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Drought, Agriculture, and Rural Livelihood: A Case Study of Bolangir District, Orissa

by

Mahendra Nayak

Madras Institute of Development Studies
79, Second Main Road, Gandhi Nagar
Adyar, Chennai 600 020

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Mahendra Nayak[♣]

Abstract

Bolangir is officially declared a drought-prone district. However it is an under-exploited ecological base where average annual rainfall is 1443 mm. Poverty level in this district is the highest in the country (61.01% as per the Union Planning Commission's estimates, 1999-2000) where one encounters frequent occurrence of starvation deaths, natural disasters like floods and droughts. As a consequence, the district suffers from chronic problems of abject poverty and malnutrition, distress induced migration, food insecurity and even starvation deaths. Majority of households have no satisfactory access to institutional loan and borrowed from a variety of informal sources both from inside and outside the villages. It is precisely in this context, the present paper examines the problems associated with drought somewhat historically and politically. In particular, the paper attempts to answer to some of the important and puzzling questions such as why does the district experience drought despite a good rainfall, which is much higher than the national average? Is the district really facing water scarcity or is it the reflection of the poor water governance in the state? On the contrary, if the present plan of linking the Mahanadi with other rivers in peninsular India, it is bound to increase poverty and unemployment, keeping the state under severe drought conditions. The analysis is based on the secondary data (published by various government agencies) and primary data collected from the village studies conducted in the district during the year 2001-02.

I Introduction

Bolangir district is primarily an agrarian economy where technological adoption is at a very low level. Due to lack of suitable irrigation facilities in many places, the success of harvest depends heavily on the monsoon arriving at the appropriate time and in adequate quantity. Perhaps, this remains as the main reason for the lack of application of new bio-chemical technology in the district. As a consequence, the occurrence of low yields and crop failures has become a common phenomenon. The growth of non-farm employment is also at a low level in this district. High level of illiteracy has aggravated the vulnerability

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of people. The deprivation and poverty on the whole have pushed the majority of the district to a corner.

The motivation of the paper is to study drought syndrome in the district and Orissa. It is interesting and surprising that the annual average rainfall of the district is 1,443 mm, but this district is declared chronically drought prone. In view of this, it is important to examine whether there is 'real' water scarcity and to throw light on the impact of drought. Against this backdrop, the paper examines the consequences of 2000-01 'drought' on cropping pattern and employment and the survival strategies adopted to sustain household income (in which year the actual rainfall was 1001.5 mm). Five villages from Bolangir district were selected purposely for detailed study to examine the impact of drought. These are: two villages from Loisingha block i.e. Loisingha[1] and Jharnipali and other three from Agalpur block i.e. Banghabahal, Telenpali and Salevata. [2]

There are six sections in this paper. Following the introductory section, definitions and perspectives of drought is discussed in Section II; the general agro-climatic characteristic of the region is discussed in section-III. Section-IV outlines how indigenous irrigation systems coped fairly well in the past but declined steeply in recent decades aggravating drought conditions in the region. Section–V analyses impact of drought and the backwardness of the region. Section-VI conceptualizes drought with summary and conclusion.

II Perspectives on Drought

The Weather Bureau of US defines drought as a 'lack of rainfall so great and long continued as to affect injuriously the plant and animal life of a place and to deplete water supplies'. In Egypt, those years, which don't bring a flood in the Nile River, is considered drought years (Chow, V.T. 1964). In India, for a hydel-power generation unit, drought will not mean absolute lack of water but a drop in reservoir level below the intake point, while for a farmer, drought will mean lack of soil moisture to match the evapotranspiration needs of the plants (Acharya, 1992). It can be defined as "a deficiency of water in the ground, streams, lakes and reservoirs, resulting from a prolonged deficiency of rain and snowmelt".[3] It is defined similarly as "the lack or insufficiency of rain for an extended period that causes a considerable hydrological imbalance and, consequently, water storages, crop damage, stream flow, reduction and depletion of ground water and soil moisture". [4]

In general terms, drought can be explained as a situation arising out of scarcity of water. Water is the cause of drought and this can be solved only by water. Central Arid Zone Research Institute (CAZRI 2000) and National Commission on Agriculture (NCA) have identified types of droughts:

- **Meteorological Drought:** When there is a significant (more than 25 per cent) decrease in rainfall from the normal value over the area. It defined based on number of days with rainfall less than some specific threshold.

- **Hydrological Drought:** When prolonged metrological drought results in hydrological drought with a marked depletion of surface water and consequent drying up of reservoirs, streams and rivers, cession of spring flows and falls in groundwater levels. This may necessitate curtailment of hydropower generation and affect industry as well as agriculture. This, we can divide into two categories as lack of surface-water/reservoirs (called surface water drought) and lack of ground-water stock (called groundwater drought). It also defined as one in which aggregate run off is less than the long term average run off.

  In the case of Orissa, surface water drought or drying up of surface water sources like streams and rivers is more related to the destabilization of hydrological stability of the catchments rather than failure per se.[5] This creation of the surface-water drought through degradation of catchments amounts to a failure in the maintaining the ecological processes. However, even when rainfall is not that heavy, loss of hydrological function of the river catchments in absorbing the rainfall resulting from lack of green cover will also lead to floods and consequently drought.[6] The question of land use and management in the upper catchments of river basins and their ecological performance is most vital for controlling floods and droughts.

- **Agricultural Drought:** When soil moisture and rainfall are inadequate during the growing season to support a healthy crop growth to maturity and cause crop stress and wilting. The main reasons for declaring agricultural drought are unseasonal rainfall destroying crops and also heavy pest attacks.

- **Environmental Drought**: This is yet another type of drought. Even an adequate and seasonal rainfall will have no sense if water pollution is a serious problem, in

particular in a situation, where surface and groundwater are already severely contaminated due to effluent discharge. Available water might simply be unfit for drinking as well as irrigation purposes because of excessive salinity, brackishness, fluorides, sulphates, hardness, nitrates, iron, manganese, heavy metals and pesticides (Janakarajan, S. 1999).

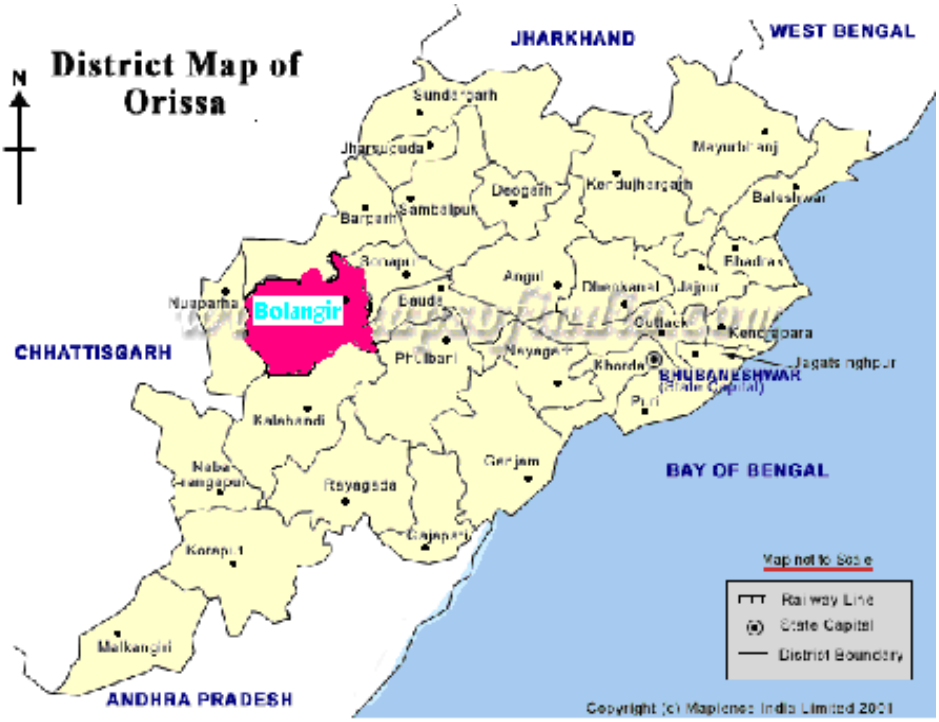
Drought in agriculture alters cropping pattern (Muranjan, 1992), causes steep reduction in farm production, employment days, income level, household consumption (Pandey and Upadhyay, 1979; Udin, 1984; Acharya, 1992) and reduces the calorie intake. These micro level studies have recommended the coping strategies such as soil and moisture conservation, irrigation facilities and livestock and pasture development to lessen the severity of the impacts of drought. Specific programmes suggested to minimize adverse consequences of drought in different regions include small-irrigation development (Klein and Kulshreshtha, 1989) and government-sponsored rural works projects for the creation of rural infrastructure (Bliven *et al.,* 1994). Farm level analysis shows that drought causes a chain reaction of events in economic and social terms. Small farmers and marginal farmers are the worst affected people (Bokil, M. 2000). However, the farm households with their ingenuity temporarily manage droughts through adjustments in production and consumption. The adaptive mechanism varies with the agro-climatic and resource characteristics of the area, knowledge of which would help in evolving location-specific coping measures. Studies on farmers' adjustment mechanisms against droughts are available in Jodha (1975, 1978, 1991); Jodha and Mascarenhas (1983).

III Agro-climatic Conditions of the Study District

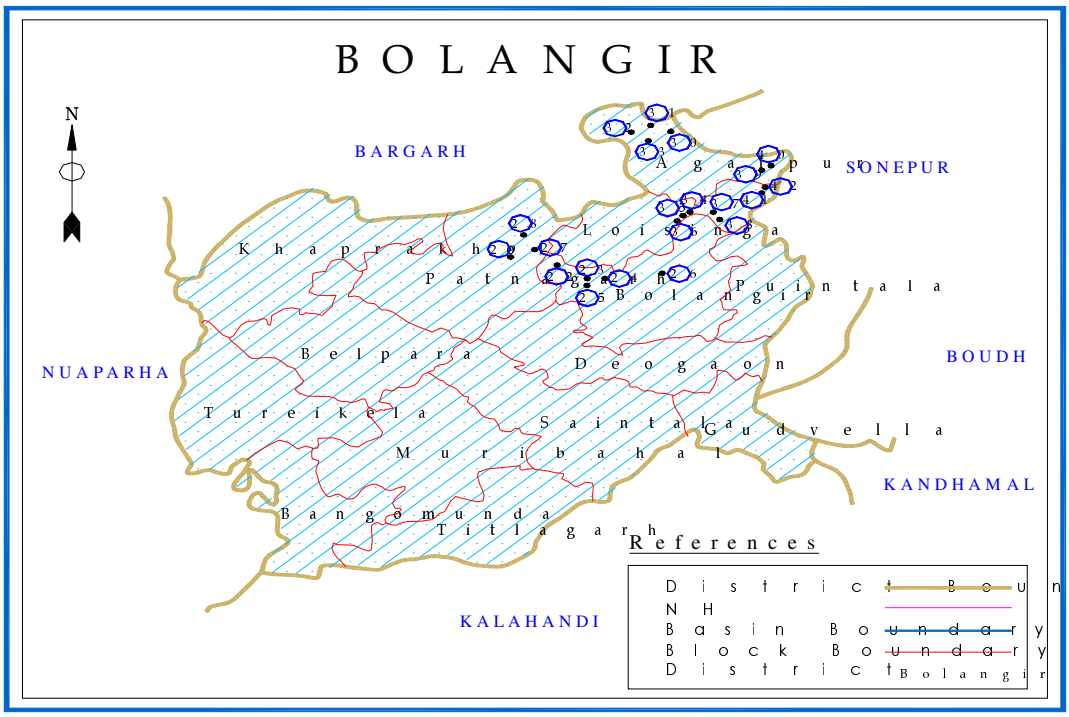
The present study is confined only to the Bolangir[7] district situated in the western part of Orissa. The district is divided into 14 administrative blocks with an area of 6551.3 sq kms and over 1700 villages (see Map-1 and Map-2). The district lies between 20º9′ and 21º11′ north latitudes and 82º41′ and 84º16′ east longitudes. It is bounded by the districts of Bargarh, Sonepur, Kalahandi and Nawapara. It is a surprising fact that the annual average rainfall of the district is 1,443 mm still the areas are declared chronically drought prone regions (Table-1 & 2) [8]. Water scarcity, as both the cause and the effect, is the most visible attribute of drought. However, 'the commonly made correlation between failure in seasonal rains resulting in drought is simplistic and inadequate. Drought occurs whenever

and wherever the links in the water cycle are broken or destabilized'.[9] After the monsoon, the springs and rivers dry up and there is drought.[10]

Map – 1 Map of Orissa



Map – 2 Study Regions in Bolangir District



The district has two distinct physiographical regions, namely, plains and hilly areas of western and southern parts of the district. The plain area can be further subdivided into irrigated and non-irrigated plains. The maximum area of the district depends mainly on tank irrigation. Fertile plain areas nestling between the undulating landscapes are criss-crossed by a number of semi-perennial rivers like *Mahanadi*, Ang, *Tel* and tributaries to *Tel*, *Jira*, *Salesingh* etc. During monsoon, these rivers drain anything between 1 lakh to 4 lakh cubic feet of rain every day into the Bay of Bengal.[11] Lack of Water Harvesting Structures allows this huge quantity of rainwater to go waste. The soil of Mahanadi, Tel, Ang basins are alluvial in nature and are very fertile. The soil in the remaining part of the eastern side varies from light sandy type to sandy loam, similar soil, but with patches of black earth is found in the central parts of the district. The soil of the southern and western fringes is mostly laterite in character.[12] The annual precipitation in this area is 1,250 mm.

