased to 30 kg. per hectare. The popular brand of chemical fertilisers used in the district are Gromore 28:28, Syamala, D. A. P., IFFCO, NPK, CAN (S), A/S, S. S. P. and M. D. P.

The quantity of various chemical fertilisers consumed in the district during the year 1987-88 to 1989-90 is given in the following table.

Year	N	P	K	Total
1987-88	12,271	4,822	4,273	21,366
1988-89	20,262	7,981	6,548	34,791
1989-90	22,871	8,286	6,500	37,657

PLANT PROTECTION

Chemical control is a widely adopted method to combat pest and diseases. The cultivators seldom take plant protection measures because of their unawareness of occurrences of various insect pests causing damages to the crop. In the past the farmers were basing gamaxene, D. D. T., bordeaux mixture, lime sulphur and tobacco decoction, etc. in greater proportions, which has been restricted now and has been replaced by other selective modern insecticides and fungicides, developed scientifically to avoid environmental pollution. Well-to-do farmers use plant-protection equipments whereas the poor farmers use broom stick for spraying operations. The cultivators are being advised for need based application of pesticides through extension agencies for which they are also given training in identification of pests and diseases in various training forums, group discussions, etc. Pest and disease surveillance work is being done by agricultural field staff and monitored by district and State level officers to know about the pest situation of the district and take necessary control measures at Government level if situation so arises.

Insecticides and fungicides are supplied to cultivators through blocks and Grama Panchayats as incentive to the farmers on emergent pest situation. The cultivators get pesticides and sprayers at subsidised rates under various schemes through sale centres opened by the various agencies. Some farmers have their own equipments also. The sprayers are being supplied to the blocks under different schemes to meet the emergency for mass spraying operations. There is provision of free spraying of pesticides in epidemic areas by the Agricultural Department, if the area is declared epidemic by the Collector.

AGRICULTURE FARMS AND CENTRES

Before Independence, two Agricultural farms namely **Kujanga** and **Jajpur** existed which was inadequate to meet the seed requirement of the farmers of the district. Therefore, another six small farms and one large farm were established and developed during the years 1948 to 1982 at Athagarh, Narasingapur, Banki, Barachana, Tirtol, Punanga and Sukinda for seed multiplication and production of foundation seeds. In total 10 farms including one Soil Conservation Farm have been established in this district for demonstration, research and for multiplication of different seeds and to produce quality and foundation seeds for the farmers. The details of two such farms are described below. Other farms are small once with area varying between 5 to 21 hectares.

Biswanahakani Farm

This farm known as Soil Conservation Demonstration Centre was established in the year 1966 with an objective to demonstrate different soil and water conservation techniques needed for proper land utilisation with different kinds of soil by adopting soil conservation measures like contour bunding, field bunding, bench terracing and engineering structures like water harvesting and gully control structures, etc. on micro-water-shed basis. This is a demonstration-cum-research centre for high yielding cocconut and cashew crops. This farm is located over an area of 830 acres eroded undulating hill-slope and gully land covered mostly with shrubs, thorny bushes and secondary forest growth after heavy deforestation. It is situated 11 km. from Kapilas Road Chhak on the N. H. No. 5 by the side of the road leading to Kapilas. It is a scenic spot where large number of people from Cuttack town congregate during vacation and holidays for picnic purpose. There is an Inspection Bungalow for officers of Soil Conservation Department which is not available to outsiders. It has great potentiality for developing as a tourist spot. The land use so far made by the Soil Conservation Department in this farm is as follows :

1. Area under cashew plantation	..	432 acres
2. Area under cocconut plantation	..	125 acres
3. Area under commercial plantation crops and fruit trees		20 acres
4. Area under annual cropping	..	105 acres
5. Area under waste land unclaimed land or roads and buildings and farm pond		148 acres

830 acres

The foot soil portion extending over an area of 582 acres is covered with cashew plantation (200 acres), the land between 5 to 10 per cent slope is utilised as coconut plantation (125 acres). The steep hill portion is covered under thick vegetation and is not subject to erosion. A series of water harvesting and gully control structures have been constructed across the nallah which controls gully erosion of the farm and also protects hundreds of acres of farmers' fields lying down the stream and provides supplementary irrigation during drought.

Sukinda Farm

This is the biggest farm in the district. It was established in the year 1948-49 with a geographical area of 557.6 hectares, out of which 450 hectares are cultivable. It is situated on the way from Jajpur road to Kamakshanagar road at a distance of 3 km. from Mangalpur bus stop. This farm is meant for seed multiplication. Besides paddy, jute, groundnut, Arhar, Mung and Biri are cultivated in this farm.

AGRICULTURE RESEARCH CENTRE

Under the World Bank assistance one Research Station has been established at Barachana from the year 1980-81 under the National Agricultural Extension Programme by Orissa University of Agriculture and Technology as supporting activities for agricultural extension. Various trials on cultural practices and weedcides are being undertaken in this Research Station. During the Kharif season of 1989 four such trials were taken up by this Research Centre.

Research Institute (Central Rice Research Institute)

The Central Rice Research Institute (C. R. R. I.) is a Central Government establishment set up at Cuttack in 1946. It is in the administrative control of the Indian Council of Agricultural Research (I. C. A. R.).

The Institute conducts research on crop improvement and resource management, imparts training on research to rice research workers and on production technology to subject matter specialists. It serves as a source of information concerning rice production, protection and conservation. The institute has developed high yielding varieties of rice, rice varieties resistant to pests and diseases which it has transferred to farmers and has helped the country in augmenting rice production.

The institute has twelve major divisions/sections namely, Plant Breeding and Genetics, Soil Science and Micro-biology, Agronomy, Plant Physiology, Plant Pathology, Entomology, Biochemistry, Agricultural Engineering, Agricultural Economics, Statistics, Genetic Resources and Extension, Communication and Training.

It is also a Research Institute where training is imparted on doctoral and post-doctoral research, rice research and production technology. It has conducted collaborative research programme with various national and international organisations.

Water and Land Management Institute, Pratapnagari (WALMI)

WALMI, Orissa came into being as a component of office of the Engineer-in-Chief, Irrigation, Orissa during 1984 at Pratapnagari in Cuttack district. The Institute has since been registered as an autonomous society during 1986. For some time it was assisted by the World Bank and later upto 30th September, 1992 by U. S. aid. A Governing Council under the presidentship of the Commissioner-cum-Secretary to the Government of Orissa, Irrigation Department, administers the Institute.

The Objectives of WALMI, Orissa are as follows:

- (a) To promote advancement of science and acquisition of scientific knowledge and provide instructions and training in all branches of science both theoretical and applied and in particular in water management and development for irrigation and agriculture.
- (b) To impart instruction and training in water management and land development for irrigation and agriculture and hold examinations and grant certificates/diplomas, etc. recognised by Universities in India as well as abroad.
- (c) To undertake research in water management and provide consultancy in water management.

WALMI, Orissa joined the Indo-U. S. Water Resources Management Training Programme with effect from the financial year 1988-89.

The permanent campus with land area over 52 acres is coming up at Pratapnagari on the side of National Highway No. 5 at a distance of 8 km. from Cuttack and 15 km. from Bhubaneswar. The campus is located in Mahanadi-delta command area and is bounded by Puri main canal, Kakatpur branch and Phulnakhara distributory on its three sides. It conducted sixteen courses during 1991-92 for 338 trainees of various levels (in addition to the above-one farmers' course and Water Resources Day celebration were conducted) and during 1992-93, up to the end of December 1992, conducted nineteen courses for 470 trainees. In addition, Water Resources Day at one centre during 1991-92 and at twenty centres during 1992-93 were celebrated to spread the aims and

objectives of WALMI. The second most important activity of WALMI is "Action Research" and "Adoptive Research". In Action Research, the thrust is to improve the agricultural produce from a given area by investigating the causes for underproductions and then listing the remedies required and prioritising the remedies. A judicious balance between solutions with least cost and larger time frame vs. solutions with least time and normal cost are to be studied and an optimum solution derived. Adoptive Research on the other hand lays emphasis on transfer of technology that has been successfully adopted elsewhere to the farmers' fields by actual interaction with the farmers and their trainers. The third important activity of WALMI is to motivate the farmers to form water users societies. These societies in the ultimate stage would take over the running and maintenance of the irrigation system in their respective areas.

FOOD PRESERVATION

There is one Government Cold Storage at Cuttack with 15,000 quintals capacity and six co-operative cold storages operating in the district. The location of the Co-operative Cold Storages are (1) Baialish-mouza (30,000 quintals), Bahugram (16,500 quintals), Jagatpur (40,000 quintals), Jagatsinghapur (4,000 quintals), Ghasipur (6,500 quintals) and Athagarh (20,000 quintals). There is also one Government Fruit Preservation Centre located at Cuttack.

AGRICULTURAL EXHIBITION AND SHOWS

Exhibition plays a vital role for publicity of agricultural activities and programmes to create interest in the farmers' mind for taking up better agricultural practices. Accordingly, due importance has been given to organise exhibitions in different spheres i. e., at Village level, Block level, Subdivision level and District levels. During the year 1989-90, 3 exhibitions at District Level and 12 exhibitions at Subdivision and Block levels were organised.

HORTICULTURE

Under Horticulture Directorate, there are seven Horticultural Divisions in this district each headed by a Horticulturist in Class-II of State cadre. The divisions are located at Cuttack, Jajpur, Jagatsinghapur, Kendraparha, Athagarh, Tirtol, and Marichipur. To look after the extension work, gardeners and grafters are posted at Block levels. The Junior Agriculture Officers are posted in the headquarters of Horticulturists to supervise the work of the gardeners and grafters.

The high land and negligible part of medium land of the district are suitable for horticultural plantation. Accordingly programme for growing banana, papaya, vegetables in the medium land and other fruit crops at comparatively higher lands is taken up.

The important fruit crops of the district are cocoanut, banana, citrus and mango. Crops like guava, pineapple, papaya and other miscellaneous fruit crops are also grown to a limited extent. Since the irrigated areas are not normally spared for horticultural plantation, importance is given for optimum utilisation of the potential area. In the district there are cocoanut nurseries at Athagarh, Derabis, Tirtol, Marichpur, Mahanga and Rajkanika out of which the last two are not functioning at present. In these nurseries about 2.5 lakhs of cocoanut seedlings are produced annually. In addition, varieties of planting materials are produced in the fruit farms and headquarters nurseries established in the office campus of the horticulturists to supply them to the cultivators. Considering the agro-climatic factors of the district attempts are made to utilise the potential area where irrigation can be made available through dug-wells and other sources for extending more area under fruit and vegetables. The following is the achievement under various horticultural programmes undertaken in the district.

Area Extension Programme on Fruit Plants

Under this programme 867 hectares in 1986-87 and 1,006 hectares in 1988-89 were covered with different fruit crops of which cocoanuts were 620 and 776 hectares respectively.

Area Extension Programme on Vegetable Development

Area under vegetables like Vendi, cowpea, brinjal, gourds etc. during Kharif and potato, cole crops, spices, onion etc., during Rabi season has been extended particularly around major urban centres keeping in view the availability of marketing facility. Vegetable seeds and seedlings of improved varieties alongwith pesticides and fertiliser in small packets are supplied at Horticulturist Office, kitchen garden sale centres and also in interior villages through the office staff.

Production of Planting Materials

Quality planting materials like grafts, gooties and seedlings of different fruit crops like mango, sapeta, litchu, guava, jack-fruit, drumstic, wood apple, custard apples, ornamentals, suckers of banana and

pineapple are produced in fruit farms and nurseries and distributed to the cultivators. 5,550 Gooties and 19,984 seedlings were produced in 1987 under this programme.

Preservation of Fruits and Vegetables

Under this programme demonstration is arranged to show the method to the beneficiaries for preparing squash, jam, jelly and chutney, etc. from perishable fruits like orange, guava, pineapple, tomato and mango, etc. 1,000 beneficiaries were covered under this programme in 1988-89 in the canning centre at Cuttack town.

Backyard Plantation

Under this programme Scheduled Caste families possessing space at their backyard are supplied with fruit bearing trees to plant them in their backyards to increase their economic status. These plants are mainly cocoanut, K. lime, jackfruits, mango, etc. 5,964 beneficiaries benefited out of this scheme and 35,080 plants were distributed among them in the year 1988-89.

Plantation under National Rural Employment Programme

Under this programme 50,000 seedlings of fruit bearing trees were distributed free of cost to the institutions, school orchards, Gram Panchayats, orchards of Scheduled Caste and Scheduled Tribe families to plant them in their back-yard in 1987-88.

Plantation under 20 point Economic Programme

Under this programme 2.56 lakhs fruit bearing trees as well as trees with economic importance raised in different farms and transit nurseries were supplied / sold to the interested cultivators coming under small and marginal farmer group and others in 1987-88.

Kitchen Garden Scheme

Under this scheme vegetable seeds, pesticides, fertilizers in small packets are supplied to the needy cultivators in the sale centres functioning at the office of the Horticulturist headquarters and in the transit nurseries. The seeds are also being supplied to the interior villages through the Horticulturists staff.