The land type with regard to the fertility is one of the factors in any agricultural productivity. All the land types do not require equal amount of rain for an optimum production. In the study villages low land (*Bahal*/Class I), medium land (*Berna*/Class II) and high or upland (*att*/Class III) are noticed. Each type is further divided into *Khari*, *mamuli*, *pani* and *kharipani* classes according to the facilities of irrigation and supply of manure.[13] The best quality of cultivable land is *Bahalpani* where even with scanty

rainwater paddy can grow well. In *Bahal-mamuli* and *Bahal-khari*, medium type of rain is required. Similarly the cultivation in *Berna* land requires comparatively more water, and in case of *Att-mamuli* much rain is needed for paddy cultivation. But, in *Att* types of land, paddy can't be cultivated under any condition. So, this type of land is suitable only for *Koda (*cereals*)*, *Mandia* (millets) etc. All the *Kharipani* and *Pani* categories of lands[14] are used to get supplemental or protective irrigation from tanks called traditional water bodies and other sources, which were previously owned by the ex-rulers or private cultivators. It is estimated that in Bolangir district at the time of independence, such land (having protective irrigation) comprised about 50 *per cent* of the total cultivable area. However, after independence most of these irrigation sources are nationalized[15] and in the absence of maintenance most of them are no more in a condition to provide any irrigation. This is a major reason why the total irrigated area in Bolangir instead of increasing has come down to 6 *per cent* of the total cropped area as in the year 2001-02.

Rainfall Pattern and Drought Syndrome

Conventional wisdom suggests that lack of rainfall or inadequate rainfall leads to drought. Is it true in the case of study area? To answer this question, let us study the rainfall pattern in Bolangir district and Orissa during the period 1901 to 2000. It can be seen from Table-1, Table-2 and Figure-1 that the average annual rainfall in Bolangir district and Orissa has been 1,443.5 mm. and 1482.2 mm respectively which is quite impressive as compared to other states in India. During past the 100 years, eight years have recorded the lowest rainfall of less than 1000 mm. It is seen from the table that the annual rainfall of the district was more than 1,200 mm in 71 out of 100 years (see Appendix-A). From the rainfall pattern, it is important to analyze drought syndrome effectively (Table-2). It will be seen from the Appendix-A.II that out of 100 years, 47 were declared as drought years. That means declared drought has occurred roughly once in two years, even if the average rainfall is more than 1200 mm. Can we say, then that deficit rainfall is the cause of drought and its impacts on poverty? As the answers to the question is no, the problems must lie elsewhere.

Table-1: Some Key Indicators of rainfall in Bolangir district and Orissa

Particulars of rainfall	Bolangir	Orissa
Normal RF (1900 – 2000) mm	1443.5	1482.2
Normal no. of rainy days (1900-2000)	67	72.2

Normal intensity of RF in mm (1900-2000)	21.54	20.52
No. of rain gauge stations	14	320
Density of rain gauge stations (one per sq. kms)	467.95	483.77
Maximum RF during 1900-2000	2165.25	2231.56
	(In 1917)	(In 1917)
No. of years having RF < normal	67	64
No. of years having RF < 75% of normal	14	10
CV of annual RF for the past 100 years	20.33	17.14

Source: Complied from several Government of Orissa Publications
Note: CV – Coefficient Variation

Table-2: Decadal Rainfall (RF) Pattern in Bolangir district (1901-2000)

Decades	No. of yrs above normal RF	No. of yrs below normal RF	No. of yrs below 75% normal RF	No. of yrs 50% below normal RF
1901-1910	2	8	1	0
1911-1920	5	5	0	0
1921-1930	4	6	0	0
1931-1940	6	4	1	0
1941-1950	5	5	0	0
1951-1960	4	6	0	0
1961-1970	2	8	2	0
1971-1980	1	9	1	2
1981-1990	3	7	6	0
1991-2000	1	9	3	0
Total	33	67	14	2

Source: 1.Orissa District Gazetteer, Bolangir, 1968, p.28
2. Board of Revenue, Cuttack, Orissa
3. Directorate of Agriculture & Food Production Orissa, Bhubaneswar
Note: RF = Rainfall. Numbers of years less than 75 per cent below normal rainfall are not counted under less than 50 per cent below normal rainfall.

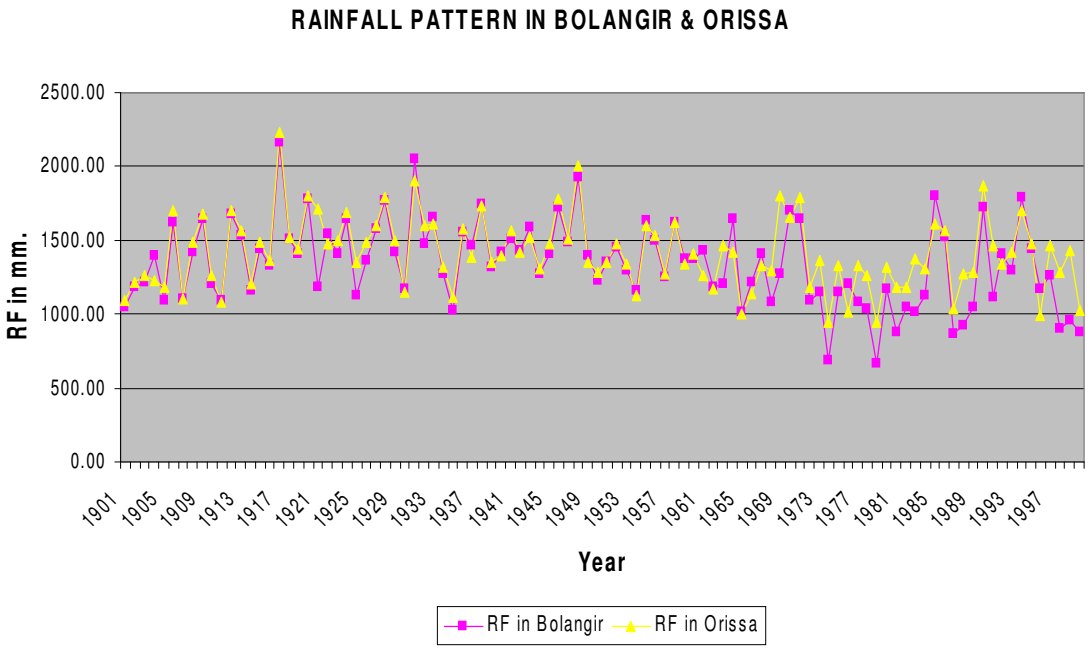
Table-3: Decadal RF Pattern in Orissa State (1901-2000)

Decades	No. of yrs above normal	No. of yrs below normal	No. of yrs below 75%	No. of yrs 50% below normal

	RF	RF	normal RF	RF
1901-1910	3	7	2	0
1911-1920	6	4	1	0
1921-1930	7	3	0	0
1931-1940	5	5	0	0
1941-1950	5	5	0	0
1951-1960	3	7	0	0
1961-1970	2	8	1	0
1971-1980	1	9	3	0
1981-1990	3	7	1	0
1991-2000	1	9	2	0
Total	36	64	10	0

Source: 1. Board of Revenue, Cuttack, Orissa
2. Directorate of Agriculture & Food Production Orissa, Bhubaneswar
Note: RF = Rainfall. Numbers of years less than 75 per cent below normal rainfall are not counted under less than 50 per cent below normal rainfall.

Figure-1: Rainfall pattern in Bolangir district and Orissa (in mm)



The Indian Metrological Department defines the erratic nature of rainfall using the statistical parameters such as Standard Deviation (SD) Coefficient of Variation (CV) and Histogram. Table-1 discusses the rainfall pattern and its variation over the various years

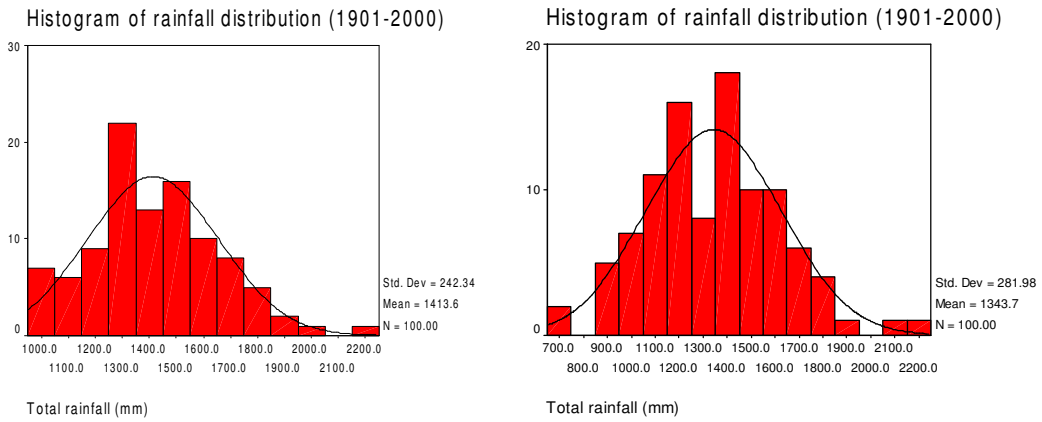
(1901-2000) through which we can compare how far the rainfall distribution is vary between Bolangir and Orissa. The annual rainfall does not seem to be erratic since the CV works out to be 20.33 and 17.14 of Bolangir district and Orissa during the period 1901-2000. As per this norm, both in Bolangir district and Orissa the rainfall is not erratic and the picture remains the same across the monthly rainfall also, compared to India 24.18, Tamil Nadu 27.41 and Rajasthan 30.36.

Histogram of Rainfall Distribution in Bolangir district and Orissa

The histogram rainfall distribution of Orissa figure depicts that the most range of total yearly rainfall (80 %) occurs between 1206 and 1719 mm, yet the variability takes its value between 1000 to 1900 mm. By contrast, the histogram rainfall of Bolangir district reflects the most frequent range of total yearly rainfall (79 %) occurs between 1118 to 1716 mm, yet its variability takes 900 to 1900 mm. So, the rainfall pattern varies little more in case of Bolangir than Orissa, otherwise more or less same. The above figures focus one central thing that the average rainfall of both Bolangir district and Orissa is not below 1350 mm (1343.7 mm).

Figure-2: Histogram of rainfall distribution of Bolangir and Orissa

Orissa *Bolangir*



Agriculture in Bolangir and Orissa

The agriculture of the district is mostly of subsistence cultivation. Farmers practice traditional technology and use local varieties of paddy. Use of high yielding varieties of seeds is low. Similarly, the use of chemical fertilizer is also low. For instance, the use of chemical fertilizer of all varieties during the year 1996-97 was 10.22 kgs/hectare for the Bolangir district as compared to 30.52 kgs/hectare for the state. Thus, the use of fertilizer

was negligible for cultivation. In view of this the productivity of crops including that of paddy was low. Data provided in Table–4 and Table-5 reveal the relative position of Bolangir district within the agricultural map of Orissa. Is the crop pattern responsible for the agricultural drought in Bolangir? From the tables, we find that 23.43 per cent of its area is under forest and 66.13 per cent (434500 ha) are gross cropped area indicating that shortage of rainfall has not been the cause for poverty and drought in the district. As per the statistics of 2001, the density of population per sq km in Bolangir was 203. This figure for Orissa was 236 and that for India was 324.25. One may compare this figure with the density of population of West Bengal, which is 904, Bihar 880, Kerela 819 and Uttar Pradesh 689. The decadal population growth in Bolangir during 1901-2001 has been always less than the state or national growth. Between 1991 and 2001, the variation has been 8.52 for the district where as it was 15.94 for Orissa and 21.34 for India.