Vegetable Minikit Programme

Under this programme improved and high yield varieties of seeds, fertilizers and pesticides are supplied to the vegetable growers free of cost in order to introduce new varieties in the area to get more yield of the crop. This programme is taken up in both Kharif and Rabi season.

Plantation under E. R. R. P.

Under this programme mainly cocconut plantations were taken up on canal embankments for distribution to poor beneficiaries. Each beneficiary gets 20 plants. The beneficiaries have been supplied with the 'patta' issued by the respective Tahasildars conferring dafayati rights. 3,04,390 cocconut plants were planted under this scheme upto 1985-86. This scheme has been a complete failure as the beneficiaries do not take care of the plants, and fruits, if and when appear, are immediately pilfered by the local people.

STATE ASSISTANCE TO AGRICULTURE

The following special agricultural schemes were implemented in the district with a view to increasing productivity by adoption of improved technology.

(i) Special Rice Production Programme

As per the programme, 98,400 No. of paddy kits (each 5 kg. weight) were supplied to the farmers at nominal cost in 1988-89. Sale points have been opened in each block for sale of fertilizer, pesticides, sprayers, agricultural implements at 50% subsidy to the farmers. Besides, pump sets and power tillers are available at subsidised rates.

(ii) Special Jute Development Programme

This scheme is in operation in this district since 1988-89 in seven blocks viz., Salepur, Nischintkoili, Mahanga, Barachana, Derabish, Kendraparha and Marsaghai. In that year 510 mt. of soil amelioration materials were supplied and 123 no. of training programmes conducted under the programme.

(iii) Crop Demonstration

Demonstrations are being conducted in the farmers' fields on different crops by availing assistance from different schemes. 2,204 such demonstrations were carried out in 1988-89.

(iv) Multiple Crop Demonstration

Multiple crop demonstrations have been conducted in the district in different pockets of the command area. 250 acres of M. C. D. P. demonstrations have been conducted in different C. A. D. A. Blocks in the area where field channels have been completed in the year 1988-89.

(v) Farmer's Training

In the command area two types of training programmes are conducted. These are short duration courses for one day and sustained training for 3 days only. Specialists from Agriculture Department, O. U. A. T. and Central Rice Research Institute impart training to the farmers. This type of one day and three days training camps are organised during Kharif and Rabi seasons at different blocks of the command area. 1,362 farmers were trained and 44 numbers of training were conducted under the scheme in 1988-89.

(vi) Rotational Water Supply (Waravandi) Programme

The rotational water supply on Waravandi system is an effective method of distribution of irrigation water among the farmers having lands within an outlet command. This system not only reduces the water-logging in the head zone of each canal, distributary, minor, sub-minor and even water courses, but also stabilises water supply in middle and tail end zones. The achievement under Waravandi programme during the year 1988-89 was 15,030 hectares against the target of 16,500 hectares. The short fall of acreage was due to short supply of canal water for barrage construction.

CROP INSURANCE SCHEME

A comprehensive crop insurance scheme is under execution since 1987-88. The main paddy crop has been included in the insurance scheme. The aim and object of the scheme is to compensate the loss caused due to flood, drought, cyclone and other natural calamities.

AGRICULTURAL CO-OPERATIVES

By making provision for timely and adequate credit, supply of chemical fertilizers, improved seeds, pesticides and insecticides and weedicides, agricultural machines, land reclamation, installation of tubewells, purchase of tractors, dairy farming, horticulture, pisciculture, etc. and by creating facilities for marketing of agricultural produce and storage arrangements, agricultural co-operative societies have come to play an important role in the field of agriculture. The co-operative credit movement received a boost in 1954, when the integrated scheme of rural credit was introduced to expand the role of co-operatives in rural finance, following the recommendations of the All-India Rural Credit Survey Committee appointed by the Reserve Bank of India.

The advances sanctioned by different Co-operative Societies and Commercial Banks in the year 1988-89 is given below :

	Amount advanced (Rs. in lakhs)
1. Primary Agricultural Credit Societies ..	761.01
2. Commercial Banks ..	420.91

NATURAL CALAMITIES

The most difficult problem which the district administration is facing is the natural calamity which visits the district almost every year. The rainfall is in most years ample for its needs, but it is precarious, and its early cessation is fatal to the rice crop on which the people mostly depend. In the deltaic tract which forms the greater part of the district, the difference of level between the high and low-lying lands is so slight that, in the event of scarcity of rainfall, all parts are equally affected. The low lands are not sufficiently below the level of the uplands to retain moisture for any considerable time after the rains have ceased, and in years of drought the crops grown on them do not compensate for the loss of those which may be burnt up on the arid higher level. A drought is, therefore, liable to affect Cuttack district more seriously than other districts. Since the droughts, however, of 1836, 1837, 1842 and 1865-66, all of which caused more or less distress, and the last of which brought on the great famine of Orissa, large irrigation works have been constructed so that the district is partly protected from famine, even when there is a prolonged cessation of the rains.

The next great danger to which the district is exposed is that of inundations. The district is liable to suffer from the floods of the Mahanadi, the Brahmani and the Baitarani, as the channels of those rivers are insufficient to carry off the great volume of water which comes down after heavy rains. The low floods do little harm, as they are prevented from devastating the country by the embankments. The high floods which sweep across the paddy-fields do great damage to the standing crops, as they generally occur in July, August and September, when the paddy is in the first vigour of its growth, or is in flower or nearing maturity.

The district also suffers from violent cyclones and storm-waves which generally occur before and after the rains, of which October is the most crucial month. The other months in which storms affect Orissa coast with lesser frequencies are May, September and November. Cyclones generally bring in their trail heavy rains causing severe floods, tidal disasters and saline inundation.

A short description of some of the serious natural calamities that occurred in the district are discussed below:

Famines

According to the historical records, terrible famines occurred in the 14th, 15th and 16th centuries and also during the rule of Marathas in the district. In the famine of 1770 which is known as the great "Bengal famine" the people died by hundreds of thousands, rice was two seers per rupee and the situation was very grave while the Maratha soldiers plundered and devastated the country. Four years later, i.e., in 1774 another scarcity occurred due to failure of rains and there was acute shortage of food grains. In Cuttack town rice was purchased at 10 annas (Re0'62) for the local seer (105 Tolas). In 1792-93, the last great famine of the 18th century swept away a good fraction of population. After that another scarcity occurred in 1803, and when the district passed into the possession of the British the condition of the country was wretched.

Famine of 1865-66

The years 1806, 1808, 1817 and 1828 were years of bad crops and scarcity and in 1836, 1837 and 1842 Cuttack district suffered severely from drought. But the really great catastrophe of the century was the famine of 1865-66, popularly known as "Na-Anka Durbikhya". No such calamity had occurred for nearly a century; it had to be dealt with by a body of officials totally ignorant of the signs of its approach,

unprepared to expect it, and inexperienced in the administration of relief measures; nor were the inhabitants any better aware of it when it descended on them than the British officers. The rainfall of 1865 was scanty and ceased prematurely so that the outturn of the great crop of winter rice, on which the country mainly depends, was reckoned at less than a third of the average crop. Foodstocks were low as the quantity exported in 1865 was unusually large and because the people, unaccustomed to precarious seasons, had not retained sufficient stock of foodgrains at home. When the harvest failed, the gravity of the occasion was not perceived and no special inquiries were instituted, while price long remained so moderate that they offered no temptation to importers and forced no reduction in consumption on the inhabitants, till suddenly the province was found to be almost empty of food. It was discovered only in May 1866 that the markets were too empty for the jail prisoners and the Government establishments to get supply of rations. As the southern monsoon had now begun, importation by sea or land became nearly impossible. Orissa was at that time almost isolated from the rest of India; the only road leading to Calcutta, across a country intersected by large rivers and liable to inundation, was unmetalled and unbridged; and there was very little communication by sea. By great exertions, the Government succeeded in importing about 10,000 tons of foodgrain by the end of November and this was given away gratuitously or sold at low rates, or distributed in wages to the starving people. But meanwhile the mortality among those whom this relief did not reach or reached too late, had been very great and it was estimated that nearly 1,00,000 persons had died. Though the general famine may be said to have come to an end in November when the new crop began to come into the market, great distress still continued in some parts of the country. The later rainfall of the year was so heavy that it caused great floods in the river Mahanadi and though the harvests in the higher lands were excellent, in all the low lands the crop was submerged and lost. Half the district of Cuttack was thus devastated. In January 1867 forty deaths a day from starvation were reported and relief work had to be resumed. Altogether about 40,000 tons of rice were imported and lavishly distributed and about half had been disposed of when the monsoon of 1867 followed by an unusually fine harvest, altogether put an end to the famine in 1868.

History of the famine in the district

The preceding summary of the history of the Orissa famine is condensed from the report of the Famine Commissioners of 1868, but the

catastrophe in the district was so great that a fuller description of the way in which it affected Cuttack district can be found in O'Malley's Cuttack District Gazetteer.

Scarcity of 1896-97

Since 1866, there was no occurrence of famine in the district owing to the protection afforded by the irrigation works. Due to complete failure of monsoon in October 1896 and an unprecedented flood of great severity followed by short rain in September there was scarcity in 1897. All the great rivers rose almost simultaneously to nearly the highest level on record, overflowing their banks or breaching the embankments. They submerged the low lands, which remained water-logged for more than a month owing to the long duration of the flood waters in the rivers. Not only was the crop ruined, but much land became unfit for cultivation by sand deposit. On the subsidence of the floods the cultivators replanted as soon as possible, but the next sowings were sacrificed to drought as the old ones had been to flood. The drought was also of long duration, the rains having ceased at the end of September; in some places the winter rice crop which is the mainstay of the district, failed entirely, and in others the harvest was very poor. The affected area was 1,360 square miles (3,522 sq. km.) or more than one-third of the district, with a population of 6,24,840 souls but distress existed more or less throughout the whole district and relief had to be given in all the Subdivisions from the middle of March to the end of September, 1897.

Drought of 1971

In this drought there was severe loss of Kharif crop upto 34 per cent of the normal harvest. Kharif paddy crop was completely damaged in 38,470 hectares and partially damaged in 35,000 hectares and about 11.60 lakhs of people were affected.

Drought of 1979

In the year 1979, there was practically no pre-monsoon rain in the district. Monsoon started late and the rainfall was erratic. Early variety of paddy in almost all the Blocks was reported to have sustained heavy damage. The medium and late variety also suffered serious set back, specially in non-irrigated and rain-fed areas, the recoument of which was not possible for want of continuous good rainfall. In this drought, 3,991 villages in 370 Gram Panchayats of 37 Blocks and 2 Notified Area Councils sustained crop loss of 50 to 74 per cent in the district.

Flood

Cuttack district falls within the two major deltaic zones of Orissa i.e., Mahanadi and Brahmani. The topography is extremely flat, contained between contour 21 metres and the mean sea-level. While the slope at the delta head (Naraj) is about 5 metre per mile, it is about 9 inches per mile at tidal water. In case of Brahmani delta, the slope is still less and does not anywhere exceed 14" per mile. To add to it, the flat land is broken by numerous small and large natural drainage channels and minor depressions. Innumerable small streams and creeks also flow into large streams. The problem relating to drainage congestion has already been discussed. Coastal conditions pose a serious impediment in improving drainage in this area. Strong littoral drifts help building large sand dunes and bars along the coast line, blocking thereby river flows.

Excepting the major rivers, their tributaries almost dry up in the hot weather. Their beds give a very desolate look consisting of vast stretches of sand only. But in the rainy season and especially after a cyclonic storm, the entire delta gives a different picture. The entire rainfall in the catchment tries to find way into the sea through the delta. The rapid rain water in the upper reaches, laden with silt & sand finds it difficult to maintain its velocity because of the flat land in the deltaic plain and consequently deposits the suspended material in the river bed as well as by the side of the embankments. Repeated action like this, year after year, has raised the river bed in relation to the surrounding area. This state of affairs results in spilling over the banks during rainy season. In very high flood, excess discharge of river water inundates the surrounding country and cause severe damage to life and property.

Since 1630 to 1927 floods of a serious character have occurred no less than 28 times, viz. in 1831, 1834, 1848, 1851, 1855, 1856, 1857, 1862, 1866, 1868, 1872, 1874, 1877, 1879, 1880, 1881, 1885, 1892, 1894, 1895, 1896, 1900, 1907, 1911, 1913, 1920, 1926, and 1927. It would be a mistake, however, to suppose that the floods are always destructive. They undoubtedly do harm in many ways, and the greatest of them have caused widespread havoc and destruction; but if they are not of long duration or of great height and they come pretty early in the season, these inundations are productive of almost as much good as harm, as they are usually followed by excellent harvests. In many places the receding waters leave a fertilizing deposit of silt, which enriches the soil and its productive capacity and is of much benefit to the crops; and even the highest floods are of service as their scouring action results in the

clearance of silt on a large scale, and thus increases the capacity of the discharge of the various channels. It is only when their duration or height is extraordinary or when they occur so late as to render resowing impossible, that very serious and widespread damage is done.