Table-4: Land Use in Bolangir District in 2000-01 (in ha)

Total geographical area	657000
Gross cropped area	434500
Percentage of Gross cropped area to geographical area	66.13
Percentage of forest area to total geographical area	23.43
Percentage of paddy crop area to gross cropped area	47.84
Percentage of total cropped area irrigated	10.43
Total Population (2001)	1336000

Source: Orissa Agricultural Statistics, 2000-01

Table-5: Area operated by Size Class of operational Holdings in Bolangir District during 1995-96 (Area in ha)

Size classes	Number	Area (ha.)	% of Total Area	% of Total Holdings
< 1 ha (Marginal)	96925	48946	17.62	49.98
1 to 2 ha (Small)	54365	71706	25.81	28.03
2 to 4 ha (Semi-medium)	30565	79343	28.56	15.76
4 to 10 ha (Medium)	10830	59299	21.35	5.58
10 and > (Large)	1250	18477	6.65	0.64
Total	193935	277771	100.00	100.00

Source: Economic Survey 2000-01, Govt. of Orissa, p. ANX. 23-26

Irrigation has a grater role in raising cropping intensity (CI). The economy where provision of irrigation is more, cropping intensity is likely to be more. The table-6 clearly

gives a comparative result over the years with respect to Bolangir, Orissa and India. The advent of new crop technology, popularly known as 'green revolution' has considerably enhanced the cruciality of water as a basic productive input. It warrants for assured, quality and timely controlled application of water. Access to water is probably the major factor which would held in increasing the prevalent low cropping intensity in the district. The cultivation of the high yielding variety of paddy has not made much headway either in kharif or more important in rabi seasons, largely because of the meagerness of irrigation facility. Hence, the impact of Green Revolution is marginal increased in Bolangir district where as high in case of Orissa and India. So, we can able to draw a conclusion from table itself that Bolangir district is backward on cropping intensity means less in utilizing irrigation facilities.

Table-6: Cropping Intensity in Bolangir, Orissa and India in selected years

(in Percentage)

Year	CI in Bolangir	CI in Orissa	CI in India
1950-51	100.10	105.90	111.07
1960-61	104.16	108.26	114.69
1970-71	106.58	120.69	117.77
1980-81	110.77	142.68	123.38
1990-91	111.04	152.95	130.40
2000-01	118.07	150.63	134.30

Source: 1. District Statistical Handbook, Bolangir, Various Years
2. Statistical Abstract of Orissa, Various Years
3. Economic Survey of Orissa, Various Years
4. Ministry of Agriculture, Government of India

The prevailing crop pattern in the district is not drastically different from that of Orissa State. The major crops grown are paddy, pulses, sugarcane, oilseeds and vegetables etc. However, one finds a lot of difference between the proportion of area irrigated and unirrigated. Table-7 gives the average area under different crops for the years 1992-93 to 2001-02 in Bolangir district and Orissa.

Table-7: Area under different crops in Bolangir and Orissa (Area in 000 ha)
(***Average*** for the Years 1992-93 to 2001-2002)

Crops	Bolangir			Orissa		
	Area under crops (gross)	% Irrigated	% of GCA	Area under crops (gross)	% Irrigated	% of GCA
Paddy	202.9	23.14	47.85	4469.78	59.58	51.14
Pulses	105.04	3.62	25.33	1743.6	6.01	19.82
Sugarcane	2.16	100.00	0.47	29.66	100.00	0.34

Oilseeds	40.84	8.92	9.86	849.38	13.14	9.65
Vegetables	18.72	81.38	5.00	615.87	54.78	7.10

Source: Orissa Agricultural Statistics, Bhubaneswar, Orissa, Various Years

It may be seen from the table that paddy is the single most important crop in both Bolangir district and Orissa. But, in Orissa almost 60 per cent area under paddy is irrigated while in Bolangir district only 23.14 per cent (one-fourth) of the area under paddy receives irrigation. This is mainly because lack of irrigation facilities in the district. In addition to that the irrigation from tanks is not assured. Thus, a major part of paddy cultivation in the district is carried out under dry and sparsely irrigated conditions. The only crop, sugarcane, receives same percent irrigation in both Bolangir district and Orissa. Interestingly, in Bolangir district 81.38 per cent area under vegetables is irrigated while in Orissa it is 54.78 per cent. This is because farmers of Bolangir district have more number of dugwells for vegetables cultivation.

Despite the high rainfall, vast areas of good quality agricultural land, comparatively less populated area and abundant natural resources, it is a fact that a majority of the people of Bolangir have been reeling under acute poverty (Table-8). Is there a solution? The problem of Bolangir is primarily due to the negligence of agriculture and the farming sector and not due to the deficit rainfall. The problems are seemingly artificial.

Table-8: Bolangir vis-à-vis the State of Orissa

Items	Bolangir	Orissa
Density per sq. kilometer (2001)	203	236
No. of females per '000 Males (2001)	983	972
% of urban population (2001)	11.52	14.97
Literacy rate (2001)	54.93	63.10
Female literacy rate (2001)	39.27	50.50
Percentage of workers to total population (2001)	42.01	38.88
Percentage of marginal workers to total population (2001)	15.69	12.80
Percentage of non-workers (2001)	57.99	61.12
Fertilizer consumption during 1996-97 (kg\ha)	10.22	30.52
Yield rate of Rice during 1996-97 (kg/ ha)	357	993
Percentage of forest area to total area (1997-98)	25.19	35.6
Percentage of cultivated area under irrigation (kharif, 1997-98)	8.08	32.7
Percentage of cultivated area under irrigation (Rabi, 1997-98)	2.36	13.31
Cropping Intensity in 1997-98	116	141
Population Below Poverty Line (1999-2000)	61.01	47.15

Source: a. Census of India, 2001, Government of India, New Delhi
b. Complied from various Publication of Government of Orissa

The strong correlation between drought and poverty has long been established and disasters being endemic in nature in Bolangir, they inflict a never-ending cycle of poverty on a large segment of the population. Table-8 provides a consolidated picture of the relative disposition of Bolangir with the overall scenario in Orissa State on some related parameters having bearings on the district's poverty profile. Bolangir is one of the poorest districts in Orissa, where people die of starvation. According to the latest estimate of the Planning Commission it has the highest percentage of people below poverty line, 61.01 per cent in 1999-00, is much higher than the State average of 47.15 per cent and much higher than the all India level of 26.10 per cent. This clearly indicates that the performance of Orissa in eradication of poverty in Bolangir district is the worst. The district and state are lagging far behind compared to other states in India (See Appendix-D). In particular information pertaining to population below poverty line, per capita income and degree of urbanization are quite stunning. These data are the clear manifestations of the Orissa state's poor socio-economic performance.

On the whole, this section helps to get some broad understanding of the agro-climatic conditions of the region, which might help our subsequent discussion. With this we shall move on to discuss traditional irrigation institutions in Bolangir district and its role in mitigating drought condition.

IV Traditional Irrigation Institutions in Bolangir District

The traditional sources of irrigation (age-old community managed irrigation systems/small water bodies) for the cultivated land were tanks, ponds and wells etc.[16] As the District Gazetteer reports, tanks occur almost in every village. The size of the tanks varies from less than a hectare to about 50 hectare. They are generally classified as *Kata, Munda, Bandh, Sagar* and *Sara.*[17] The tanks are chiefly used for bathing, drinking, pisciculture and irrigation purposes depending on needs of the locality.[18] The different tanks, wells etc had been constructed with the use of labour extended by the cultivating peasants of the village communities. The construction, maintenance and renovation remained the responsibility of the village community as a whole. Due to local ingenuity of design and location, they are continuing to serve as a sustainable source of protective irrigation of crops (Sengupta, N. 1993).

In 1906 irrigated land constituted 58 per cent of the total cultivated area whereas the area under irrigation was only 50 percent of the total cultivated area in 1936. By 1976, most of the old irrigation works had deteriorated due to heavy silting and lack of proper maintenance. The factors responsible for such devastating consequences of irrigation works were change in legal status of the tanks, and *Bandhas*, derecognition of the traditional mode of operation and maintenance and preference of the state to develop canal irrigation which involved heavy public expenditure. The settlement officer in 1936 had expressed a grave concern for the deterioration of the indigenous sources of irrigation. "There were altogether 3000 *Bandhas* and tanks, the majority of which stand recorded in the *Anabadi* holding of the village. Originally there were prepared at the cost of the villagers. Like *Bhogra* lands (good quality lower lands) these *Bandhas* and tanks had been recorded as *anabadi* in order to avoid future trouble among the villagers.[19] Subsequently, the persons who actually excavated the tanks ceased to take interest in them. The tenants claimed water from the tanks during the drought and actually utilized them in times of need but they did not repair them when they were called up to make repairs. Thus, *Bandhas* and tanks remained uncared for and if the present state of affairs continues there is every chance of these material assets to be lost for no purpose. It is therefore suggested that either some arrangements should be made or these may be left in the charge of some important persons of the village".[20] Derecognition of the traditional control of village headmen, particularly after the merger of the princely states in post-Independence period, resulted in further deterioration of irrigation works.

The villages of the erstwhile Patna State (now Bolangir) were prosperous and irrigation tanks were common.[21] There were more than 3,000 tanks in the state (now Bolangir).[22] In 1919, it had 33,700 ha of irrigated land. This increased to 53,356 ha by 1937.[23] These traditional sources played a major role in reducing severity of droughts and famines. Thus, the state encouraged tenants to dig more tanks and develop other water sources with the permission of the authorities. Such water sources were declared as public *Jalchar* land which basically meant public ownership. An irrigation *khatian* was maintained indicating the plots irrigated and sources from which they were receiving water. The settlement report of 1937 states that all water reservoirs of the village shall be kept in good repair by the farmers working under the direction of the village headman and the *panch* and no fee was charged for the use of water.[24]

The organization of reservoirs for drinking and irrigation purposes witnessed a major change with the introduction of British Settlements. The different sources of irrigation being owned by the government and with the creation of private property in land, the construction and maintenance of these water sources were left with the government. In the absence of reinvestment of the collected revenue by the government for developing such sources of water and with changing property relationship within the village preventing the organization of the village community in conditions of scare rainfall leading to continuous drought (Sengupta S. 2000). After the abolition of *zamindari* and *gountia* system in 1950, ownership rights to private tanks were abolished and the private tanks expropriated from the *zamindars* and the landlords, were vested in the State government. The vested tanks were handed over to village panchayats, but, others were put under the direct control of the Minor Irrigation Department. In all cases, tanks, for all practical purposes, became a common pool resource (CPR); all farmers who own land in the command area of a tank have access to the tank water. The irrigation tanks are now a CPR and therefore like other CPRs, are a victim of the 'tragedy of the commons'. They are silted and infested by weeds; their beds and foreshore areas are encroached; their sluices and outlets are choked in the absence of regular cleaning; and water distribution channels are either non-existent or are badly silted and breached. All these problems arise principally from a tendency on the part of the co-users of tanks to shirk their responsibility in contributing to repair and maintenance, protection and management (MIDS, 1986:147). This tank irrigation system remained eco-friendly and sustainable practice until 1950s (Von Oppen, M. and K. Subba Rao 1980a). Tanks irrigated about 50 *per cent* of the cropped area in Bolangir district at the time of Independence, compared to 4 *per cent* in 2000-01 (table-10).[25] Thus, tank irrigation has declined (table-9) and become a source of instability rather than stability. [26] It is clear from the table-9 that the tanks have lost their capacity to irrigate and that leads to the impact of drought became more acute in the regions.

Table-9: Tanks and their physical problems in the study villages

Village Name	Block	Number of Tanks	Area irrigated in 1976 (acres)	Area irrigated 2001-02 (acres)	Percentage declined	Present problems with tanks
Bangabahal	Agalpur	3	230.36	173.00	24.90	Siltation, Canals need repair
Jharnipali	Agalpur	9	91.77	61.08	33.44	Encroachment Siltation, Canals

						need repair Encroachment
Telenpali	Agalpur	7	96.41	67.14	30.36	Siltation, Canals need repair Encroachment
Loisingha	Loisingha	6	681.49	518.52	23.91	Siltation, Canals need repair Encroachment
Salevata	Agalpur	10	266.03	176.50	33.65	Siltation, Canals need repair Encroachment
Overall		35	1366.06	996.24	27.07	

Source: 1. Computed from Tahasildar Office, Bolangir, Land Records, 1976 (Column 4),
2. Field Survey (Column 5),
Note: AV- Average

These traditional sources played a major role in reducing severity of droughts and famines. In 1897, when most parts of the economy suffered from one of the worst famines of the 19th century, Sambalpur and Bolangir were scarcely affected. Despite the 1900 famine been really severe, the cultivators of Sambalpur and Bolangir managed to save half of their crops due to *katas.* This was possible because of the patronage extended by the Gond kings to the *gountias.* The *gountias* were responsible for the management and maintenance of the traditional water harvesting systems for a certain period.[27]

Thus, these indigenous irrigation systems coped fairly well in the past, but today, these systems are becoming more and more inadequate and incapable of responding to the ever-increasing needs and demands of farmers (Janakarajan, S. 1993).[28] With the increasing scarcity of water resources, declining soil fertility and degradation of other natural resources such as forests, tanks, grazing lands etc living in the arid, semi-arid areas has become even more difficult. As a result, migration has been taking place from drought prone areas to irrigated command areas and metro cities over the past 100 years (Guha, R. 1991).

Present Conditions of Study Tanks

After discussing the historical part of tank irrigation in Bolangir district, now we will try to discuss the tanks and its hydrological structure at the present condition in our study areas.[29] The size of the tank and the water spread area are closely related. It is 1: 1 in Tamil Nadu and Karnataka. But it differs in Orissa as all tanks in Orissa are filling more than 3 times in a year. It comes 1: 3. The water spread area of the tanks has been reduced

over the years due to encroachment by the farmers owning land in the foreshore area of the tank. This varied between less than one acre to more than 50 acre in large tanks. The tanks are of varying sizes: 163 tanks out of 290 tanks (i.e. 56 per cent) irrigate about 6.13 acre per tank (Table-10). At the other hand, one tank irrigates roughly 320 acres (i.e. Narayan Sagar in Loisingha) covering 4 villages. It is interesting that there are 77 small water harvesting structures in the study area which are able to irrigate one acre only. Most of them are privately owned.

The shallow well per acre works out to 0.06 in the ayacuts of selected tanks (Table-10). The wells hold water through the hot weather and largely used for the irrigation of sugarcane and vegetable plots. The bulk of these wells are fitted with indigenous method, locally called *tenda-party system* (this consists of a long wooden pole system to lift water from wells).[30] Being mostly dependent on the seepage from the tanks and irrigation channels in their ayacut, the supply of well water is closely related to the volume of water flowing from tanks. Moreover, the wells do not significantly reduce the inter-year variability in surplice supplies. Also in a year when supplies to tanks are good, those with wells may be able to raise an extra rabi crops like pulses, cereals and vegetables. The soils conditions and sub-surface geology varies a great deal and consequently there are wide variations in the distribution of shallow wells between tanks ayacuts. There are some tanks whose ayacuts have no wells at all while there are a few with as many as 0.22 wells per acre of ayacut.

Catchment is the most important part of the tank system. A part of precipitation received in the catchment area percolates into the soil, a part is lost through evaporation, and the excess flows as run-off. The catchmnet area differs from tank to tank. Generally, the command area (capacity of the tank) is positively associated with the catchment area (Table-10). However, area under the catchment is influenced by the ago-climatic conditions, i.e. rainfall and topographic conditions of the region. The free catchment per acre of ayacut under study areas works out to 8 to 17 times of area irrigated by the respective tanks. The feeder channels in almost all the tanks (except few) are either damaged or encroached. The average depth of tanks from different categories was more or less uniform, varies from 5.01 feet to 7.50 feet. It continuously reduces due to siltation. The average level of silt in the tank bed is 3.10 feet. It varies from 2.5 feet to 4.00 feet.

Table-10: Frequency Distribution of Tanks in our Study Area

Water spread area (acre)	No. of tanks	AV Catchment area (acre)	AV area irrigated (acre)	AV Depth of tank (feet)	AV level of silt (feet)	Shallow well per acre
0.01-1.00	77 (26.55)	19.17	1.09	5.01	3.97	0.01
1.01-5.00	163 (56.21)	72.78	6.13	7.31	2.84	0.05
5.01-10.00	23 (7.93)	340.00	19.47	7.35	2.53	0.14
10.01-20.00	20 (6.90)	601.10	38.74	7.35	2.70	0.15
20.01-50.00	6 (2.07)	1560.00	66.96	7.50	2.55	0.21
Above 50.01	1 (0.34)	2500.00	318.00	6.00	3.00	0.22
Total	290 (100.00)	155.31	10.43	6.70	3.10	0.06

Source: Meso-level Survey 2001-03
Note: AV- Average; Parenthesis indicates percentage of the value.

In our tanks surveyed, majority of them (of course 90 per cent) are rainfed tanks; but only 8 (2.8 per cent) tanks are fed directly from medium and minor irrigation sources; and other 20 (7 per cent) tanks get their supply from canals as well as depend on rainfall (Table-11). It is quite interesting that all rainfed tanks received in the past considerable supplies from stream and spring channels – originating mainly from hilly areas and fed to tanks. But except few cases the others have dried up; some of them since 2 decades or even earlier. Almost all tanks have free catchments, their importance being generally greater in the ayacut to feed tanks.

Table-11: Sources of Supply to tanks

Water spread area (acres)	Source of water supply			Total
	Canal+Rainfed	Rainfed	Canal	
0.01-1.00	2 (0.7)	73 (25.2)	2 (0.7)	77 (26.6)
1.01-5.00	10 (3.4)	148 (51.0)	5 (1.7)	163 (56.2)
5.01-10.00	4 (1.4)	19 (6.6)	0 (0.0)	23 (7.9)
10.01-20.00	4 (1.4)	15 (5.2)	1 (0.3)	20 (6.9)
20.01-50.00	0 (0.0)	6 (2.1)	0 (0.0)	6 (2.1)
Above 50.01	0 (0.0)	1 (0.3)	0 (0.0)	1 (0.3)
Total	20 (6.9)	262 (90.3)	8 (2.8)	290 (100.0)

Source: Meso-level Survey 2001-03
Note: AV- Average; Parenthesis indicates percentage of the value.

The Inlet Channels

The inlet channels (called *nallas* in Bolangir district) vary in a few hundred meters to several kilometers. The inlet channel feeding the Narayan Sagar, for instance, is 9 km

long. In almost cases, inlet channels are affected by silting, encroachment (due to demographic pressure) and heavy weed growth or by some combination of the three. Everywhere this has resulted in narrowing of channels and reduction in their depth, leading to a significant reduction in the volume of water they can carry in a given amount of time. In some cases, the channels hardly bring any water. Drying up at the source, as in the case of several spring channels, is also a contributory factor. Several instances of farmers doing occasional deweeding/silt removal of inlet channels have been reported. And in 3 or five case (like Narayan Sagar in Loisingha, Bada Kata in Kutasingha and Upara kata in Rot) this effort is more or less regular.

The Tanks and Associated Structures

Some of the tank bunds or dam structures are either damaged or weak. We find from the field that as many as 13 tanks out of the 290 tanks studied have damaged/weak dams and 42 have modest dams which need to be strengthened. Almost all tanks have accumulated silt in the bed. The accumulation of silt is either near the tank bund/dam or the mouth of feeder channels. Out of 290 study tanks, 249 tanks (86 per cent) are partially silted and 28 (10 per cent) are full of silt (Table-12). So time will come when the presence of dam (tank bund) only reminds us that there would have been a tank in the past. All except 49 tanks serve a single village. Out of 49, 27 tanks mentioned above whose water spread area is more than 20.00 acres are served more than 2 villages: the ayacut of *Narayan Sagar* is in 4 villages. Most of the tanks do not receive sufficient run-off from the catchment due to human made obstructions in the catchment like diversion of flow, siltation of feeder channels, etc. However, most of the tanks retain water till February/March only. On an average large tanks seem retain some water for a longer duration for drinking purposes.

Table-12: Hydraulic information

Water spread area (acre)	AV no. of sluices	Villages served	AV duration for retention of water (months)	Water spread area in per acre of area irrigated	AV no. of farmers in the tank	Present Condition of tanks				
						1	2	3	4	Total
0.01-1.00	0.99	0.75	2.2	0.35	1.34	40 (13.8)	5 (1.7)	5 (1.7)	27 (9.3)	77 (26.6)

1.01-5.00	1.31	1.02	3.47	0.43	5.73	159 (54.8)	1 (0.3)	2 (0.7)	1 (0.3)	163 (56.2)
5.01-10.00	1.91	1.26	3.91	0.37	15.7	23 (7.9)	0 (0.0)	0 (0.0)	0 (0.0)	23 (7.9)
10.01-20.00	2.3	2.1	4.35	0.38	29.05	20 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	20 (6.9)
20.01-50.00	2.83	2.83	4.83	0.44	51.33	6 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	6 (2.1)
Above 50.01	3	4	4	0.42	0.42	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
Total	1.38	1.09	3.26	0.4	8.77	249 (85.9)	6 (2.1)	7 (2.4)	28 (9.7)	290 (100)

Source: Meso-level Survey 2001-03
Note: AV – Average; 1- Partly silted, 2 – Tank bund damaged, 3 - Weak, 4 - Silted
Parenthesis indicates percentage of the value.

Sluices and Regulatory Structures

Most of the tanks have traditional sluices (made more than 20/30 years). The waste weirs or surplus weirs at many places are damaged. The accumulated silt in the tank bed has reached the surplus level and farmers have suggested raising the height of the surplus weir to augment the storage capacity of the tank. In our tanks surveyed, the supply channels of 145 tanks are not in bad condition whereas others are in a miserable state (Table-13). They are silted up, encroached, damaged and some are converted to irrigate lands. With the results supply channel are narrowed down. Therefore the volume of water that could flow in the channel is considerably reduced. In fact in several of the cases these channels hardly bring any water from the tanks. However, we found that in some of tanks where the TIIs are effective, there has been some collective effort to repair supply channel for getting water efficiently and equitably.

Table-13: Conditions of Supply Channel

Water spread area (acre)	Not bad	Encroached	Damaged	Irrigated lands	Silted	Total
0.01-1.00	9 (3.1)	4 (1.4)	20 (6.9)	23 (7.9)	21 (7.2)	77 (26.6)
1.01-5.00	89 (30.7)	14 (4.8)	17 (5.9)	35 (12.1)	8 (2.8)	163 (56.2)
5.01-10.00	21(7.2)	1(0.3)	1(0.3)	0 (0.0)	0 (0.0)	23 (7.9)
10.01-20.00	20 (6.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	20 (6.9)
20.01-50.00	5 (1.7)	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	6 (2.1)
Above 50.01	1 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)
Total	145 (50.0)	20 (6.9)	38 (13.1)	58 (20.0)	29 (10.0)	290 (100.0)

Source: Meso-level Survey 2001-03
Note: Parenthesis indicates percentage of the value.

Measurement of Effectiveness

We develop some indicators/norms to measure how best the TIIs function. A number of factors which influence functioning of TIIs have been identified in the study areas. These are water supply condition, prevalence of TII, physical structure of tank and net area irrigated.[31] These four variables are part of a larger set of indicators of the quality of tank performance collected during field inspection at each of the sampled tanks. The magnitude of the variables influencing tank effectiveness varies from tank to tank. For example, in one tank, water supply condition may be good while prevalence of TII may not exist. Therefore, for each indicator, each tank was given a score of "1" (good), "0.5" (not bad) or "0" (bad).[32] The scores for the surveyed tanks are summarized in Table-14. At last, we categorize the tank on the basis of water spread area with calculating their cumulative score.