Details about some major floods are given below:

Flood of 1855

With the possible exception of the flood of 1834, the highest flood occurred in July 1855, when the Mahanadi rose to an enormous height and the maximum reading (127·13 ft.) on the Lalbagh gauge was recorded. The embankments were breached at no less than 1,365 places and besides the terrible losses sustained by the people in the submerged tract, 52 square miles (135 sq. kilometres) were reported as being permanently left waste. Fortunately, however, the flood fell as quickly as it rose and though it submerged nearly the whole district, it did not cause nearly as much damage as a protracted flood would have done.

Flood of 1872

The next great flood was that of 1872, which was very nearly though not quite as high as the flood of 1855. The water level at Jobra was recorded 75·95 ft.*. In Cuttack district 1,135 sq. miles (2,940 sq. km.) of area was inundated. Cuttack town was cut off from all communication with the surrounding areas and was in imminent danger, being saved only by the energy of the local officers. The canals and embankments were seriously affected and the country was a vast sea of water stretching from Cuttack to the coast, dotted here and there with a few village-sites, where the people and cattle found a temporary shelter and huddled together in the greatest distress. Fortunately this flood occurred early in the season, in the first week of July and as the subsequent season was favourable, a good crop was obtained from most of the lands inundated.

Flood of 1892

The flood of 1892 was due to Mahanadi being swollen to a great height by heavy rainfall, the level at Naraj on the 26th July being 92·10 ft. and at Bellevue on the Kathjodi 88·30 ft. The level above which the Mahanadi may be considered to be in high flood is 88·00 ft. at Naraj and the river was above this level for only 5 days as against 8 days in 1872.

*The danger levels at Naraj (undivided Mahanadi), at Jobra (divided Mahanadi) and at Bellevue (Kathjodi) are 26·52 metres (68·68 ft.), 21·84 metres (56·56 ft.) and 22·5 metres (58·27 ft.) respectively.

The Kendraparha canal was breached in the 19th and 20th miles, and the Kendraparha Extension canal from Marsaghai to Jambu was also overtopped and breached in the 19th and 20th miles, and the Kendraparha Extension canal from Marsaghai to Jambu was also overtopped and breached in many places.

Flood of 1896

In the flood of 1896 the Brahmani and Baitarani as well as the Mahanadi rose to great heights almost simultaneously, but the main feature of the flood was its long duration. For fifteen days, i. e., from the 24th July to the 7th August, the Mahanadi was continuously above the level of 88·00 ft. at Naraj except for a few hours on the 2nd August; on the 25th July it attained its greatest height at 92·10 ft. or the same height as was reached by the floods of 1872 and 1892. The embankments were breached in numerous places, and the Kendraparha Extension canal, standing out like the bank of an inland sea, suffered much from the erosion of the waves breaking on it, and was again wrecked. In almost all the parts unprotected by embankments the heavy floods destroyed the *bhadoi* and winter rice crops, and extensive tracts lay under deep water for many days. Some lost their lives and property and there was considerable distress as all the country lay open to the ravages of the flood.

Flood of 1920

In August 1920, there was another disastrous flood, which affected all rivers and rose to new record heights in the Brahmani and Kharsuan, breaching the embankments in many places. The Aul ring bundh gave way, and an area of nearly 80 square miles (207 sq. km.) within it was laid waste. This bundh, erected in the latter part of the 18th century and preventing the deposit of silt upon the area within it, had created a basin lower by several feet in places than the surrounding country, and this remained water-logged long after the floods had subsided.

Flood of 1926

In 1926 all three rivers were in simultaneous flood on three separate occasions. A very high flood in the third week of August was followed by a moderate flood early in September, and again by a very high flood in the third week of September. The monsoon had been late, and the crops only recently transplanted, were in no condition to put up any kind of fight for survival. The levels in most of the rivers were little, if any, below the records of 1920. Almost all the embankments were excessively damaged. Kendraparha and Jajpur Subdivisions were the worst affected, the crops of over 60,000 acres in each being damaged. The water level in the Mahanadi was 91·86 ft. at Naraj and 75·39 ft. at Jobra.

Floods of 1933 and 1937

There was also a flood in the Mahanadi in 1933, when the water level at Naraj was recorded 91.86 ft. In this flood 3,919 houses collapsed, 7,565 houses were damaged and 8 human lives were lost. Similarly in the flood of 1937 the water level at Naraj was 91.50 ft. causing 75 breaches in the Mahanadi embankments. In this flood 758 villages were affected, 3,378 houses were damaged, 6 human lives and innumerable cattle lives were lost.

Flood of 1955

In the year 1955 heavy incessant rain in the catchment area continuing for one week ending on the 4th September created unprecedented floods in the principal rivers of the district. The district did not ever have the experience of this kind of flood in living memory during the preceding one hundred years. The flood-water overflowed the banks of the great rivers of the Mahanadi, the Brahmani and the Baitarani which with their branches and tributaries swept over the three coastal districts of Cuttack, Baleshwar and Puri before reaching the Bay of Bengal.

The Mahanadi with her catchment basin of 51,000 sq. miles (1,32,090 sq. km.) had faced heavy rainfall. The floods of this year were considered abnormal due to the fact that in addition to the very heavy rainfall in a short time of about 48 hours in the catchment areas of the river, there was widespread rain throughout the delta area simultaneously adding to the volume of water all along the course of the river in the lower reaches right upto its estuary. The Mahanadi gauge at Jobra in Cuttack city rose up to 76.20 feet and at Naraj upto 89.17 ft. in the early hours of the 6th September, 1955. This was the highest gauge reading recorded at Jobra so far in the history of the Mahanadi flood in about a hundred years against the previous flood water level of 75.95 feet recorded on 4th July, 1872 at the same gauge. Within about 48 hours upto the midnight of 5th/6th September, 1955 the level of Mahanadi rose by about a height of 5.02 feet. In the early hours of the 6th September, 1955 the left bank of Kathjodi near Dalaihai breached for a length of 610 metres diverting the major current of the river into the fully protected and irrigated areas of Cuttack district.

During the period from the 26th August to 4th September, 1955 the Brahmani with its catchment basin of 14,000 sq. miles (36,260 sq. km.) also had heavy rainfall. The heavy rain in the Brahmani catchment area caused the worst flood ever recorded in the history of the river

*"Rivers of Orissa"—A. S. Thompson (Page-3).

which started rising from the 3rd September, 1955 and within 24 hours recorded the highest gauge-reading at Jenapur. The gauge at Jenapur rose to 72.20 feet at 02.00 hours on the 4th September 1955 against the highest record of 71.30 feet in 1943.

When the district had hardly been able to recover from the shock of the first flood, on the 2nd of October, 1955 a recurrence of high floods in the Mahanadi, the Baitarani and its tributary, on account of heavy rainfall in different parts of the State since the 30th September, 1955 seemed imminent. The immediate result of this second flood in the Mahanadi was that the temporary ring bundhs constructed at the most dangerous points at Dalaighai in the Kathjodi by the Orissa military police and the Army personnel were breached on account of its over-topping at 0.25 hours on the 4th October, 1955.

Devastations by 1955 Flood

The devastations caused by flood was the greatest in 1955 due to breach at Dalaighai in the Sadar subdivision of the district which inundated a large area of thickly populated, protected and irrigated region which is more or less the granary of the district. The suddenness of the flood and the velocity with which the floods descended in all the rivers simultaneously, and the simultaneous occurrence of a very large number of breaches in all of them, caused widespread inundation of the fertile and populated areas. So vast was the area covered by flood water that when the relief parties flew over the inundated areas the whole area between the Baitarani and the Mahanadi extending upto the Chilika lake looked almost like one sheet of water. Villages were marooned for days together. Besides casualties involving loss of human life and livestock, there was disruption in roads, railways and telegraphic services and communications by water were also paralysed. The breaches caused heavy damage to crops and houses. Approximately 13,56,516 population in 3,440 number of villages were affected in this district. The total cultivated area affected in Cuttack district by this flood was 6,30,889 acres (2,55,510 hectares). Total number of human lives lost by this flood was 59.1160 ha. of land were sandcast and 101 houses were completely washed away. There were altogether 263 breaches in embankments in Cuttack and Puri districts.

Flood of 1971

As a result of heavy rainfall during the period from the 20th July, 1971 to the 22nd July, 1971 in the catchment areas of the rivers Mahanadi, Brahmani, Baitarani and its other tributaries there were high floods in

the said rivers inundating vast areas of Bari, Dasarathpur, Barachana, Dharmashala, Rasulpur, Binjharpur and Jajpur Blocks in Jajpur subdivision and Rajkanika, Pattamundai, Rajnagar and Aul in Kendraparha subdivision and Athagarh Block in the Athagarh subdivision. On the 21st July, 1971, there was a breach at village Nosta in the Kelua embankment. As a result of this, flood water submerged vast areas of Dasarathpur, Barachana, Jajpur, Korei, Rasulpur and Bari Blocks. On the 23rd July, 1971, there was a breach near Kacarrigan on the irrigation embankment at Mirpatna on Kharsuan right embankment.

Before the rush of the water of this flood was fully discharged into the sea, the same rivers were again in spate on the 27th July, 1971. This caused a major breach at village Mohanpur in the Dharmashala Block.

Again on the 3rd August, 1971 to the 12th August, 1971 due to high flood in river Brahmani and its tributary Kharsuan all blocks of Jajpur subdivision and vast tracts of Kendraparha subdivision were inundated. There was a major breach in All Ring Bundh at Aitpur. There were breaches at Daultora and Joriguida on the Kharsuan left embankment. A breach occurred at Jaharighai on the Brahmani left near Bari-Ramachandrapur and another major breach at Rambhadeipur on Kelua right embankment.

The fourth flood occurred on the 1st September, 1971 in the said rivers which caused a wide breach at Dhanikhia ring bundh in Devi river near village Gorei in Naugan Block of Jagatsinghapur subdivision.

The fifth round of flood came in the same rivers from the 14th October, 1971 to the 16th October, 1971 causing untold miseries to the area already affected on account of flow of water through the existing breaches. The damages in the district due to this flood were as follows:

Area affected—2.59 lakh hectares in 41 blocks

Population affected—15.20 lakhs.

Damage to crops—2.11 lakh ha. valued at Rs.8.84 crores

Damage to houses—67,293 houses valued at 8.81 crores

Human lives lost—15

Cattle lost—54

Flood of 1975

Due to heavy rainfall in catchment areas, rivers Sapua and Kantia, the two tributaries of the river Mahanadi were in spate and affected 18 villages and more than 6,000 people in Athagarh Block from the 16th June, 1975 to the 19th June, 1975.

The floods in August in the major rivers Mahanadi, Kathjodi, Brahmani, Baitarani, Kharasrota with their numerous tributaries like Budha, Birupa, Genguti, Kalua, Patra, Chhinda, Hansua, Luna, Chitrotapala, Sapua and Devi caused havoc.

The flood water in river Brahmani which reached the highest level with maximum discharge ever recorded on the 20th August, 1975 remained above the danger level till the 23rd August. Aulring bundh had a minor breach. River Luna crossed danger level and caused breach in the left. Due to non-discharge of water of river Hansua there was water-logging in Ersama area.

In this flood six subdivisions, 31 blocks, 291 Gram Panchayats, 2,376 villages were affected. The total area and population affected by the flood were 1,103,360 acres (4,46,860 hectares) and 1,432,305 population respectively. 18,736 houses completely collapsed, 30,083 houses were partly collapsed and the total loss was Rs.2,57,58,090. Total casualties due to flood was 32.

Flood of 1977

Due to heavy rain in the month of August and September of 1977, high flood came in the Brahmani, Baitarani, Mahanadi, Kharsuan, Kathjodi, Birupa and Genguti rivers of Cuttack district. Out of 41 blocks of the district, 36 blocks were affected by the flood. Extensive damages occurred in 6 subdivisions viz., Kendraparha, Jajpur, Sadar, Banki, Jagatasinghapur and Athagarh. This flood affected 9,75,955 population in 1451 villages under 293 Gram Panchayats. Eighty houses completely collapsed, 700 houses partly collapsed. In agriculture, 2,70,416 acres (1,09,516 hectares) of crop were affected and the estimated value of crop loss was of Rs. 554.40 lakhs.

Flood of 1979

Heavy rainfall followed by hailstorm and strong gale during first week of August 1979 caused high flood in Rivers Brahmani, Kharasrota and Baitarani. In river Brahmani at Jenapur Anicut on 9th August, 1978 gauge reading was 66'20 ft. against danger level 66 ft. Kharsuan at Binjharpur read 19'40 ft. against danger level 17'50 ft. and Baitarani at Akhuapada read 65'15 ft. against danger level 63 ft.

Besides, rivers Sapua, Kantia, Chatara, Dhanua, Prachi, Gobari, Majjora, Mandhakhai, Hansua, Budha, Devi, Dudhei, Genguti, Kelua, Kimiria, etc. were in spate which affected 35 Blocks, 2 N. A. Cs., 263 Gram Panchayats with 1,245 villages. In agriculture 3,39,344 hectares were affected, population affected was 7,37,556. 4800 houses fully collapsed, 13,850 partially collapsed and 892 were damaged. Total loss was estimated at Rs. 40.82 lakh rupees. There were 25 breaches in embankments. 23 P. W. D. roads, 540 Gram Panchayat and Panchayat Samiti roads with 68 culverts were breached. Crops over 1.85 lakh hectares were submerged and 532 hectares sand casted, 4 adults and 3 children died, 341 schools, 22 revenue villages, 47 Blocks and 13 other buildings were damaged.

Flood of 1980

The district was just recovering from the serious damages caused by the drought and flood of 1979 when large areas were ravaged by the unprecedented flood in the system from the 19th to 24th September, 1980. In this flood 5 persons lost their life. Loss of 1,176 heads of goats and sheep, 506 heads of cows and bullocks, 2 pigs and 1,455 other livestock was reported. Out of 2.73 lakh hectares submerged, 1.24 lakh hectares were damaged causing loss of about 1.27 lakh metric tons of paddy, 158 dwelling houses were swept away, 18,331 completely and 39,819 partially collapsed whereas 50,124 were damaged. A large number of public utilities were damaged. Over 6.92 lakh beneficiaries were given emergent relief by air dropping in marooned villages.

Flood of 1982

This flood again saw a breach in Dalaighai. The water level at Naraj in Mahanadi and at Bellevue in Kathjodi rose to 93.60 ft. and 94.32 ft. respectively. This flood is one of the severest in Orissa resulting thereby in loss of life and property and disruption of road, train and tele-communication system. Road and train communication between Cuttack and Bhubaneswar was completely disrupted. A long breach in the right embankment of Kathjodi breached the National Highway No. 5 between Cuttack and Bhubaneswar. Extensive areas remained submerged for about a month. The Delta Irrigation system was also badly damaged. The fate of Cuttack city was also hung in balance for about three days because of seepage of water through vulnerable points and due to overtopping of embankments at several places. The flood was so severe that two historic rivers namely Prachi and Alaka which were silted up about centuries ago. opened up during this flood. The flood

of 1982 affected 4,478 villages, with 33.78 lakh population with the district alone. But it saw Cuttack city emerging as a more secure city because the river embankments along both sides of the city were strengthened and a well planned ring road was constructed.

Flood of 1984

Series of depressions in the Bay of Bengal from June to August of 1984 caused spells of extensive floods in the river systems of Baitarani, Brahmani and Mahanadi. The heavy rainfall that followed all the depressions caused not only floods in the above river systems but also extensive water logging. Before the flood waters could recede, further floods added to it caused inundations to paddy lands. In Cuttack city low lying areas were submerged due to very heavy rains of 167 mms. on 16th August. About 4,500 persons were shifted to school buildings and given emergent relief.

In this flood 28 Blocks, 367 Gram Panchayats, 2,398 villages and 1,531,877 population were affected. Human casualty was reported 12. Total cropped area effected was 2,01,916 hectares. 14 numbers of houses were completely swept away.

Flood of 1991

The floods in July-August, 1991 affected almost all the subdivisions in the district. 132 numbers of houses fully collapsed and 2,373 houses partly collapsed. The most striking feature of this flood was that there was no breach in river or canal embankments. Consequently crops in 73.97 ha. only were affected and the area sandcast was limited to 21 ha.

Flood of 1992

Another serious flood occurred in the year 1992 in three phases. In the first phase heavy rains occurred in the 3rd and 4th week of July and the rainfall was 389.9 mm. against the normal rainfall of 351.8 mm. The gauge recording of Kathjodi river was of 25.20 ft. at Bellevue and at Jobra in Mahanadi it was 21.47 ft. on 30th July, 1992. Similarly in August the precipitation was 323.2 mm. against the normal rainfall of 315.8 mm. and the gauge at Bellevue was 25.35 ft. and at Jobra it was 21.61 ft. on 21st August, 1992. The third rainfall was on 11th and 12th but the gauge recording was lower owing to large number of breaches through which the flood water passed.

As a result of heavy flood there was loss of 4 human lives and 10 number of live-stocks in July and one human life and 10 livestock in August. Damages in these floods have been estimated as follows :

There were 104 river breaches, 105 embankment breaches and a large number of other breaches in various other embankments. A large number of houses were swept away and the crop loss is estimated at about Rs. 30 crores. There was also considerable damage to roads and buildings of Works Department, R. D. Department and Grama Panchayat Department and other Departments. The total loss on account of these damages to private and public properties has been estimated roughly at Rs. 80 crores.

Flood of 1994

On account of the unprecedented nature of this flood and the immense and widespread devastation and suffering caused, a special report on this flood is enclosed as Appendix II.

Remedies

At present the Mahanadi embankment system can stand a flood of about 28,300 cumec (10 lakh cusec) at Naraj. But there are also floods of 17,000 cumecs. The State Government have prepared a Delta Development Plan at an estimated cost of about Rs. 600 crores, of which among others, the hydrology and flood control schemes account for about Rs. 135 crores. The flood protection schemes mainly aim at (i) raising and strengthening of embankments, (ii) river training (construction of spurs and revetments) and scour protection works, (iii) special strengthening at weak points and (iv) specific works of flood control.

River Mahanadi and its branches have got embankments on both sides to a large extent. In the district alone the embankments constructed run over a distance of about 935 km. But these embankments are mostly under sized. Free board available is not adequate at many places. Materials used in the embankments are also mostly sand and silt. In the year 1927, the Government set up a Committee of experts to examine the whole question as to what action is possible to mitigate the injurious flooding in deltaic tract. The Committee consisted of Mr. Addams Williams, the then Chief Engineer of Bengal, Mr. D. C. Harries consulting Engineer of the Government of India, and Rai Bahadur Bishnu Swarup, retired Chief Engineer of Bihar and Orissa who submitted their report in 1928.

The general conclusions arrived at by the Committee were that flooding is inevitable, but that its violence and resulting injurious effects have been increased in considerable areas by protecting other neighbouring areas by means of embankments constructed both by Government and Zamindars without any scientific system or adequate control. They expressed the opinion that embankments in the long run are ruinous to the areas which they protect, as they deprive them of the land-raising silt brought by floods, and thus eventually convert them

into badly-drained depressions liable to disastrous flooding. Accordingly they opposed embankment construction, recommended systematic and strict control of all existing embankments, and a general policy of gradual removal of all embankments which could be abolished without unbearable injury to property either private or of Government. Their report contained a large number of specific recommendations for administrative action and engineering works calculated to mitigate flood injury.

The Government accepted more or less the general conclusions of the committee, except that in view of the very extensive vested interests and rights involved they expressed doubt as to the real practicability of the advocated general policy of gradual but ruthless removal of existing embankments, and have since ascertained that there is very great opposition to the throwing open of protected areas to floods in the interests of unprotected areas. One of the recommendations acted on very early is the separation of the public works charges dealing with embankments and flood disposal works from those dealing with the canals and irrigation.

Pending clearance of the Delta Development Plan by the Central Water Commission and the Planning Commission, the State Government spends money from meagre plan allocation of Rs. 5 crores on an average, annually, on normal flood protection works. For special repairs to be undertaken, funds under non-plan are available. Besides, the State Revenue Department funds the flood damage repair works from the margin money available for expenditure on natural calamities and on receipt of grants/loans from Government of India for undertaking test relief works. But this is not adequate to meet the requirement. The coastal area which suffers from saline ingress also needs protection embankments. Until 1992, there was no concerted attempt to oversee the works of saline affected areas, when Government created an exclusive division with headquarters at Cuttack.

The great river "Mahanadi" could not be tamed by Hirakud dam alone. The unintercepted catchment area of the river down below Hirakud and upto Naraj is 52,000 sq. km. which needs to be harnessed by way of building dams on either the tributaries or the main river itself. A second dam across the Mahanadi near Gania in Puri district (Manibhadra Project) is under survey. But due to large scale submergence of land and displacement of human settlement, this project is not favoured by many.

Cyclone of 1885

The most terrible cyclone from which the district has ever suffered was the False Point Cyclone of 1885, the memory of which still endures among the people. It presented two peculiar features as it occurred during the monsoon months and was of very narrow area, though of unusual severity. The cyclone burst upon the coast in the early morning of the 22nd September, 1885, the barometer falling to 27.135 at False Point Light House, a reading unprecedented at the level of the sea. It was accompanied by a storm-wave rising to a height of about 22 feet above mean sea-level, which at once submerged the village of Jambu at the terminus of the Kendraparha canal to the north-west of False Point and then rolled on in a north-westerly direction till it lost itself in the Brahmani river. The storm was most keenly felt in the Jajpur and Kendraparha subdivisions. In the former subdivision no less than 2,447 villages were affected and nearly 50,000 houses were destroyed; about 300 human lives were lost by falling trees, walls and homesteads, and 2,973 cattle were killed. The Executive Engineer's house at Akhuapada was entirely wrecked, the roof bodily carried away. In the Kendraparha subdivision about 5,000 persons were drowned and 10,000 cattle were lost, 7,000 of these belonging to the funds of the Kanika Wards estate meant for charitable donations to the raiyats.

Cyclone of 1890

Another disaster of this kind which visited the district was in 1890, when a storm-wave affected a considerable part of the Kujang estate, which, since the tidal wave of 1885 had been more or less subject to the inrush of sea-water every year. Matters, however, reached a climax in June 1890, when another wave passed over this portion of the estate, completely destroying the crops in a tract extending from the *Keabag* to Gagua. The standing crops were swept away, all the tanks and wells were filled with brackish water, and the supply of foodgrain was all but exhausted. Four months after this tidal wave, it was reported by the manager of the estate that nearly nine-tenths of the people in the affected tracts had no grain in their houses, and had no means of purchasing it.

Cyclone of 1967

Cyclone hit the coastal area of the district causing damage to valuable lives, cattle and crops. It was reported that 236 persons were killed and loss of property etc. was to the tune of rupees three lakhs.

Cyclone of 1968

A severe cyclonic storm which centred in the Bay of Bengal about 250 km. south of Gopalpur in the district of Ganjam at 1.30 p. m. on 26th October, 1968 crossed the Orissa coast near Gopalpur and swept over the coastal areas of the district at a speed of about 144 kilometres per hour between the period from the 26th to 28th October, 1968. The storm was accompanied by incessant heavy rain. The unprecedented rainfall within a short period marooned several villages and took the inhabitants unawares.

Before normalcy could be restored, a second spate of cyclone accompanied by heavy rainfall swept over the area between the period from the 11th to 13th November, 1968 and caused equally severe damages to the properties of the people in the area including standing crops.

In all, 2 Blocks and 8 Municipalities and Notified Area Councils of this district comprising an area of 22.43 sq. miles (55.85 sq. km.) covering 368 villages and a population of 37,874 were affected. The catastrophe took toll of 3 lives comprising of 2 women and 1 child.

Cyclone of 1971

The year 1971 was a year of sorrow not only for the people of the district but also for the state as a whole. Even before the flood and drought affected population had time to recover from the debilitating ravages of the repeated onslaughts of swollen rivers, another unprecedented and shattering catastrophe suddenly struck and overwhelmed the people of Orissa.

Shortly after midnight of 29th October, 1971, while the people were asleep in their homes in the coast of Orissa north of Paradeep upto Basudebpur was lashed by a savage and disastrous cyclone which lasted till the evening hours of the next day. This terrific cyclone whipped up a massive tidal bore estimated to be 15 ft. high which swept over a 75 mile long stretch of coastal area bringing in its wake death and destruction of a magnitude hitherto unknown before. In the silent hours of that night, the high waves killed and swept back into the sea hundreds of helpless and unsuspecting men, women and children. Entire villages were struck and pulled down and strewn on the sands along with their dead occupants, carcasses of their cattle and all their possessions. Some clung to their lives on roof tops and on trees and

some managed to escape death by moving to higher grounds. Even they had lost their relatives, their possessions and were rendered homeless. The tidal bore entered inland upto more than 5 miles, then tapered off and inundated several lakh acres of homestead and agricultural lands. The sea water also rushed through the rivers and creeks in the delta region and overflowed the banks far inland, salinating and inundating paddy fields and destroying hopes of a good harvest. In these saline inundated areas also several human lives were lost due to collapse of houses; cattle were drowned and possessions lost or damaged. Further inland, the cyclone, which had gathered a speed upto 175 km. per hour wrought havoc over vast areas destroying crops, blowing off roofs of houses and buildings over 8,214 sq. miles spread over the districts of Cuttack, Baleshwar, Puri, Mayurbhanj, Kendujhar and Dhenkanal. Telephone, telegraph, rail and road communications were cut off in the coastal areas. A large number of power boats and country crafts were either washed away or destroyed at their moorings. Fallen trees, boulders and rubbles blocked the roads and prevented assessment and rendering of immediate relief. Large areas were inundated and isolated.