Table-14: Tank performance variables with relative scores

Variables	Range of variables	Scores
Water supply condition	If the tank gets water supply to FTL every year at least once	1.0
	Moderate	0.5
	No	0.0
Prevalence of TII	If the organization exists/functions	1.0
	Exists/does not function	0.5
	Not exits	0.0
Physical structure of tank	Good	1.0
	Not bad	0.5
	Bad	0.0
Net area irrigated	> 75 per cent area irrigated (good)	1.0
	50-75 per cent area irrigated (not bad)	0.5
	< 50 per cent area irrigated (bad)	0.0

Note: FTL – Full tank level

Functioning of TIIs in the tanks can be seen from Table-15. The table shows that the TIIs function at varying degrees in the selected tanks; in some it is effective; in some it is less effective; in some it is exists but not functioning and in some others it is defunct.[33] Out of 290 tanks, 60 are effective, 94 are less effective, they are exists but not functioning in 109 and defunct in 27. Quite surprisingly, all 27 defunct tanks are under the water

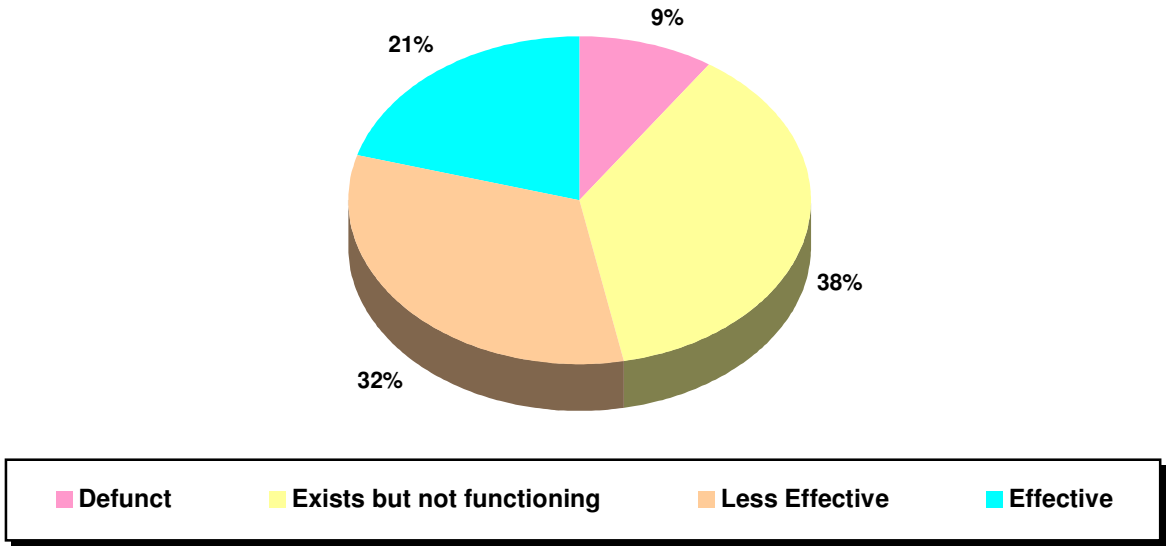
spread area of 0.01 to 1.00 acre. That means out of 77 very small tanks 27 are vanished (9.3 per cent in our study areas) or became irrigated lands (Figure-3). It concludes that in almost all the tanks, we surveyed it was reported that the TIIs were operation before four to five decades and also reported to be effective.

Table-15: Measurement of Effectiveness

Tank Score	No. of Tanks	Results
0.00-0.00	27 (9.31)	Defunct
0.00-1.99	109 (37.59)	Exists but not functioning
2.00-2.99	94 (32.41)	Less Effective
Above 3.00	60 (20.69)	Effective
Total	290 (100.00)	

Source: Meso-level Survey 2001-03
Note: Parenthesis indicates percentage of the value.

Figure – 3: Measurement of Effectiveness



The physical conditions of most of the tank systems are in a degraded condition at various levels. Catchments are getting eroded contributing to the silting of the storages reducing the capacity. Feeder channels are either blocked or diverted diminishing the inflows. Tank bunds are getting out of shape and in bad conditions with reduced sections

exposing to dangers of overtopping or failure due to continued leakage or piping conditions at the toe of embankment. Surplus weirs in some are damaged needing repairs. Sluice gates and structures are damaged with leakages of water flow and the conveyance system for irrigation is out of shape with leakages and seepage losses.

To sum up, there has been a shift in the irrigation system from traditional irrigation in the pre-plan period to modern irrigation in the plan periods. In the pre-plan period there was dominance of tank and stream sources, but in the plan periods there has been a shift towards the dominance of canal and well irrigation. This became possible, as importance has been accorded to irrigation development through increasing outlay in different plan periods.

V Impact of Drought on Livelihood Systems

General Features of Study Villages

The general profile of population of these sample villages can be seen from table-16. The status of women can be measured in many ways. Presently, the focus is on sex ratio, work participation and literacy rate. The analysis shows that the sex ratio (number of females to 1000 males) was favourable to males with the exception of Bangabahal. In all four other study villages the sex ratio was lower than that of district level estimates, i.e. 983 per thousand during 2001. The level of literacy among males ranged from 46.09 per cent to 54.1 per cent and from 27.8 per cent to 31.9 per cent among females. The present literacy rate among the sample villages was less than the district level i.e. 55 per cent during the Census 2001. The average family size ranges from 5.3 in Salevata to 6.03 in Telenpali. It was almost comparable with the 2001 census figures (not reported in table). The availability of workforce and its deployment determines the level of production, consumption, investment and saving pattern of the households. In the development process of the agriculture sector, the availability of labour force becomes crucial for the households. The proportionate availability of work participation rate varies between about 56.47 to 68.23 per cent across the selected villages. It is noticed that there does not exist much difference between males and females. However, in one village (Salevata) female work participation rate is found high. The landless household is highest in Bangabahal (40.54 per cent) village and lowest in Loisingha (23.61 per cent).

Table-16: General Features of Study Villages

Village	Population	HHs	AV family size	Sex Ratio	Literacy			Work Participation rate			% of Landless HHs
					M	F	T	M	F	T	
Bangabahal	880	148	5.95	1000	48.30	31.42	39.86	63.02	58.68	60.85	40.54
Jharnipali	459	77	5.96	940	47.40	28.80	38.10	65.78	65.52	65.65	25.97
Telenpali	362	60	6.03	982	46.09	27.80	36.95	61.76	56.33	59.05	28.33
Loisingha	2524	470	5.37	965	52.08	29.30	40.69	68.23	68.23	68.23	23.61
Salevata	1608	303	5.31	918	54.10	31.90	43.00	55.42	57.51	56.47	28.05
Total	5833	1058	5.72	961	49.59	29.84	39.72	62.84	61.25	62.05	29.30

Source: Field Survey

Note: AV=Average, HHs=Households, M=Male, F=Female, T=Total

Ownership and Distribution of land Holding

Land is the major resource, which determines the economic status of households in the rural economy. It is essential to understand the pattern of ownership and distribution of land among different categories of farmers while discussing the benefits from tank irrigation in a drought prone area (Table-17). The small and marginal farmers together formed 85 per cent of the farmers but own 46.14 per cent of the total area. The medium farmers constituted 11.90 per cent of the farm households owning 21 per cent of area. By contrast the large farmers constituted 3.14 per cent of farm households but owned 32.85 per cent of total area. Clearly the medium and large farmers have cornered about 54 per cent of area even though they formed about 15 per cent of the total households. Thus the inequality in the landholding is very high in the study villages. It is noteworthy that the large farmers as a group have owned one third of total area land and land owned per household was very high. It was nearly 3.5 times higher than that of medium farmers. These two groups dominate in the land market in terms of provision of employment to the other groups as well as in the generation of surplus.

Table-17: Ownership and Distribution of land Holdings in the Study Area

Size group (Area owned in acre)	No. of HHs in the group	AV amount of land owned per HHs (in Acre)	AV area operated per HHs (in acre)	Percentage of area owned by the group to total are owned	Percentage of area operated by the group to total area	Percentage of tenants in the group to total tenants	% of landed HHs to total landed HHs

					operated		
0.00-0.00	293	-	1.33	-	2.02	29.17	-
0.01-0.50	354	0.42	0.86	1.79	1.75	8.21	46.27
0.51-2.50	167	1.63	1.74	20.23	19.48	37.11	21.83
2.51-5.00	129	3.76	4.55	24.12	24.80	18.71	16.86
5.01-10.00	91	7.58	8.71	21.01	21.00	6.80	11.90
> 10.01	24	27.09	27.24	32.85	30.95	-	3.14
Overall	1058	2.79	3.94	100.00	100.00	100.00	100.00

Source: Field Survey
Note: AV=Average, HHs = Households

Given the inequality in the land ownership it is expected that many land-poor households should try to lease in land to expand their size of plot. In such a case the distribution of operated area would be different from that of owned area. The distribution of operated area among different group of households including that of landlessness tenants is given in Table-17, Column 6. It is seen that there is slight variation in the distribution of operated area in comparison with that of owned area. Landlessness households cultivate about 2 per cent of operated area.

Cropping Pattern and Cropping Intensity

Winter paddy is the most dominating crop, covering about 61 per cent of the total cropped area. However, this percentage is much higher in the case of landless tenant and marginal farmers. It varied between 68 to 80 per cent of the total cropped area. Besides paddy, cereals such as *gurji, kudo, bajra*, pulses and oil seeds are the other crops favoured by the farmers. The share of these crops constitutes 16.59, 7.78 and 8.02 per cent respectively (Table-18). Their share together formed 32 per cent of the gross cropped area. There is some variation in the percentage of area under these crops among different size groups. Vegetables and sugarcane are minor crops in the area. Vegetables are grown in all size groups of holdings including that of landless tenants, but its share is 4.10 per cent of total grossed cropped area. This percentage is very less among the marginal and small farmers. The cropping intensity of the overall farm households is 113. It varies from 106 among the landless tenants to 118 among the medium farmers. Thus the cropping intensity in the case of medium and large farm groups is slightly higher as compared to that of other farm size groups and it is lowest among the landless tenant households. It appears that the medium and large farmers in the study area have more irrigation facility as compared to other group of farmers. The sources of irrigation in large farmers land are mostly the traditional system of irrigation such as ponds, *munda*, *bandha* and *katta* etc.

Table-18: Cropping Pattern and Cropping Intensity of Farmers by different Size group of Holdings

Size group (in acres)	AV GCA operated per HHs (in acres)	IN PERCENTAGE						CI
		Paddy	Inferior cereals	Pulses	Vegetables	Oil seeds	Others	
Pure Tenants	1.38	73.49	9.64	7.23	4.82	4.82	0.00	106
0.01-0.50	0.45	80.00	1.20	10.13	3.55	2.53	2.59	113
0.51-2.50	1.65	67.79	14.07	5.86	1.95	8.92	1.41	111
2.51-5.00	3.95	62.38	22.46	5.25	3.34	5.57	1.00	109
5.01-10.00	8.07	51.95	24.78	4.35	6.31	12.61	0.00	118
> 10.01	26.00	59.22	18.92	9.99	6.16	5.71	0.00	115
Overall	3.63	60.87	16.59	7.48	4.10	8.02	2.94	113

Source: Field Survey

Note: AV- Average, GCA-Gross Cropped Area, HHs – Households and CI-Cropping Intensity

Crop Output Produced

The gross value of output of different crop is given in table-19. It can be seen that the gross value of output per acre of different crop as well as the total value of output of all crop is low among different size group of farms possibly due to lack of application of modern technology including use of HYV seeds and chemical fertilizer. In case of landless tenant the average value of paddy output was much higher than the average value of paddy output produced by other group of households. This is possible due to the fact that the tenants have leased in better quality of land with same irrigation facility. Besides these households have no choice but to work hard in order to generate surplus for the payment of rent.

The average value of all output per household is about Rs. 5286/- in the study area. The average value of crop output in the case of landless tenant, near landless and marginal farmers is less than half of the average output in the study villages. By contrast value of output per household of large farmers is 9 time higher than overall average value of output in the study villages. In the case of medium farmers it was 1.65 time higher than the average value. It is clear that only the large farmers generate substantial amount of surplus in the study villages. It is interesting to know as to how the households utilize their surplus in different activities. It is discussed below.

Table-19: Gross value of output produced per acre and average value per household among different size group of household

Size class (in acres)	No. of HHs	Paddy output	Inferior crop	Pulses	Vegetables	Oil seeds	Others	Total value

	cultivating	per acre (bags)	(kgs)					of output per HHs (Rs.)
Pure Tenants	49	12.59	113	63	480	110	120	3800
0.01-0.50	354	8.77	310	75	136	100	120	1057
0.51-2.50	167	6.97	109	132	84	63	88	2385
2.51-5.00	129	5.94	58	41	62	65	-	4559
5.01-10.00	91	6.29	45	62	54	63	-	8715
> 10.01	24	9.11	61	67	59	61	-	48098
Overall	814	7.43	63	70	71	58	93	5286

Source: Field Survey, HHs – Households

We have collected information relating to the current expenditure incurred by the household during the survey year. The expenditure has been classified into food items, and other non-food items such as clothes and kerosene oil, medical and education and other family expenditure (Table-20). It is clear that in the case of landless labour households about 89 per cent of the total expenditure is spent on food items. It varied from 80 to 84 per cent in case of marginal and small farm households. By contrast, it constituted about 59 per cent in the case of large farm households. There is rise in per household expenditure with the increase in the status of household. It is noteworthy that the total expenditure incurred per household by landless and near landless and marginal farmers is very low, implying that they are much below the income poverty line. It is only the large farm groups which are comfortable in their expenditure pattern. The expenditure incurred on other items by majority of poor households is very low both in absolute as well as in relative term, implying the backward nature of the households. However, there is inequality in the expenditure pattern incurred by different size groups. The main significance of the findings is that there is positive relationship between size groups and the level of expenditure pattern. With the given facts, it may be considered that existing irrigation facilities do not contribute to farm income as should be expected.

Table-20: Composition of Current Expenditure Pattern

Size group (acre)	No. of HHs	Total Exp. Per HHs	% of total exp spent on food items	Clothes & K.Oil	Med & Edu	Other family exp	Total (5 to 7)	Column Total (4 + 8)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

0.00-0.00	293	790	89.31	4.04	3.38	3.27	10.69	100.00
0.01-0.50	354	912	80.20	4.68	2.03	13.09	19.80	100.00
0.51-2.50	167	1007	83.65	5.69	4.07	6.59	16.35	100.00
2.51-5.00	129	1224	79.71	6.31	1.47	12.51	20.29	100.00
5.01-10.00	91	1692	68.48	5.97	4.96	20.59	31.52	100.00
> 10.01	24	2520	58.64	5.06	3.93	32.37	41.36	100.00
Overall	1058	1056	80.58	5.34	3.31	10.77	19.42	100.00

Source: Field Survey, HHs-Households

Quality of House, Drinking water and Lighting facilities in the study Villages

As mentioned earlier, the study area is one of the poorest regions of the state. As such we may find the standard of living of majority of people may be low. Proper housing facility is a reflection of accumulation of funds, which has been utilized in the construction, and maintenance of houses by the individuals. The scenario in the study villages is utterly bad. For instance about 51 per cent of households live in thatched roof house, another 32 per cent live in kuchha house (Table-21). Thus, 83 per cent of household have poor housing conditions. By contrast, 17 per cent of households, in the villages, live in semi pucca/pucca houses. Majority of the households belonging to medium and large farmers lives in semi pucca/pucca houses. Further, the houses of these categories have more rooms with much space inside. By contrast the poor people live not only in thatched and kaccha houses but these houses contain very small unventilated rooms.

It is noteworthy that all the five study villages have provision of electricity. But most of poor people have no access to it. On the whole 14 per cent of households have access to electricity. The landless households don't use at all and have to depend on kerosene. Proportion of households with the access to electricity increases with the rise in the status of households (Table-21).

Table-21: Some features of Housing, Drinking water facilities and Lighting arrangements according to different size group of households

Size group (acre)	No. of HHs	QUALITY OF HOUSING				DRINKING WATER FACILITIES			% of HHs with provision of Electricity
		% of HHs with thatched housing	& of HHs with kuchha housing	% of HHs with semi-puchha housing	% of HHs with pucca housing	% of HHs using tube well	% of HHs using owned well	% of HHs using other well	
0.00-0.00	293	52.80	39.88	7.32	-	67.97	-	32.03	-
0.01-0.50	354	58.62	35.63	5.75	-	82.75	1.14	16.11	6.89
0.51-2.50	167	56.20	29.45	12.42	1.93	70.54	4.65	24.81	12.01
2.51-5.00	129	47.72	30.32	16.66	5.30	71.21	13.63	15.16	20.45
5.01-10.00	91	35.08	21.05	24.56	19.31	66.66	28.07	5.27	42.10
> 10.01	24	4.00	16.00	40.00	40.00	56.00	36.00	8.00	56.00
Overall	1058	50.74	31.75	13.02	4.49	70.69	7.61	21.70	13.80

Source: Field Survey
Note: HHs-Households

In all the study villages there are tube wells, open well meant for drinking water. Besides, the village *pond, katta, bandha and munda* are also being utilized for bathing of people and animals. About 71 per cent of households have said that they use tube well water for drinking purposes (Table-21). The rest of the households use open well present in the villages. It is important to note that about 7.6 per cent of the households have their own wells which are utilized for their personnel purpose. Even here the percentage of households having owned well rises with increase in the status of households.

Normal Water Requirements

During the course of survey in the five sample villages it was tried to assess the normal water requirement of the people for their personal use, i.e. drinking, cooking, bathing, washing utensils and clothes and for their domestic animals. The respondents were asked to give their normal requirement both for the winter and summer season. The average per capital daily requirement for personal use comes to 15 litres during winter and 20.2 litres during summer, while the requirement for domestic cattle is respectively 75.5 litres and 105.5 litres per household (Table-22). The survey affirms that individual requirement of water is quite low, as compared to developed societies. Especially during drought years when a sizable proportion of population has migrated, providing water to domestic cattle becomes a real problem in summer season.

Table-22: Water Requirements (in litres per day)

Size group (acre)	No. of HHs	Drinking and other domestic use (per HHs)	Cattle (per HHs)

		Winter Season	Summer Season	Winter Season	Summer Season
0.00-0.00	293	89.5	108.3	NA	NA
0.01-0.50	354	93.1	123.5	NA	NA
0.51-2.50	167	100.8	134.7	NA	NA
2.51-5.00	129	115.1	147.3	NA	NA
5.01-10.00	91	120.2	185.4	NA	NA
> 10.01	24	150.7	191.6	NA	NA
Overall	1058	100.8	130.4	75.5	105.5

Source: sample survey, NA-Not Available, HH-Household

Note: The average size of family is 6. The calculation of water requirement for domestic cattle is based on villages as whole.

Labour Market in the Study Area during Drought Condition

We have seen in the previous section that the average amount of income received from the crop is low for majority of households. In order to maintain a minimum subsistence of survival income these households have to rely on labour market. While the landless labour households are more vulnerable to poverty and unemployment, marginal and small farm households are also not escaped of the same in the study region. Moreover in the absence of adequate resource endowment, such as land and other assets, and access to assured services, these households have to search employment even at low wage rate (Sarap, 1991). In the absence of availability of work in and around the area they may have to seek job outside the village. In view of this it is important to understand the labour use strategy of the farm households in the study villages. First, we discuss the empirical situation about the socio-economic characteristics of rural households based on survey data from the study area.

Socio-economic characteristics of labour households

The average number of workers per family was 2.77 with some variation across different size groups. The landless, marginal and small farmer households have higher numbers of workers in comparison with other groups (see column 5 of Table-23). In these groups, even children below 14 years and old person both male and female also work. In view of this average actual number of workers per household in these group is relatively higher in comparison with medium and large farmers groups. We find both male and female workers in each group of households. However the average number of worker both male and female decreases with increase in the status of the households. It is found that among the low caste households both male and female members work as labourers. The average workers dependent ratio (calculated by taking in to account normative workers to dependent members)

was 54 per cent. It was relatively higher among the poor households but as mentioned earlier the children and old persons also work in these households.

Table-23: Some characteristics of labour households in the study villages

Size group (acre)	No. of HHs in the group	Percentage of HH to total HH	AV size of family per HH	AV number of workers per HH	Worker dependent ratio	AV number of male workers per HH	AV number of female workers per HH	Actual* workers per HH
0.00-0.00	293	27.69	6.50	2.66	59.09	1.40	1.26	3.03
0.01-0.50	354	33.46	6.12	2.98	51.29	1.67	1.31	3.40
0.51-2.50	167	15.78	5.98	2.99	50.05	1.58	1.41	3.32
2.51-5.00	129	12.19	5.56	2.66	52.16	1.46	1.19	2.94
5.01-10.00	91	8.60	5.50	2.56	53.40	1.38	1.18	2.65
> 10.01	24	2.27	5.02	2.23	55.00	1.19	1.03	1.34
Overall	1058	100.00	5.72	2.77	53.75	1.45	1.28	3.04

Source: Field Survey, AV-Average, HH-Household

* Actual workers include children and old peoples worked during the year including the population between 15 to 60 years.

Table-24: Nature of Employment available to Households in the study villages

Name of the Village	Own Village	Nearby Village	Nearby Town	Migration to outside (1) and nature of work (A) done	
				Individual	Group
Bangabahal	Crop activity, Non-crop activity	Crop activity	Non-crop activity	(1) *Raipur* (A) Unskilled worker	(1) *Karim Nagar* (A) Brick making
Jharnipali	Crop activity, Non-crop activity	Crop activity, Non-crop activity	Crop activity	(1) *Raipur* (A) Unskilled worker	(1)*Karim Nagar, Hyderabad*, (A) Brick making
Telenpali	Crop activity, Non-crop activity	Crop activity, Non-crop activity	Non-crop activity	(1) *Raipur* (A) Unskilled worker	(1)*Karim Nagar, Hyderabad*, (A) Brick making
Loisingha	Crop activity, Non-crop activity	Crop activity, Non-crop activity	Crop activity, Non-crop activity	(1) *Raipur* (A) Unskilled worker	(1) *Rourkela* (A) Brick making
Salevata	Crop activity, Non-crop activity	Crop activity, Non-crop activity	Crop activity, Non-crop activity	(1) *Hyderabad* (A) Brick making	(1)*Karim Nagar, Hyderabad*, (A) Brick making

Source: Field Survey

Note: (1) Crop activity includes ploughing, transplanting, inter cropping, weeding, grass cleaning etc.
(2) Non-crop activity includes brick making, broom making, house repairing, soil lifting etc.
(A) Include unskilled labourers like *Kuli, Mali, Rickshaw puller* etc.

Labour use pattern among Households

We have estimated the labour pattern of each group of households. The use of labour by different members of a household in different activities has been taken in to account in self-activities including agriculture and allied activities and days utilized for collection of common property resources (see Table-24 for pattern of employment in the study area). In case of free collection, the amount of time utilized per day for the season or weeks have been aggregated in to full days of work. For instance, a person has been engaged in collection of *mahula* for 21 days, by taking about 3 hours per day, we have taken seven days in to account while calculating the labour use of this person (Table-25). On average the households have utilized about 314 days of different activities including wage employment, self employment and collection of goods from common property resources per year. It was much higher in the case of near landless and marginal groups followed by landless group. By contrast, the medium and large farmer groups utilized relatively less number of days in different activities. But the landless and marginal farmer household have utilized more than three fourth of their days in wage employment goes down with the increase in status of households. By contrast the percentage of labour use in self-employment activities goes up with the rise in the status of the households. Clearly in the absence of own assets majority of the household in the study villages had to depend on wage employment. Besides these activities about 3.4 per cent of labour days have been utilized in free collection by the household.

Table-25: Number of days used by the Households in the study villages

Size Group (acre)	AV size of family	AV no of days utilized in wage employment	AV no. of days utilized in self employment	AV no of days utilized in free collection	Total no. of days utilized per HH
0.00-0.00	6.50	261.08 (87.03)	27.2 (9.07)	11.72 (3.91)	300 (100.00)
0.01-0.50	6.12	331.43 (80.84)	63.12 (15.40)	15.45 (3.77)	310 (100.00)
0.51-2.50	5.98	267 (76.72)	67.41 (19.37)	13.59 (3.91)	348 (100.00)
2.51-5.00	5.56	196.01 (68.53)	78.29 (27.37)	11.7 (4.09)	286 (100.00)
5.01-10.00	5.50	166.7 (59.11)	109.95 (38.99)	5.35 (1.90)	282(100.00)
> 10.01	5.02	23.51 (14.88)	124.96 (79.09)	9.53 (6.03)	158 (100.00)
Overall	5.72	241.48	61.73 (19.66)	10.79 (3.44)	314 (100.00)

	(76.90)

Source: Field Survey, AV-Average, HH-Household
Note: Figures in the brackets denote percentage of labour use in particular activities.

Let us have a look at the nature of wage employment in which the households are engaged. Of the total days of wage employment the availability of job through public work is negligible (Table-26). By contrast, about 28 per cent of employment was in non-farm activities in and around the villages including outside job through migration. The lion share of the employment was in agriculture sector where the wage rate is low (Appendix-C). It is noteworthy that household of each size groups including the medium farmers have participated in state employment program because of the minimum wage rate paid in such job was slightly higher than the market wage rate prevailing in the villages. The labour pattern of different groups of households revealed that a majority of the household in the study villages depends on wage employment even at low wage rates to maintain their livelihood.