Statistics on the areas affected by tidal bore and cyclone, information on casualties, and damage to lands and houses so far as Cuttack district is concerned are as follows :

Houses damaged	5,20,438	Area affected	
		(i) Blocks	38
		(ii) ULBS	6
			} 7,310 sq. km.
Human Casualty	7,397	Population affected	33.04 lakhs
Cattle Casualty	77,921	Cultivated area affected	6,065 sq. km.
		Crop area damaged	3,788 sq. km.

Cyclone Distress Mitigation Committee

In view of such excessive damage to life and property, the Government of India, Ministry of Irrigation and Power appointed a committee in November 1971 to examine various measures to mitigate human suffering and to reduce the loss of life and property in the event of recurrence of such cyclones in future. The committee was headed by Dr. P. Koteswaram, Director General of Observatories, India Meteorological Department. The committee gave 59 recommendations to mitigate the ruinous effects of the cyclones so frequent in

the Orissa coast. It is beyond the scope of this chapter to give a summary of their recommendation. One of the important recommendations was No. 32 which stated, "As an effective measure against potential damage due to cyclone coastal bundhs may be built along the coast line vulnerable to tidal inundation with afforestation to a depth of about 1 km. to act as wind breakers and prevent soil erosion".

Although the first part of this recommendation has not yet been implemented (may be due to heavy cost involved), the second part, namely coastal shelter belt plantation has been implemented to a great extent as has been described in Chapter I under the heading "Coastal Shelter Belt Plantation".

Cyclone and Whirlwind of 1979

Localised whirlwind during February to August 1979 and February, March 1980 in Kendraparha, Jajpur, Jagatsinghapur and Sadar Subdivisions affected 15 Blocks, 381 villages in 78 Gram Panchayats and 81,880 population. 121 houses fully collapsed, 110 partly collapsed and 2,005 partly damaged. Four persons died and 13 persons were injured during the wind. Total loss on account of the whirlwind to public utilities was estimated at Rs. 5,57,200.

Cyclone of 1982

This cyclone of 1982 crossed Orissa coast around 23:30 hrs. on the 3rd June, 1982. According to information received from Meteorological Department, the storm was detected at 14:30 hrs. on the 1st June about 800 km. south-east of Paradeep. It moved steadily in a north-westerly direction without appreciable intensification upto 08:30 hrs. of the 3rd June. But it intensified into a severe cyclonic storm with a core of hurricane wind during the course of the day and crossed North Orissa coast near false point around 23:30 hrs. After land-fall it weakened into a cyclonic storm and moved in north-westerly direction, causing heavy rains in the districts of Cuttack, Puri, Baleshwar, Dhenkanal, Kendujhar, Sambalpur and Sundergarh. The anemometer of Paradeep radar was blown away when the speed reached 180 km. and the wind speed at the time of actual crossing is reported to have reached 220 km. per hour. A special feature of this cyclone was that there had been no instances of severe cyclone striking Orissa coast in June and there was hardly an interval of 8 hrs. between the forecast of higher wind speed of 150 km. hr. and actual crossing. The devastation caused by this cyclone

to public and private properties was far in excess of that of 1971 cyclone, though the loss of human lives was very much less. The area and population affected was much larger. The details so far as the district is concerned were as follows:

Area affected	..	Blocks	41	} 10,017 sq. km.
Urban Local Bodies	...		9	
Number of villages	..		6,682	
Population affected	..		46.17 lakhs	
Human casualty	..		201	
Human injury	..		241	
Loss of live-stock	..		4,861	

Rescue/Relief/Restoration Operation

The calamities due to famine, flood and cyclones are considerably mitigated if timely action is taken by the Government and/or other national and international voluntary agencies. It is not possible to give an account of such rescue/relief/restoration measures that had been done in case of each calamity described in this chapter. However, a broad picture regarding general pattern/policy adopted in cases of such natural calamities is given below which equally applies to such measures taken up in this district.

The concept of relief has undergone a vast change since the first famine Commission report was published in 1901. Disasters of the type occurring in 1865-66 famine (Na'anka Durbhikhya) is unthinkable in a Welfare State with improved agricultural and irrigation facilities and faster means of communication. In a Welfare State, the Government accepts the responsibility for relief operations and positive measures are undertaken to alleviate the distress of the human-beings and cattle in the affected pockets. Prior to Independence the relief administration in the State was being carried on under the Bihar and Orissa Famine Code, 1913 as revised in 1930. The provisions of this Code became outmoded in the post-Independence era owing to the shift of administrative emphasis from law and order to social welfare and economic development. In the past, the primary object of relief was to save life and was limited to emergency feeding and/or providing test relief works. It was primarily a rescue operation. At present the primary object is not only to ensure that

no one should die of starvation and but also to prevent destitution and physical deterioration in living standard of the people. Assistance has to be provided to enable them to resume their normal pursuits of life on return of better times. In short approach to relief in the present context is both preventive and curative.

Due to this change in the concept of relief and due to the inadequacy of the provisions of the Famine Code as published in 1950 to meet the situation arising out of the drought, flood and cyclones, etc. Government had issued executive instructions from time to time to supplement the provisions of this Famine Code which were embodied in publication of a fresh Code called the "Orissa Relief Code, 1980". The provision of this Code have also undergone several amendments to meet the situations arising out of unprecedented calamities. So rescue/relief and restoration measures arising out of all kinds of natural calamities are being administered according to the provisions of this Code as amended from time to time.

At the district level a District Natural Calamity Committee has been constituted under the Chairmanship of the Collector. Local M. Ps. and M. L. As. are *ex officio* members of this Committee. The Committee is convened before the onset of the rains. S. D. Os., Tahasildars, B. D. Os. and all District Level Officers attend this meeting. Flood contingent plans are prepared by various District Level Officers which is dovetailed into a comprehensive plan for the district as a whole. S. D. Os., Tahasildars and B. D. Os. are assigned with specific tasks relating to rescue/relief and rehabilitation within their jurisdictions during flood. The tasks generally assigned to Revenue Agencies include advance stocking of food-grains and building materials, etc. in areas which are likely to be cut off by flood, positioning of power and country boats in strategic locations, selection of elevated sites and shelters for accommodating people who are to be evacuated or rescued and provision for temporary shelters for these persons, supply of food, clothes, utensils, etc. to flood victims and assessment of the overall damages. The services of Police, Homeguards, National Cadet Corps, etc. are mobilised for rescue/relief operation. In case of major floods help of Army and Air Force is availed of for rescue and air dropping of supplies in marooned area. In times of widespread natural calamities many national and international voluntary organisations come forward with food, cloth, and medicines. Immediate help is also provided from Prime Minister's/Chief Minister's Relief Fund. The Red Cross Society of India also comes forward in a big way to give succour to the disaster victims.

As soon as a major calamity occurs the entire administrative machinery at the field level swings into action. Field Officers of each Department carry on their respective duties under the overall control, direction and supervision of the Collector supplemented by those of the Revenue Divisional Commissioner and the Special Relief Commissioner. Immediately rescue operation is taken up with the help of power and country boats owned by the Government or requisitioned from private owners. Emergent relief in form of rice/Chuda, Guda, match box, clothes, tarpaulins, etc. are rushed in. Immediate steps are taken to restore communication. If the places are not approachable the supplies are made by requisitioning helicopters from the Army. Revenue/Block Agencies are geared to assess the extent of damages to public and private properties. Officers of the respective Departments like P. W. D., Irrigation, Power, Education, Animal Husbandry assess the damage done to their buildings/projects/properties. If the disaster is due to drought conditions the extent of damage to crops is determined on the results of the crop cutting experiments done by the Revenue Agency/Bureau of Statistics. As the degree of relief is proportionate to the extent of damage to public/private properties, a tendency generally develops among the people represented by their elected representatives to exaggerate damage than what has actually occurred. But a balance is reached by a fair assessment done through the normal Revenue agency under the direction of the Collector. The officers of the Health and Animal Husbandry Departments visit the affected areas and take up inoculation and disinfection measures to prevent outbreak of epidemic among the affected people/cattle. The normal pattern of relief/restoration operation is as follows:

So far as public properties are concerned each Department assesses the damage to its own property like buildings, roads, culverts, bridges, embankments, shutters, sluices, electric installations, lift irrigation points, machineries, etc. prepares an estimate for restoration of such properties to the pre-disaster condition, and sends it to Special Relief Commissioner for provision of funds which is normally met from the margin money (ceiling of margin money called "Calamity Relief Fund" is Rs.47 crores per annum at present in the ratio of 25:75 provided for respectively by the State and Central Governments. If a major disaster occurs and the margin money is not sufficient for the relief/restoration measures, central assistance is sought for and given in the form of loans/grants after visit of the Central Team in the form of advance plan assistance or otherwise).

So far as relief to private persons is concerned emergency relief is provided for certain days either in the form of cooked food (only when the affected people are not in a position to cook their own food) or in the form of rice/Chuda. The duration of the emergent relief depends upon the local situation and according to the power vested in the Collector, R. D. C., S. R. C., and the Government. This emergent relief is given irrespective of the economic status of the affected family. Thereafter test relief operations are taken up for construction/repair of roads, embankments, etc. There are some poor/destitute women, children, old and infirm people who are unfit for physical labour in test relief works. They are given gratuitous relief in form of rice. The scale of emergent/gratuitous relief is :

500 grams per adult	--	per day
250 grams per child	..	per day (below 12 years)

The scale of other forms of financial assistance to affected families is as follows:

1. Maximum House Building grant per family

- (a) For completely washed away houses .. Rs. 2,500/-
- (b) For fully collapsed houses .. Rs. 1,000/-
- (c) For partially collapsed houses .. Rs. 500/-
- (2) Sandcast subsidy with a depth of more than 6" Rs. 1,500/-per ha.
- (3) Relief for loss of life while rendering selfless service Rs. 5,000/-
- (4) Relief for other loss of life
 - (a) Rs. 5,000 if any member of a family dies
 - (b) Rs. 3,000 if the 2nd member of the family dies
 - (c) Rs. 2,000 if the 3rd member of the family dies
 - (d) Rs. 1,000 in each case of death of an addl. member of the family
- (5) Relief to betelvine growers-maximum of Rs. 200/-

In large scale damage to crops, remission/suspension of rent/cess/-water cess in the affected areas is ordered by Government.

FISHERIES

Cuttack is one of the four maritime districts of Orissa which has vast resources in marine, fresh water and brackish water sectors each possessing a very substantial potentiality for economic development through fish production. The district has a coastline of 135 km. which is 28 per cent of the total coastline of the state. In the inland fresh water sector there are 38,206 tanks belonging to private, Gram Panchayats and Government the water area of which stretch to 9,149 hectares. Out of these 28,513 tanks having water area of 5,937 hectares are suitable for scientific pisciculture as ascertained from the survey conducted by the State Fisheries Department. There are also 16 numbers of minor irrigation projects having water area of 2,126 hectares which are suitable for pisciculture. In addition, vast areas of rivers and canals, swamps and bheels, estuaries and brackish water tanks provide employment and means of livelihood to a considerably large number of fishermen. (There are 1,050 inland fishermen villages in the district in which 1.43 lakhs of fishermen are living). The brackish water resources include 6,400 hectares of mud flats which are suitable for brackish water shrimp and fish culture. For development of fisheries in the State a separate department came into existence in the year 1955 with headquarters at Cuttack.

The important activities of the Fisheries Department in the marine, fresh water and brackish water sectors of the district are given below.

Fresh Water Aquaculture—The people of the district as also of the State have been practising aquaculture for the past several centuries, though it was not on scientific lines. The yield, therefore, was as low as 10-15 kg. per hectare. For exploring possibility of scientific fish farming and to obtain higher yield, a unit of central Inland Fisheries Research Station was established at Cuttack which developed the technology of composite fish farming on the one hand and induced breeding of Indian major corps on the other hand to have a dependable source of quality fish seed required for fish culture. Initially, however, the induced breeding technology was not perfected. The department had to depend on the rivers like Mahanadi, Kathjodi and Brahmani for fish seed to Cuttack district farmers. Small hatchlings of fish called spawn were collected from the rivers, reared to identifiable size called fry in fish seed farms and supplied to pisciculturists. Riverine spawn collected from the district accounted for nearly 1,500 lakhs spawn annually which in fact went to other districts as well. Now, however, with the improvement of the technology, induced breeding has completely replaced the riverine

spawn collection. The present level of production of spawn through induced breeding in Cuttack district is 57.00 lakhs. For rearing of the spawn and supply of fry to the pisciculturists there are 10 fish farms in the district having 34 ha. of total water area. The present demand of fry in the district is 200 lakhs out of which 56.5 lakhs of fry are supplied by the Fisheries Department, 97.5 lakhs by the private farmers and 46.0 lakhs by Orissa Fish Seed Development Corporation annually.