Table-26: Labour Utilisation pattern in the study villages

Size group (acre)	AV no. of workers per HH	AV no. of wage employ-ment per male worker	AV no. of wage employ-ment per female worker	AV no. of days of wage employ-ment received per HH	Percentage in total days of employment		
					Crop	Non-crop	Public work
0.00-0.00	2.66	104.86	90.70	261.08	74.29	25.34	0.37
0.01-0.50	2.98	112.54	109.51	331.43	72.25	27.14	0.61
0.51-2.50	2.99	97.85	79.72	267.00	70.54	29.25	0.21
2.51-5.00	2.66	80.76	65.64	196.01	66.35	33.14	0.51
5.01-10.00	2.56	74.22	54.46	166.70	70.56	29.19	0.25
> 10.01	2.23	11.90	9.07	23.51	88.56	11.44	0.00
Overall	2.77	95.51	80.46	241.48	71.48	28.17	0.35

Source: Field Survey, AV-Average, HH-Household

Composition of Income of Different Size of Households

We have estimated income of different groups of households coming from different sources. These include income earned from wage, cultivation and other related activities transfer from the state in the form of old age pension and subsidies, income originating from

business and services. Besides many households have collected from common property resources and either consumed or sold in the market. For common property resources, we have taken the market price of the commodities at which the household have sold this. For agricultural output we have taken the price prevailing during the harvesting period. In case of vegetable and pulses the price at which the households have sold these products have used. The income derived this way from different activities have been aggregated for different size groups and presented in Table-27. There are some members in the household in different groups, except the large farmers, where the persons are working in the service sector. About 5 per cent of the total income has come from this sector. Similarly, transfer income constitutes about 1.41 per cent of total income. In both these sources of income there is some variation in different size groups. In case of service sector the near landless groups has derived 13.45 per cent of income. Marginal farmers followed it. Similarly in the case of business income some marginal and small farmers have been engaged in poultry, trading activities and derived about 2 to 3 per cent of their total income.

Table-27: Average Income per HHs and its composition from different sources

Size group (acre)	AV income per HH (Rs.)	Wage Employment	Self Employment	Free Collection	Transfer	Business	Service
0.00-0.00	11219	81.51	8.18	1.66	4.45	1.57	2.63
0.01-0.50	11393	57.55	20.40	2.05	3.39	3.16	13.45
0.51-2.50	12221	50.39	35.97	1.74	2.32	2.11	7.47
2.51-5.00	13050	33.83	55.68	2.10	3.46	0.09	4.84
5.01-10.00	16431	26.54	63.21	0.58	3.55	1.77	4.35
> 10.01	50058	0.94	97.63	0.33	1.10		
Overall	13008	47.60	41.58	1.48	3.12	1.24	4.98

Source: Field Survey, AV-Average, HH-Household

The major source of income for landless, near landless and marginal farmers is wage income. Even for the small and medium farm households, this source account for one-third to one-fourth of their total income. Clearly, for majority of households, wage income is crucial to maintain their livelihood in the study villages. By contrast, agriculture is the dominating source of income for the large farm households. It is seen that even among the large farmer groups nearly one per cent of income has come from wage employment. This relates to income received by individual members who have either migrated individually outside and/or

worked in state run employment programmes. Income derived from free collection is another important source for the poor households. It formed 1.48 per cent of the total income in the study villages. This percentage was much higher for marginal and small farmer households. It appears that the poor households supplement this source of income to maintain their livelihood during the period of drought when alternative source of availability of income is negligible or nil.

The evidence of composition of income revealed that resource poor households had to diversify their sources of livelihood including seeking wage employment as well as collection of common property resources around their villages. It is important to note that the average annual income earned per household belonging to landless, marginal and small farmers was very low and it was below the poverty level income. In other words, existing livelihood options for landless, marginal and small farmers have not been enough to meet their basic need.

Migration of Rural Labour in Drought prone Area

This section analyses the nature, structure and pattern of migration and its consequence in terms of generation of income and its utilization by the migrant in our study area. Here we discuss the nature of migration, whether of a particular individuals or of entire household. Whether the nature of migration is of permanent, temporary or circular nature? Moreover, who migrates, what pattern and type of migration generated due to drought? What consequences – short and/or long term- follow for the livelihood of the household?[34]

Nature of Migration in the Study Area

We have found migration of households to both nearby as well as distant places from the study area. The nature of migration is mostly of push type in the sense that in the absence of adequate job opportunities even at low wage rate, people try to go elsewhere in search of job for their survival. It is mostly seasonal and circulatory in nature. The prominent destinations of migration are to the towns i.e. *Raipur, Rourkela, Hyderabd/Karim Nagar (AP)* and *Hirakud Command Areas*. In the case of AP it is mostly group migration (Families in group travel there and stay there for 5 to 6 months continuously). The migrant workers belong to landless, small/marginal and even in some cases, the medium farmers. The migrants mostly belong to backward caste like SC and ST such as *Gond, Binjhal, Kondh* and other backward caste (like *gauda*).

It has been estimated that about two lakh of labourers from Loisingha Tahasil migrate to different places of AP, especially Karim Nagar area, during October-November every year and come back during May-June to their villages. These migrants are very big conglomerate of labour migrating to a single destination within a month or so. The owners enlist the help of dalal/sardars for cheap labour. The owners come to the centre of recruitment (Bolangir town) and provide a lump sums amount to the chief contractor under whom a number of *kuli* sardars work. The Kuli sardars distribute a part of the amount in the form of advance to the group of workers.[35] The advance payment made by the contractor is repaid during the work. Thus, at the end of the work the group has repaid the entire loan to the owners and left with some amount of wage income.[36] It is noteworthy that the groups of labour have to work during day as well as night in order to earn the money.

It has been reported by migrants that in the absence of work during drought period (the lean season) in the village, they have no choice but to migrate even for earning subsistence wages. Further, they have to stay under unhygienic conditions near the field where bricks are made. There is no facility of proper drinking water and they sleep on the field. Many of them have been attacked by diseases during their stay. Many of them have returned home as sick persons.

Characteristics of Migrants Households in the Study Villages

On the whole about 25 per cent of households have resorted to migration in the study villages. The tendency to migrate declines with the economic status of the household (Table-28). About 26 per cent of landless labour have resorted to migration from the study villages. It was 31 per cent among the marginal farmers and about 18 per cent in the case of small farmers. Even some individuals from the medium farm size group have also migrated. Of the total workers found among the households where migration has taken place, 72 to 76 per cent of workers among landless and marginal farm category have resorted to migration. It was 33 per cent in the case of medium farmers. The percentage of workers migrating within the large farm group is also high. But it is noteworthy that the nature of migration is different in case of richer households in comparison with proper households. In case of the landless and land poor households it is more of group migration. By contrast in case of medium and large farmer household, it was mostly individuals who have migrated to different places around

Chhatisgarh (*Raipur*) and Hirakud command area. Some of them have worked as tenant and cultivated land there temporary.

The average duration of migration, group as well as individual migration was around six months, with minor variation among different size groups. We have also asked the respondents about the network which helped them for migration (Table-28). In case of about 41 per cent of households, it was the contractors who helped them to migrate. By contrast, 54.3 per cent of households have gone through self-contact and 5 per cent through the roles of friends/relatives. Even in the case of self-contact, many of them have gone earlier to the place of destination and have established contact among the employers. It is noteworthy that there is a linkage among the owner of brick making activity, contractor, money lenders and labourers. Many labour households are enticed by the contractors and they actively recruit the labour for brick making activity.

Table-28: Some Characteristics of Migrant according to different size group of HHs in the Study Area

Size group (acres)	% of HH migrated to total HH	AV size of migrating family	%of workers migrating to total workers in the HH	Who helped to migrate to distance place (in percentage)		
				Contractor	Self	Others
0.00-0.00	26.08	3.81	75.69	33.33	63.33	3.34
0.01-0.50	31.25	4.50	72.31	60.00	40.00	-
0.51-2.50	30.71	4.84	71.61	45.71	47.14	7.15
2.51-5.00	18.11	5.26	57.51	52.17	39.13	8.70
5.01-10.00	16.12	5.00	33.33	70.00	30.00	-
> 10.01	11.54	5.67	62.55	-	100.00	-
Overall	25.24	4.54	75.05	40.86	54.30	4.84

Source: Field Survey, AV-Average, HH-Household

To sum up, the above analysis on labour use pattern revealed that more than three fourth of the rural households in the study area had to depend on wage employment. But the availability of it there is low and these households had to work at low wage rates. In view of this many of them had to go out of the village in search of job. Despite large scale out migration to different destinations, there is not improvement in their living standard. Because they have to work at low wage rates, a substantial proportion of remittances is utilized in

consumption and repayment of loan (Sarap, 1987, 1990). As such the migration, which is mostly push type, worked as an ameliorate measure to supplement the livelihood of the poor households. Besides, many of them had to depend on collection of common property items available nearby areas. The amount of income generated from this source to the households is very low yet they had to spend a lot of time to collect these items. However, this source of income worked as an insurance against hunger during the drought period. The State run employment programmes, such as Employment Assurance Scheme (EAS) and Jawahar Rojgar Yojana (JRY) have hardly created any impact on poor householod's income or wage rates in the study area as the proportion of employment and income generated from this source is negligible.

Structure of Credit Markets in the study Area

Broadly, there are tow types of credit institutions prevalent in the study area. These are the institutional/organized sources and the private/unorganized sources of credit. The institutional sources of credit are cooperative banks, commercial banks, regional rural banks and the land development banks. But the access to formal credit markets by the landless and farm households in the survey area was utterly poor. The private sources of credit include professional moneylenders, traders, both big and small, friends and relatives (table-29). In some villages there are some instances of village fund collected by the villagers and that is utilized for giving loan. But this source is negligible.

Table-29: Type of Interlinked Credit Transactions prevalent during the drought period

Name of the Village	Type of Interlinkage	Principal source of Borrowings	Description of lending	Mode of payment of loan	Place of Interlinkage and distance
Bangabahal	Output, Labour Land	Money Lender, Big Farmer	Food grains, Money, cloth, construction materials, input	In terms of working with the creditor or by selling output to him	*Agalpur*-5 kms *Duduka*-6 kms Inside the village
Jharnipali	Output, Labour	Moneylender, Traders	-do-	-do-	*Agalpur*-8 kms
Telenpali	Output, Labour	Traders, big farmer, Service Holder (inside the village)	Good grains, Grocery Items	-do-	*Salevat*-6 kms *Agalpur*-7 kms
Loisingha	Output, Labour Land	Traders, Shopkeeper,	Food grains, Cloth,	-do-	*Bolangir*-12 kms

		Money lender	Medicines		Inside the village
Salevata	Output, Labour Land	Traders, Shopkeeper, Money lender	Food grains, Cloth, Medicines	-do-	*Duduka*-8 kms Inside the village

Source: Field Survey

Transaction in Informal Market

As has been seen in the above section majority of households have no satisfactory access to institutional loan in the survey area. In such a situation they have to depend on the informal credit market to satisfy their needs both for consumption and production purposes. The structure of informal credit market prevalent in the study area is given in the table-30. It is found from the study areas that the households have borrowed from a variety of informal sources both from inside and outside the villages. Borrowing in terms of cash formed 82 per cent of all households in the study villages in the reference year. By contrast, 18 per cent of households have obtained loan in kind in the same year. The proportion of kind loan borrowed by landless and medium farmers was formed between 27 to 28 per cent of the total loan. The amount of loan borrowed increases systematically with the rise in the status of households indicating the possibility of rationing of credit to the poor households (Plateau, 1985) (except in the case of medium farmers). This trend confirms the general pattern of behaviour in the credit market that a loan is given according to the credit worthiness of the borrower and, as such, the general association between wealth and borrowings seems to hold good in general.

The main categories of lenders are moneylenders, traders and one's landlord. Together they account for as much as 87 per cent of the loan borrowed by the households from this sector. By contrast friends and relatives and other source (village funds) constituted about 13 per cent of total loan. It is noteworthy that in the case of large farm households, friends and relative does the principal source of informal borrowing constitute 93.6 per cent of loan borrowed.

Calculations of rates of interest on private loans present some difficulties. For instance, as we have seen in Table-30, a portion of such loan is made in kind and the kind rate of interest involves valuation of commodities advanced as loans and of refund liabilities. In some cases, such as kind to cash loans, the interest rates attached to the loans are implicit

because, the amount of grain remaining constant, the value of same quantity of grain at the time of loan repayment differs from the time of loan offer. Sometimes, creditors overvalue the commodities advanced as loan and undervalue the repayable commodities. For instance, we have found that some lenders have sold cloth and items such as ration from the rations shops and changed cash for these items while repaying loan by the borrowers. It can be seen that 21.41 per cent of loan are without any rate of interest (Table-31). In the case of marginal and small farmers, the amount of interest free loan varied between 14 to 15 per cent of loan. By contrast, it was 100 per cent in case of large farm households. Interest free loan constituted about 34 per cent of loan in case of landless labour households. But, in this case, it was given as advance in lieu of a migrating to distance place to do particular work. Further small and marginal farm households have borrowing more than 50 per cent of loan by paying interest rate between 10 to 15 per cent per month. Clearly the burden of loan in such cases is very high.