Fish Farmers Development Agency

A Fish Farmers Development Agency has been established in 1980-81 in the district for scientific pisciculture development. The general objective of the F. F. D. is to effectively introduce and popularise improved techniques of fish culture so as to progressively step up inland fish production and augment fish supplies to the public. The Agency running under the chairmanship of the District Collector has the following functions: (i) it assists in reclaiming and bringing all fallow cultivable fishery resources such as swamps, heels, silted up tanks, water-logged areas, etc. under optimum fish production, (ii) contributes to the strengthening of rural economy by making those engaged in fish farming economically stable, (iii) builds up a trained cadre of fish farmers to undertake intensive fish culture and (iv) involves financing institutions to provide loans for capital investments to fish farmers for excavating new ponds or for improving existing ponds.

The F. F. D. A. in Cuttack since its inception upto end of the financial year 1991-92 has developed 3,159 ha. of water areas and trained 2,702 fish farmers in scientific fish farming. Besides, it has settled 771 ha. of Gram Panchayat tanks on long term lease to interested pisciculturists for pisciculture development with institutional finance.

Reservoir Fisheries Development

A project for development of Kalakala reservoir in the district with a total water area of 270 hectares is being launched with World Bank assistance. In fact it is a part of the project for development of 55 reservoirs with a total outlay of Rs. 516.00 lakhs to be spent over a project period of 5 years commencing from the year 1992-93. At full development, Kalakala reservoir would be producing 160 kg. per hectare per annum. During the years 1990-91 and 1991-92, 4.87 lakh fingerlings were stocked in this reservoir.

The project would finance for construction of captive nursery ponds at the periphery of the reservoir. Advanced fry of 55 mm. size would be reared in ponds upto 150 mm. size, when they would be stocked in the reservoirs. The project will also provide credit to fishermen for supply of boats and nets. It will also provide for construction of fish handling shed. The reservoir will be managed by the Fishermen Co-operative Society based at Kalakala.

Brackish Water Fisheries Development

Mahanadi estuary in the district is rich in different high priced economic varieties of fish like hilsa, prawn, mullets, etc. From time immemorial local fishermen were exploiting this vast resource with the help of their indigenous boats and nets. From the year 1955-56 when Fisheries Department was created a scheme called Development of Mahanadi Estuary was introduced. In order to help the fishermen and fish traders the department provided transport facilities of fish and ice. A flake ice plant was set up at Kujang. Experimental power fishing was done with Dan boats in the Mahanadi estuary. Operation of gill nets in the estuary gave good results and enthusiasm of the fishermen in the estuarine fishing grew. Simultaneously efforts were made for brackish water fish culture and first ever marine fish farm of the State was established at Khiragacha Madeli near Paradeep during 1957-58.

The present decade has witnessed considerable progress in brackish water fish culture. Since 1983-84 Brackish Water Fisheries Development Agencies (B. F. D. A.) established on the lines of F. F. D. As have been functioning in the coastal districts to look after the exclusive needs of the Brackish Water Aquaculture Development.

The Brackish Water Fisheries Development Agency at Cuttack was established during 1983. Upto the end of 1991-92, 6,453 hectares of water area of Cuttack district have been surveyed and found suitable for brackish water shrimp culture. Out of this, 3,451.65 hectares have been developed through which 1,992 shrimp farmers have been benefited by availing bank loan amounting to Rs. 65.31 lakhs. Rs. 15.38 lakhs have been given as subsidy to the farmers by the agency. 515 shrimp farmers have been trained under this programme.

In order to harness the existing resources to its maximum potential, a World Bank assisted brackish water shrimp culture project at a total outlay of Rs. 5,694.00 lakhs is proposed to be implemented during the 8th Plan period. The project is being implemented in

Baleshwar and Cuttack districts. In the district an area of 450 hectares has been identified at Jagatjor under Mahakalparha Block. The project aims at construction of 0.5 hectare and 1.00 hectare pond units for semi-intensive shrimp culture aiming at a production of 2.00 tonnes per hectare per annum. At full development the project would benefit 466 small farmers and entrepreneurs. Necessary facilities like cyclone protection dykes, infrastructure facilities (road, electric supply, fresh water supply, etc.) will also be provided.

Marine Fisheries Development

The sea near the coast is quite rich in pelagic and demersal marine fisheries resources. The indigenous crafts were operating almost all along the coast, fishing being an age-old occupation of traditional marine fishermen. Due to roughness of the sea, the traditional fishing activities were more or less localised and confined to a narrow belt of 5 to 10 km. from the shore upto a maximum depth of 10/12 fathoms, the off-shore and deep sea regions remaining mostly untapped.

For exploitation of the state marine resources through mechanisation the department introduced a new scheme "Experiment in power fishing in the sea". Mr. T. Ishiro, an F. A. O. fishing expert from Japan surveyed the Paradeep coast during February 1958 and recommended the coasts suitable for mechanised fishing and accordingly experimental sea fishing with Dan boats was started for the first time in the state at Paradeep during 1957-58. Institutional finance encouraged the private entrepreneurship in mechanised fishing on a large scale. During 1974-75 feasibility reports were issued by the department to avail loan from Orissa State Financial Corporation and banks. Traditional fishermen were also encouraged in mechanised fishing through Marine Co-operative Societies. Orissa Fisheries Development Corporation (O. F. D. C.) was established during 1962 and started operating small wooden trawlers and gillnetters in marine fishing. Four deep sea trawlers made in Poland were imported by the O. F. D. C. and operated for off-shore fishing at Paradeep which were subsequently handed over to the Fisheries Department. As the scheme became uneconomical, they were sold off to private entrepreneurs.

The programme of motorisation of traditional fishing boats was introduced during 1987 by the Government of India under a centrally sponsored scheme. During the year 1984-85 F. A. O./Bay of Bengal programme was introduced and 5 numbers of JND-25 beach landing crafts were provided to Marine Fishermen Co-operative Societies of the district.

At present 638 numbers of mechanised boats and 4,045 non-mechanised boats are operating in the coast line falling in Cuttack district. 13,035 marine fishermen are living in 38 marine villages along the coast of the district.

The present level of marine fish catch of the district is 34,576 m. tons, which are landed in 11 fish landing centres. Important fish species of commercial value are shrimp, hilsa, pomfret, polynemids, clupeids, sciaenids, cat fish and Bombay duck. Out of the total marine fish landings from Cuttack district, 16,405 tons of fish are marketed fresh to outside the State and 1,730 m. tons are converted to dry fish (Sukhua).

For development of marine fisheries, infrastructural facilities and auxiliary industries have been provided in the district. There are 11 ice plants in the private sector in the district having total production capacity of 177 m. tons of ice per day. Besides, there are 3 processing plants in the private sector at Paradeep having capacity of 15 m. tons per day and frozen storage capacity of 390 m. tons. There is a net making plant at Khapuria and a synthetic rope making plant at Chaudwar used for net fabrication. For construction of mechanised boats there are 4 boat building yards in the district having annual production capacity of 90 boats per annum. Two of these boat building yards are located at Paradeep.

Two freezing plants were first established during 1969 in private sector, one at Khapuria and the other at Paradeep in Cuttack district which enabled Orissa to earn foreign exchange through frozen shrimp export.

In the district 2,043 m. tons of marine shrimp are caught annually and 1,491 m. tons are cultured in brackish water shrimp culture tanks out of which 341 m. tons of processed frozen shrimp valued at Rs. 5,40.52 lakhs was exported to foreign countries mostly to Japan through Paradeep Port in 1991-92.

Two fishing harbours at Paradeep are under construction at a cost of Rs.2,884.43 lakhs with 100% central assistance, one for deep sea trawlers inside commercial harbour and another for small mechanised boats.

Fishermen Welfare Programme

For supporting the poor fishermen, many fishermen welfare programmes have been implemented in the district.

- (i) In order to provide relief to surviving family members of active fishermen succumbing to death during fishing or to invalid fishermen due to accident, a centrally-sponsored Fishermen Accident Insurance Scheme has been introduced.

- (ii) Saving-*cum*-relief Fund for marine fishermen of the district has been launched in order to give financial relief during lean period of fishing.
- (iii) In order to safeguard the interest of the traditional marine fishermen the Orissa Marine Fishing Regulation Act, 1982 has been introduced.

Development of Fishermen Co-operatives

For development of socially and economically backward fishermen communities, 202 Primary Fishermen Co-operative Societies have been organised in the district which include, 194 Inland and 8 Marine Societies. The total membership of these co-operatives is 13,640 fishermen. These societies are given financial assistance through bank loans and subsidies by the department for which special need-based schemes are prepared.

Fisheries Extension and Publicity

To reach the benefits of the fisheries development programmes to people the department has posted trained Fisheries Extension Officers, one in each Block of the district and 3 in important coastal points. These Extension Officers conduct technical survey of the resources, identify beneficiaries, prepare bankable proposals for the pisciculturists, arrange finance and long term lease of Grama Panchayat tanks, organise Fishermen Co-operative Societies, supply critical inputs and provide technical guidance to the beneficiaries, besides organising demonstration and publicity programmes. In the brackish water sector too there are 4 Inspectors of Fisheries and a Deputy Superintendent of Fisheries acting as Extension Officers posted in the coastal areas of Cuttack district.

ANIMAL HUSBANDRY AND DAIRY

Veterinary/Animal Husbandry activities did not receive much attention during the British period for the genetic improvement of live-stock in the district. There were only 6 Veterinary Dispensaries in the entire district, one each at Cuttack, Jagatsinghapur, Kendraparha, Jajpur, Salepur and Banki from which veterinary aid was available to the live-stock. After Independence, various departmental programmes were launched. Animal Husbandry avocations have been chosen as the most beneficial programme for the upliftment of the rural poor. To implement these programmes successfully a number of Veterinary Dispensaries and Livestock Aid Centres have been opened throughout the district and at present in 1992 there are 67 Veterinary Dispensaries and 439 Live-stock Aid Centres in 41 Blocks for rendering veterinary services to the live-stock owners in this district. Each Block has minimum of one Veterinary Dispensary with a number of Live-stock Aid Centres in which required number of staff have been employed.

The live-stock population in the district as per 1991 Census is as follows:

Cattle

(a) Crossbred		
(i) Male	..	37,627
(ii) Female	..	99,168
(iii) Breedable out of (ii)	..	55,913
(b) Indigenous		
(i) Male	..	9,21,466
(ii) Female	..	9,50,729
(iii) Breedable out of (ii)	..	6,04,933

Buffaloes

(a) Male	..	31,201
(b) Female	..	59,761
(c) Breedable out of (b)	..	38,159
Goat	..	4,00,600
Sheep	..	2,46,180
Pig	..	15,379
Poultry	..	12,41,647
Duck	..	55,725

The Subdivision-wise Veterinary Institutions of the district are as follows:

Subdivision	No. of Blocks	No. of V. D./ V. H.	No. of K. V. Blocks	No. of L. A. C.s/ K. V. Units/ A. I. Centres/ I. C. D. Units	
Kendraparha	..	9	14	1	68
Cuttack Sadar	..	8	12	1	97
Jagatsinghapur	..	8	12	4	89
Athagarh	..	4	8	1	38
Banki	..	2	3	..	12
Jajpur	..	10	17	1	95
Total	..	41	66	8	399

functioning under the direct supervision of the Chief District Veterinary Officer, Cuttack.

Clinical Investigation Laboratory (C. I. L.)

In order to make detailed investigation into the diseases on modern scientific methods the C. I. L. headed by a Range Investigation Officer (Class-II) is functioning in this District for investigating and diagnosing various diseases in four Districts, i. e., Cuttack, Puri, Baleshwar and Mayurbhanj.

Duck Breeding Farm

A Duck Breeding Farm is in position at Khapuria of this district. This is managed by one Class-II Officer of the department. This institution caters to the need of supplying ducklings and hatching eggs throughout the state.

The different animal husbandry and dairy activities presently implemented in this district are detailed below.

Breeding Programme for upgradation of cattle:

(a) Artificial Insemination—The local cattle of the district were mostly of non-descript type with poor milk yielding capacity. Attempts have been made since the last fifties to upgrade these local breeds and improve their productivity by Cross Breeding Programme through Artificial Insemination, utilising Jersey, Holstien, Friesion breeds of exotic origin. The F-1 cross-breed cows (50 per cent) are inseminated with F-1 cross-breed bulls (50 per cent) semen. Artificial Insemination Programme is done in this District through 8 Key Village Blocks and one Urban Key Village Block having 86 Key Village Units: a portion of one I.C.D. Zone i.e. Niali having 21 I.C.D. Centres, 93 pure A.I. Centres and 91 numbers of normal A.I. Centres. Out of these Centres, Artificial Insemination is done through Frozen Semen Technique in 251 centres and the rest 40 centres are being supplied with chilled semen. To meet the requirement of the chilled semen there are 2 Semen Collection Centres in this district, functioning one each at Salepur and Kisannagar. Frozen Semen Bank, Khapuria, Cuttack supplies Frozen Semen Straws to these 251 F.S.A.I. Centres. 2,32,260 numbers of A.I.s have been born during the last 3 years as against the target of 3,01,600, and 99,724 numbers of A.I. progenies have been born during the corresponding years which shows an average success of 42 per cent in A. I. work.

Year		Target	Achievement	Progeny
1988-89	..	1,00,800	81,036	31,208
1989-90	..	1,00,800	75,576	35,466
1990-91	..	1,00,000	75,648	33,056

(b) **Natural Breeding**—The programme for upgradation of cattle through natural breeding in the state is the responsibility of the Utkal Gomangal Samiti (U.G.S.), a body established since 1936 and registered under the Societies Registration Act, 1860, to which the State Government gives grant-in-aid for establishment of exotic bull and buffalo bull calf rearing farms and supply of bulls to the interiors to be maintained by hosts with or without subsidy in areas where no A.I. facilities are available. The Samiti has established two such farms, one at Patha (Bidyadharpur) and another at Sagadi (Kisannagar Block) where 1,25,100 and 160 bull calves were reared respectively in the years 1989-90, 1990-91 and 1991-92. During the same years 113, 130 and 158 bulls had been supplied/maintained with or without subsidy in different parts of Cuttack district (subsidy where given is Rs. 60/- p.m. per bull). Services done by such bulls were 3,92, 482 and 516 and the progenies born were 1,72, 204 and 232 respectively. Buffalo bulls are supplied to Jagat-singhapur and Kendraparha areas whereas cow bulls are supplied to Bari/ Binjharpur areas. The U. G. S. has also established a feed mixing centre at Patha for supply of quality feed to interested cattle owners at reasonable rates.

Fodder Cultivation

Fodder cultivation being an integral part of dairy development, farmers are motivated to grow fodder in their own land through schemes like Development of Fodder Resources, subsidised Fodder Cultivation Programme, Pasture Development in Gochar land, etc. During the years 1988-89 and 1989-90, 145.30 quintals of fodder seeds (M.P.Cherry, Cowpea and Barseem) were supplied to 4,550 beneficiaries of this district. The cultivation covered 410 hectares of land and produced 53,846 quintals of green fodder. During 1990-91 and 1991-92, 41.65 quintals of seeds have been distributed to 2,270 farmers. The cultivation covered 200 hectares of land and produced 41,076 quintals of green fodder. Besides, the Utkal Gomangal Samiti in its fodder farms at Patha and Sagadi has produced 6,220, 4,575 and 7,960 quintals of green fodder to feed its own animals (bulls and heifers) during the years 1989-90, 1990-91 and 1991-92. It also undertakes to distribute roots and slips of render to interested agriculturists free of cost and has distributed 107 quintals of such materials during the last three years.

OMFED Cattle Feed Plant

The OMFED Cattle Feed Plant is situated at Radha Damodarapur under Athagarh subdivision of the district. The plant was established in November 1985. It produces pelleted and mass cattle feed which is supplied to the different milk unions of the district according to their requirement. During 1991-92 the plant produced 11,017.915 m.t. of cattle feed.

Co-operatives and Milk Supply

In order to provide pure and fresh milk and eggs to the consumers of this district at reasonable rates and to purchase surplus milk and eggs from the producers at appropriate price, 453 numbers of M. P. C. S.s (Milk Producers Co-operative Society) and 67 numbers of P. P. C.s (Poultry Producers Co-operative Society) were organised out of which 171 M. P. C. S.s and 8 P. P. C. S.s are now functioning. 4 Chilling Centres (Plants) have been established at subdivisional level, i. e. Athagarh, Kendraparha, Jagatsinghapur (Tirtol) and Banki for preservation of milk on behalf of OMFED (Orissa Milk Producers Federation) in collaboration with the District Co-op. Milk Producers Union Ltd., Cuttack. Action is being taken to install a chilling plant in Balikuda Block of Jagatsinghapur subdivision and another at Adaspur of Cuttack Sadar subdivision of this district. The Athagarh Chilling Plant was established on September 1984 with a capacity of 2,000 litres per day which is now defunct. The Banki and Kendraparha chilling plants were established in June 1987 and September 1985 respectively. The capacity of Banki Chilling Plant is 2,000 litres per day whereas Kendraparha Chilling Plant is 4,000 litres. The Tirtol Chilling Plant was established in March 1987 with a capacity of 10,000 litres per day. In October 1991 the capacity of the plant was expanded to 20,000 litres per day. All the chilling plants function under the Cuttack District Co-operative Milk Producers Union. The daily collection from all the chilling plants of the district is 32,000 litres per day.

Live-stock Breeding Farm, Khapuria

Live-stock Breeding farm, Khapuria was started during the year 1945 as a military dairy farm and after 1947 it was handed over to the Veterinary Department of the State Government. The farm is

situated on 142 acres of land out of which 78 acres are put under fodder cultivation. The farm is manned by one Dairy Superintendent and other Class-III and Class-IV employees. The lives-tock strength of the farm is 128 out of which 88 are C. B. cows and 40 are buffaloes. The achievement of the farm for the last 3 years is as follows:

Year	Area under fodder (in acres)	Green produced (in Qntls.)	Milk produced (in litres)	Expenditure (in Rs.)
(1)	(2)	(3)	(4)	(5)
1989-90	84.70	5,205.63	79,559	8,52,880
1990-91	60.45	3,548.87	65,463	16,12,547
1991-92	120.10	12,024.81	69,062	19,07,474

Calf Rearing Programme—This programme is monitored by one Project Officer (Class-I) from its project established at Buxi Bazar since 1976-77, with the aim of producing good milch cows in rural areas from crossbreed progenies available through artificial insemination in the farm on full subsidy basis. The achievement of this programme during last 4 years is as follows :

Year	Target	Achievement			Total
		Sch.Caste	Sch. Tribe	Others	
1988-89	1,100	63	1	1,077	1,141
1989-90	1,200	103	1	1,148	1,254
1990-91	1,500	104	2	1,425	1,531
1991-92	1,100	82	2	2,052	1,136

Heifer Rearing Programme

For supply of quality animals to beneficiaries of the district under anti-poverty programmes, the Utkal Gomangal Samiti has established two Heifer Rearing Farms, one at Patha and another at Bhogra of Athagarh subdivision. Exotic and semi-exotic pregnant heifers are purchased from the farmers from inside and outside the state and reared in the farms till calving stage. During the last three years, 565 milch animals of exotic and semi-exotic breed have been supplied to I. R. D. beneficiaries in the district. One more Heifer Rearing Farm will shortly be established in Tirtol where 5 acres of land have already been purchased for this. Cwing to loss incurred, implementation of this programme has since been discontinued.

Poultry Development.

Poultry breeding has been accepted as an employment industry which has given employment to many unemployed educated youths. There is good demand for the poultry meat and eggs to-day. Hence hundreds of broiler and layer's units ranging from 100 to 5,000 capacity have been established in the private sector throughout the district.

For poultry development in the district efforts have been taken by the OPOLFED for establishing one thousand and five thousand layer's units in this district under NABARD scheme with direct supervision of the veterinarians of this district. 23 one-thousand bird units and 13 five-thousand bird units were proposed to be established during the year 1991-92 out of which 5 units have already been established. One poultry complex at Khapuria has been revived with collaboration of OPOLFED. The complex is meant for providing broiler's meat to the consumers of the locality. One All-India Poultry Development Centre is functioning at Khapuria also with the aim of supplying day-old chicks to the interested farmers and selling eggs at reasonable price. There are three A. N. P. units functioning also in the district at different veterinary institutions, i. e. at Jagatsinghapur, Balikuda and Salepur.

Back-yard poultry units are also functioning from the year 1987-88. The main intention of the programme is to persuade and encourage women, specially of backward classes in remote areas, to supplement the income of the families and from the years 1987-88 to 1990-91, 237 such units have been established in different parts of the district.

Anti-poverty Programme

Steps have been taken by Government under Animal Husbandry Programme for providing cows, sheep, goats, poultry and ducks to the poorest of the poor under anti-poverty programmes (E.R.R.P. and I.R.D.P.)

for the economic development of these people. The achievements made during the last 3 years and the farmers benefited are as follows :

		1988-89	1989-90	1990-91
Dairy	..	803	866	507
Goatery	..	1,746	182	315
Sheep	..	1,773	83	283
Piggery	..	24	54	131
Poultry	..	21	75	67
Duckery	..	21

Disease control activities of this district during last 4 years are given below :

		1988-89	1989-90	1990-91	1991-92
1. Number of animals ..	treated	17,88,947	17,89,048	18,01,279	18,49,240
2. Number of preventive ..	inoculation done	8,95,965	9,08,801	8,28,119	11,36,686

Besides, the Utkal Gomangala Samiti also organises periodically cattle infertility and disease treatment camps and during the last three years 14 such camps have been organised in the district attracting favourable response from cattle owners.

IMPORTANCE OF FOREST IN THE ECONOMY OF THE DISTRICT

Because of scarcity of forests as described in Chapter I, forests and forest-produce do not occupy such an important place in the rural or urban economy of the district as it does in other districts of the state. Still the forests produce brought from neighbouring districts supply much needed fuel wood and timber for building purposes and for making agricultural tools and implements. Small scale industries engaged in furniture making and saw mills in the

district owe their existence to the forests. The forests in the ex-states areas supply edible fruits and roots for human consumption. A large number of poor people make their living by cutting down young Sal offshoots for sale as tooth brush in the urban areas.

The acute shortage of fuel wood and timber has made the farmers conscious of the need of raising trees on their farm lands as part of farm forestry programme. Under this programme individual farmers, organizations, institutions are encouraged to plant fuel wood, small timber, fodder and fruit trees on the periphery and otherwise unproductive lands to meet firewood requirement of small farmers and for environment protection. The eucalyptus and acasia trees have attracted their attention as it grows fast and does not interfere with growth of agricultural crops.

Forest Produce

The produce from the forests comprises timber and firewood. Among the minor forest products mention may be made of bamboo, Harida, Bahada, Ainla, Karanj seeds, Char seeds, Genduli and other gums, Mahua seeds, Mahua flowers, cashew, Sal seeds, Ban Tulasi, canes, barks, roots, Ashok and Dhatuki flowers, arrow roots, Siali and Sal leaves, Kendu leaves and Gilo. Chief category of timber available are Sal, Piasal, teak, Bandhan, Kasi, Kangada, Siris, Sisoo, Asan, Kurum, Dhaura, Giringa and Phasi. Nowadays due to scarcity of timber all types of trees are used for house construction, furniture making and small agricultural implements.

Income from major and minor forest produce during the period 1985-86 to 1989-90 is given below:

Year		Income from major and minor forest produce
		(in Rs.)
1985-86	..	81,51,084
1986-87	..	59,86,907
1987-88	..	69,03,497
1988-89	..	59,19,766
1989-90	..	62,37,784

APPENDIX I

List of important Capital Embankments, Orissa Agricultural Embankments, Test Relief Embankments and Saline Embankments with their length in kilometre.

Name of the embankment (1)	Length in km. (2)
Capital Embankment	
Capital Embankment No. 2 (A) Baitarani left ..	33.42
Capital Embankment No. 5 (A) Budha-Kharsuan left ..	26.40
Capital Embankment No. 27 (A) Jenapur to Manjaripada	16.89
Marginal Embankment Jenapur to Immamnagar ..	12.07
Capital Embankment No. 26 (A) N. H. 5 to Kudhalinga	15.28
Capital Embankment 34 (b) Jagatpur to Balichandrapur	37.01
Capital Embankment No. 29 (A) Chaudwar to Jaluka hill	19.85
Capital Embankment No. 41 (A) Gopinathpur to Patpur	8.35
Capital Embankment No. 44 (A) Chitrotpala left ..	11.72
Capital Embankment No. 79 (A) Bidanasi to Labour Ashram	15.00
Capital Embankment. No. 78 (A) Aitipur to Kulasahi ..	27.00
Capital Embankment Tarapur to Paradeep ..	41.30
Capital Embankment No. 83 (B) Bidanasi to Matagajpur	13.00
Capital Embankment No. 85 (B) Matagajpur to Kaijanga	10.40
Capital Embankment No. 61 (B) Kathjodi left ..	28.20
Capital Embankment No. 44 (A) ..	56.00
Capital Embankment No. 34 (b) A ..	43.20
Biluakhai right Embankments ..	14.00
Capital Embankment No. 37 (A) ..	34.20

(1)	(2)
Capital Embankment, Kuakhai right	32·03
Capital Embankment, Kathjodi left	19·00
Kathjodi Serua Devi right	68·00
Orissa Agricultural Embankment	
OAE No. 9 (B) Kharasuan right	8·00
OAE No. 7 (B) Kharasuan left	11·00
Old Marahatta Bundh Kharasuan left	11·00
OAE No. 18 (B) Brahmani left	13·73
Aul Ring Bundh No. 31 (B)	30·00
Aul Right Bundh No. 31 (B)	30·00
Aul Right Bundh No. 31 (B) Brahmani left	28·58
Chhaohindia to Gardpur	18·00
Rambhapur to Majhipada	14·48
Chitrotpala right from Guali to Mahamadpur	28·49
OAE on Chitrotpala left	46·48
OAE on Nunakarandia right	37·50
OAE No. 77 (B) Krishnapur to Sarali	25·35
OAE No. 62(B) and 65(B) Krishnanandapur to Sarali	24·21
OAE Hansua left	26·30
Flood Protection Embankment Mahamadpur to Badapal.	36·53
OAE No. 61(B)	14·48
Purunabasanta to Badapal Hansua right	12·85
Test Relief Embankment	
Naugan to Sanatrilochanpur	10·21

(1)	(2)
Paridabad to Dattapur ..	8.50
Jariguide Bundh ..	8.96
Bainsara to Kadikamaghai ..	8.00
Angalo ..	6.70
Nuamuhara ..	8.00
Kampagarh-Palatpur ..	12.00
Mohanpur-Kalaspur ..	12.00
Uttikan Saliru Gherry Bundh ..	28.35
R.E.O. Embankment, Gopalpur to Akhudasahi..	17.82
R.E.O Embankment, Dasamouza Gherry ..	19.44
Trilochanpur to Gadakujanga ..	10.00
Kunjakothe Embankment ..	14.00
Fatepur to Guamunda ..	13.00
Chhaulia to Samakatimunda, Jhimani to Chhaulia..	13.00
Botigan to Japabhuyan to Dhobai ..	19.40
Kapada right ..	11.60
Sahapur to Sipura ..	12.80
Sahapur to Benapur (Expressway) ..	12.80
Saline Embankment	
Chhachindia-Deuli-Bajrapur ..	20.00
Jhimani to Bhitargarh ..	13.50

(1)	(2)
Iribinato to Guamunda	.. 14.55
Fatepura to Guamunda	.. 13.58
Japabnuian to Iribina	.. 27.00
Badapal to Nagarighat	.. 18.15
Badapal to Pharijan	.. 16.00
Baragudiapada to Khatikuldan	.. 19.12
Noliasahi to Jatudharimuhan	.. 15.06
Keradagada-Altang Saline Gherry	.. 22.00
Rajmagar-Gopalpur Saline Gherry	.. 32.00
Rajnagar-Gadadharpur Saline Gherry	.. 22.00
Satagaon Saline Gherry	.. 32.00
Chakadagadua Saline Gherry	.. 26.00
Jamboo Saline Gherry	.. 15.00
Nalitapatia-Dalkhai Saline Gherry	.. 12.00
Talchua-Rangani Saline Gherry	.. 27.00
Radhiakarana Saline Gherry	.. 17.00
Righagarh-Dangnal Saline Gherry	.. 28.00
Sunity saline Gherry	.. 13.00
Maguranallah to Bandar	.. 20.00
Margapur to Basanta	.. 21.00

APPENDIX II

Flood of 1994

During 1994 monsoon season almost the entire State of Orissa including Cuttack district was repeatedly ravaged by the wrath of Varuna, the Rain God, continuously for a period of about 3 months since the first fortnight of July 1994 till the first fortnight of September 1994. The rainfall precipitation during the period between 15th June to 30th September in Mahanadi basin upstream Hirakud dam was 1,582 mm. and down-stream of Hirakud dam 1,838 mm. against the average rainfall of 1,200 mm. which created an unusual and unprecedented flood in the history of the district. The magnitude of the flood in Mahanadi can be gauged from the Hirakud reservoir inflow of the year compared to the previous years.

Inflow into Hirakud Reservoir

Sl. No.	Month	Inflow in Tham.				Remarks
		Average	All-time High	1961	1994	
1.	June ..	120	810	664	894	Revised live capacity 853 Tham.
2.	July ..	747	2,700	2,700	2,894	
3.	August ..	1,291	2,452	1,795	2,008	
4.	September ..	835	2,991	2,991	1,130	

Because of very incessant precipitation between July 7 to July 12 aggregating 271 mm. for the upstream and 263 mm. for the downstream, a peak inflow of 9.2 lakhs cusecs occurred at Hirakud reservoir on July 11 which was moderated to 1.75 lakh cusecs. But added to the downstream discharge of 8.5 lakh cusecs, this resulted in peak discharge of 12.25 lakh cusecs at Naraj on July 13.

Source—Special Relief Commissioner, Orissa, and White paper on successive floods in 1994

Another intense spell of rainfall occurred in the first fortnight of August and a third phase towards the end of August due to heavy rains in the catchment areas of different rivers and continued till the 2nd week of September leading to a peak inflow of 6.1 lakh cusecs which impinged on the reservoir at R. L. 624.20 ft. Concurrently downstream catchment recorded 260 mm. of rainfall which resulted in a peak contribution of 7 lakh cusecs on August 29. The peak discharge at the head of delta (Naraj) was 11.15 cusecs on 6.9.1994. At Naraj the discharge remained at 14,000 cusecs for 53 days, 17,000 cusecs for 34 days and 25,500 cusecs for 14 days.

The severity was not confined to Mahandi river system only but was also equally devastating in Brahmani and Baitarani systems when the river at Rengali reservoir was kept almost upto full reservoir level for many days. The magnitude of inflow into Rengali reservoir is furnished below.

Inflow into Rengali Reservoir

Sl. No.	Month	Inflow in Tham.			Remarks	
		1991	1992	1994		
1.	June	..	41	10	253	Live storage capacity 442 Tham.
2.	July	..	393	275	1,149	
3.	August	..	926	420	913	
4.	September	..	443	160	336	

The unprecedented prolonged rainfall in catchment areas of major rivers of the district like Mahanadi, Brahmani, Burhabalanga and Baitarani created an extremely devastating situation in the low-lying areas and delta regions of the State. The rainfall occurring during the period between 15th June to 30th September in these major river basins is given below.

Name of river	Rainfall (in mm.)
1. Mahanadi upstream	1,582.00
2. Mahanadi downstream	1,838.00
3. Brahmani	1,223.00
4. Baitarani	1,457.00
5. Burhabalanga	1,592.00

The intensity of flood was more severe in the subdivisions *of Jagatsinghapur, Cuttack Sadar, Jajpur and Kendraparha in comparison to other districts of the state as the flood water did not recede for a long period.

Agricultural operation was badly affected and the farmer's expectation of a good Kharif was upset. Overtopping of embankments of Mahanadi by the flood waters and a series of breaches in the embankments in the branch rivers below the Naraj Delta Head flooded the subdivisions of Cuttack Sadar, Kendraparha, Jagatsinghapur and Jajpur. A breach in the capital embankment of Devi river near Ghadimul in Jagatsinghapur subdivision at 1.30 a. m. on 14th July, 1994 devastated large areas of Jagatsinghapur, Balikuda and Naugan Community Development Blocks. The initial breach of 200 m. was subsequently increased to 600m.

The damages to public and private properties caused by this unprecedented flood are given in the enclosed annexure.

Rescue and relief operations carried out to alleviate the sufferings of the affected and marooned people during the emergency period of flood which are a continuing process are indicated below.

Rescue Operations

During the floods of July, August and September, 1994 rescue operations were organised by deployment of 96 power boats and 10 country boats of the Special Relief Organisation. As these boats were not sufficient for the rescue operations, Army and Naval boats were requisitioned. In July 94, 12 Army and in September 1994, 10 Naval boats were pressed into service in Jagatsinghapur subdivision. Thousands of persons were rescued from the marooned villages and taken to the shelter camps opened by the district administration. Besides, the Collectors locally pressed into service a large number of country boats in rescue and relief operations.

Relief Measures

The floods in their wake of devastations, uprooted people from their age-old habitations leaving them without work for months together. Naval and Air Force helicopters were pressed into service for air-dropping of dry food packets in inaccessible pockets for a total period of 11 days in July and September. 223.74 tonnes of dry food were air-dropped during these two phases of operation, i. e., from 16th July, 1994 to 22nd July, 1994 and from 6th September, 1994 to 9th

*These were four subdivisions of the undivided Cuttack district. Now these have been constituted into four districts.

September, 1994. Army and Naval helicopters made 67 sorties in July and 28 sorties in September to the flood affected areas. Emergency relief in kind were also distributed for a period from 3 days to 25 days among affected people. Details of the relief materials distributed to the people were as follows :

Sl. No.	District affected	Emergency Relief Distributed				Cattle feed in (in Qtls)
		Rice (in Qtls)	Chuda (in Qtls)	Gur (in Qtls)	Poly-thene Rolls	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Cuttack ..	8,806'00	172'00	400	48	2,127'00
2	Jagatsinghapur	18,355'907	3,627'43	487'267	2,292	3,264'00
3	Jajpur ..	28,845'39	648'78	2,000	115	2,831'455
4	Kendraparha	24,876'98	3'50	0'56	284	4,259'00

Supply of Safe Drinking Water

In the marooned villages there was scarcity of safe drinking water as almost all tube-wells and wells were under flood water. To provide drinking water at shelter places and marooned villages, 166 tube-wells were sunk in subdivisions of Jagatsinghapur, Puri, Kendraparha, Jajpur, Bhadrak, etc. In addition, potable drinking water to the extent of 5 lakh litres were transported by boats to the shelter camps and marooned villages.

Veterinary Measures

22,278'55 quintals of cattle feed were distributed in the flood affected areas. Besides, veterinary teams took up massive preventive measures to check spread of cattle epidemics.

Health Measures

154 health centres were operated in different flood affected areas. In addition, 16 mobile teams were also pressed into relief operation. Health measures undertaken in the affected areas are detailed below :

No. of persons inoculated	No. of persons treated	No. of wells disinfected	No. of Halogen tablets distributed	O. R. S.
(1)	(2)	(3)	(4)	(5)
1,60,939	3,45,955	1,41,258	5,09,965	1,85,010

Relief Measures by Non-Government Organisations

During the flood, voluntary organisations moved to the affected areas for distribution of food, shelter materials, clothings and medicines. These organisations were Tata Relief Society, Ramakrishna Mission, C. A. S. A., L. W. S., UNICEF, NALCO, SAIL and Bharat Sevashram Sangha, besides a large number of other registered bodies. Many of them have also contributed to Chief Minister's Relief Fund. Substantial grants were made available to individual affected families from Prime Minister's and Chief Minister's Relief Fund in case of death due to flood.

Agriculture

Agricultural operation was badly affected and expectation of a good Kharif crop was upset. Every time the flood water receded, cultivators started transplantation of Kharif paddy but their hope was belied with a succeeding flood. Cultivators/farmers were in no position to recoup the loss without Government assistance for Rabi cultivation. Until and unless Rabi crop is taken up on an extensive scale in the affected areas, it would be impossible on the part of the cultivators to have any crop till the next Kharif in 1995. The Agriculture Department are preparing a massive Rabi programme to cover all the affected cropped areas of flood affected districts. For this purpose, large inputs subsidy is to be provided but the scantiness of the Calamity Relief Fund (CRF) would not permit this. Before a massive Rabi cultivation programme in the affected zones is taken up, closure of breaches in canal embankments and repair of damaged Lift Irrigation points within a short span of time are absolutely necessary.

Communication

The prolonged flood has completely devastated the communication system in the rural areas of the flood affected areas. Even the roads within the urban areas have not escaped the ravages of flood. Culverts and bridges have been affected and require immediate restoration. Until and unless the communication system is restored the villages would remain unapproachable.

Buildings

The repair/restoration of public buildings to pre-flood condition would require about rupees 46.47 crores as most of the buildings were damaged by torrential rains and floods of 1994. This includes educational buildings of both Government and non-Government, situated in the flood affected areas.

ANNEXURE

The Statement of damages caused by 1994-flood in
Cuttack District subdivision-wise (since
constituted into separate districts
with effect from
1st April, 1993)

Sl. No.	Name of the Subdivision	Number of C. D. Blocks affected	Number of urban local bodies affected	Number of Grama Panchayats affected	Number of villages affected
(1)	(2)	(3)	(4)	(5)	(6)
1.	Cuttack Sadar including Banki and Athagarh	14	..	160	709
2.	Jagatsinghapur ..	87	1	68	329
3.	Jajpur ..	10	2	164	798
4.	Kendraparha ..	9	1	134	509

Population affected	cropped area affected (in hectares)	Sand cast area (in hectares)	No. of casualties	
			Human	Animal
(7)	(8)	(9)	(10)	(11)
3,76,837	61,841	198
2,60,000	26,627	816	12	197
7,37,730	95,320	377	12	..
5,56,667	67,221	1,201	13	3

Number of houses damaged			Value of damages of public properties (in lakhs) (Roads & Buildings)	Number of breaches in embankments		
Swept away	Fully collapsed	Partially collapsed		River	Canal	Saline
(12)	(13)	(14)	(15)	(16)	(17)	(18)
4	10	280	15,45.96	81	23	7
68	22.22	77.04	19,59.58	8	19	32
0	276	12,142	13,19.85	46	13	..
8	168	25.45	22,43.00	27