Table-30: Some characteristics of Informal Credit market (cash and kind) in the study Areas

Size group (acres)	%of HHs borrowing cash loan	%of HHs borrowing kind loan	AV amount borrowed per borrowing HH (Rs.)	Of the total loan borrowed percentage coming from				
				Landlords	Money lenders	Traders	Friends and relatives	Other sources
0.00-0.00	72.48	27.52	623	10.85	43.97	27.48	17.46	0.24
0.01-0.50	71.39	28.68	691	12.84	57.16	23.16	6.84	-
0.51-2.50	86.14	13.86	1152	13.34	63.78	15.26	6.85	0.77
2.51-5.00	86.15	13.85	1252	8.13	66.67	17.67	6.27	1.06
5.01-10.00	73.20	26.80	961	8.77	69.43	7.63	14.17	-
> 10.01	86.81	13.19	1586	-	-	6.41	93.59	-
Overall	81.89	18.71	978	10.89	58.63	17.86	12.08	0.66

Source: Field Survey, AV-Average, HH-Household

Table-31: Rate of Interest on Overall Informal Loan

Size group (acres)	Percentage per annum				
	0 %	36 %	60 %	120 %	180 %
0.00-0.00	33.79	-	17.00	26.28	22.93
0.01-0.50	14.54	-	17.96	35.93	31.57
0.51-2.50	15.46	8.68	19.07	34.31	22.48
2.51-5.00	14.58	31.62	-	31.75	22.05
5.01-10.00	18.12	28.71	-	8.97	44.20
> 10.01	100.00	-	-	-	-

Overall	21.41	13.25	11.85	29.89	23.60

Source: Field Survey

VI Drought in Bolangir: An analyis

The drought in Bolangir is a peculiar one. The drought in Bolangir is therefore unconventional, where one encounters abundant rainfall but 'persisting drought conditions'. It is a kind of drought where available water is not harnessed for use but allow the water to run-off. If the people of Bolangir have to ensure a better water supply for themselves, it is necessary to ensure the long-term sustainability of water resources. It is also necessary to look into the reasons for the other forms of drought that actually represent the concrete cases of water scarcity. Despite heavy rainfall which is highly skewed with seasonal and spatial variations, the state agencies never concentrated in harvesting the water. Defunct traditional water bodies such as tanks, springs and ponds; lack of institutional arrangements; lack of finance as reported by the Government; lack of motivation from the user side; high surface runoff; unutilized groundwater resources, less number of wells and lack of finance for farmers to dig well etc are only manifestations of government's lacking motivation and interest. Government's concentration is only on the larger irrigation projects and neglecting traditional water bodies.

It is the culmination of years of mismanagement of this precious resource on the mistaken belief that Bolangir is a water rich district and hence we can afford to overlook the susceptibility to water scarcity conditions. The shortages in these parts are aggravating environmental degradation and human distress as well. Still we remain least concerned watching millions of cubic meters of this precious resource being wasted to the sea year after year. The idea of linking river of Mahanadi with south Indian rivers is to rob the surface run-off, keeping 24 out of 30 districts of state under severe drought conditions. We consider that there is sufficient scope for expanding irrigation and growing kharif & rabi crops in drought prone districts if Mahanadi water will divert to this area, and find ourselves unable to agree with the assessment of the NWDA (National Water Development Agency) report. There is hardly 20 per cent of area irrigated till now on average (Orissa Agricultural Statistics, 2000-2001). The Report of the Committee on Pricing of Irrigation Water (1992) shows that Orissa is lacking behind in irrigation facilities and well below that of surface irrigation in comparison to other states in India. Therefore, the nature and the dimension of linking Peninsular River will only aggravate poverty instead of solving it.

Let us take up the case Peninsular rivers link, in which Mahanadi is proposed to be linked to Godavari, Krishna, Pennar, Cauvery, Vaigai and Gundar. The average potential of Peninsular river is 501.78 bcm[37] (17,720 tmc ft) and the estimated utilizable flow, excluding groundwater is 257.2 bcm (9,081 tmc ft). Therefore, the water, which is unutilized or washed into the sea, works out to 244.58 bcm (8,637 tmc ft). Out of 501.78 bcm, *Mahanad*i river alone has 66.88 bcm (2362 tmc ft) and the estimated utilizable flow, excluding groundwater is 17.00 bcm (600 tmc ft). Therefore, the water, which is unutilized or wasted into the sea per annum is 49.88 bcm (1761 tmc ft).

One of the often-stated aims of the river linking project is control of floods. But, paradoxically, both floods and droughts occur simultaneously in Orissa. While this project aims to control floods in the flood occurring regions and supply water to the drought prone regions of Tamilnadu, Andhra Pradesh and Karnataka, cares the least for drought mitigation in the region from where water is grabbed. Every year, a major part of the State is officially declared as drought affected. The districts in Orissa such as parts of Sambalpur, Baragarh and Sonepur and whole districts of Jharsuguda, Deogarh, Balangir, Kalahandi, Phulbani, Boudh, Kantamal, Dhenkanal and Angul are chronically drought-prone but falling under the Mahanadi river basin.

Now let us do a simple calculation, which may provide a strong case for not diverting water from Mahanadi. The total unirrigated area in the State is 4.4 million hectare in the year 2000 of which a major part falls in the Mahanadi basin itself. Assuming that one tmc ft of water will irrigate 2000 hectares of paddy land (which is the figure arrived at by the Central Water Commission), the so called surplus of 1761 tmc ft in the Mahanadi basin will provide irrigation to 3.52 million hectares, whereas the extent of unirrigated area in the State is 4.4 million hectares which still leaves 0.88 million hectares unirrigated in the State.

What would be the economics of diversion of surplus water from Mahanadi to unirrigated tracts of the State? On an average one hectare of paddy will produce 3.75 tonnes. In value, in current prices, it works out to Rs.20,000 at the rate of Rs.5333 per ton. Therefore, the gross income that could be generated from 3.52 million hectares of paddy land will be of the order of Rs.7040 crores from a single crop. Employment will be of the order of 176 million mandays (at the rate of 50 mandays/hectare). This will have a

tremendous multiplier effect on the entire economy of the State besides contributing to more assured livelihood options. Eventually, this may also contribute to reduction in poverty. On the contrary, if the present plan of linking the Mahanadi with other rivers in peninsular India, it is bound to increase poverty and unemployment.

While this being the ground-level reality and when the Mahanadi water is a life and death problem for a majority of the people in Orissa state, it has become a hot political issue in the States, which look forward to potential benefits. But, do these southern states have other options to mitigate their droughts? Decentralized and localized schemes (such as revamping of thousands of small water bodies like tanks) will work much more effectively than centralized system. This is because water management techniques are more local – reflects local habits, culture, institutional arrangements, needs and agro-climatic conditions. This is precisely where the logic of decentralization and bottom-up approach gains significance and substance.

Conclusion

Is drought a real problem in Bolangir? The shortage of rainfall has always been considered a culprit. Data relating to rainfall in Bolangir district clearly indicate that rainfall is not inadequate or less compared to many developed States in India. Therefore, lack of rainfall cannot be the reason for declaring droughts as it happens in Orissa. Recurring droughts have had a devastating impact on the livelihoods of the poor in Orissa and more so in the Bolanigr district. It accelerates the process of impoverishmentment in the rural areas of Bolangir. Manifestations of drought can be judged from recurring crop failures, food insecurity, distress sale of food grains and cattle, mortgage or sale of land and household articles and at last to move out of the villages in search of livelihoods. In addition, majority of households have no satisfactory access to institutional loan in the study area. In such a situation they have to depend on the informal credit market to satisfy their needs both for consumption and production purposes. The tendency for such an option was clearly visible at the time of the visit to the study villages.

In the context of the present drought situation in Bolangir district, the policy measures need to be oriented towards specific needs and requirements of the region. Orissa State and Bolangir district in particular have relied in the past traditional sources of water such as tanks, ponds, *katas* and *mudas*. Provision must be made for the renovation of these water without further delay. The renovation and rehabilitation of these water bodies will not only help

mitigate persisting drought conditions in the district but also can generate a good deal of employment opportunities. New water sources through tubewell or dugwell can be developed by way supplementing traditional sources. These, I would say, are immediate short-term measures needed for the region. And, as a matter of fact, these actions will not involve much capital investment.

The long-term measures of fighting drought require development of a series of small dams/diversion weirs over numerous rivers in the region, with the basic objective of providing for water for drinking and irrigation. Such a policy is required for ensuring food security and to achieve a greater degree of stability in agricultural development. Government must also check the ongoing massive deforestation in the region. It is not merely disappearance of trees but the resources on which the rural/tribal economy, their culture and social life depend. Consequently, the destruction of their habitat is not merely depriving them of timber but of their very life support system.

It is incorrectly argued that the Orissa State is affected by floods and that the State has surplus water in Mahanadi which could be diverted to the water-starving southern states. When major parts of Orissa are declared as drought prone areas every alternative year (Records from Board of Revenue, Cuttack), why and how come should farmers allow Mahanadi water to flow out to Tamil Nadu through Andhra Pradesh? Therefore, it will be a gross injustice meted out to the people of Orissa if Mahanadi is linked with Peninsular Rivers. There is much scope for expanding irrigation and drinking water facilities within the state by way of diverting water to drought prone regions with less cost. The 'surplus' can be calculated only after meeting the growing needs and competing demands of the state across sectors in particular chronic drought prone regions.

End Notes

1 Loisingha is a block headquarters comprising more number of households. So, we have selected purposely a part of Loisingha block with a view to give a proportionate representation to all households having access to irrigation water.

2 The primary objective of field visits was to understand the nature and extent of drought.

3 The Encyclopaedia of Americana 1972, 'Drought' p.401-3, Vol.9, Americana Corporation.

4 The Encyclopaedia of Britanica (15th Ed.), 'Drought', p.672, Vol.3.

5 The drying up of Cherapunji makes an interesting case. With the destructions of the hydrological capacity of the mixed natural forests in the catchments, the above 12,000 mm of rainfall in Cherapunji instantly runs off accentuating the flood situation in Bangladesh and as soon as the monsoon is over, the springs and the streams start drying up and water scarcity haunts the one time wettest spot on the earth.

6 The damage caused by Orissa,s killer *Super Cyclone in 1999* was most severe where mangrove forests that once protected the coastline had been cut for 'coastal development'.

7 According to tradition, Bolangir was established by Balaram Deo, the brother of Narasimbha Deo, the 12th Raja of Patna. It is said that the town being founded by Balaram Deo was named after him as Balaramgarh, from which the present name Bolangir has been derived. It merged with the province of Orissa and formed a new district on Ist November 1949.

8 Cherrapunji has water scarcity for nine months in a year despite having 11,000 mm of annual rainfall. This would be an eye opener. If you don't harvest the rain, there will never be enough water (Agarwal Anil, 2000).

9 Bandopadhyay. J. (1987): *Political Ecology of Drought, EPW*, Dec 12, p.2159-2169.

10 Ibid.

11 Average Annual Run-off in Rivers of Orissa, Irrigation Department, Shecha Bhawan, Government of Orissa, 2000.

12 *Soils of India*, Indian Council of Agricultural Research (1963), p.217-18.

13 In the settlement of 1919 all the lands in Bolangir had been classified in to 20 different categories.

14 *Bahal Kharipani, Berna Kharipani, Mal Kharipani, Bari Kharipani, Bahal Pani, Berna Pani* and *Mal Pani* are the seven categories of lands which used to get water easily from traditional sources.

15 After independence confusion reigned as regards the ownership of these tanks. Many of the tanks have been registered under 'Jalchar', which basically meant public ownership. All water reservoirs existing from before the settlement of 1937 and which were in use for drinking water purposes were kept under government 'khatian'. The maintenance of tanks suffered. In the next 10 years, many of them silted up and subsequently could irrigate less and less land during the kharif season.

16 Tanks are also rainwater harvesting structures, known differently in different parts of the country- *kata*, *bandh, munda* and *sagar* in Orissa, *kere* in Karnataka, *cheruvu* in Andhra Pradesh, *erie* in Tamil Nadu, *johad* and *bund* in Rajasthan, *ahar* and *pyne* in Bihar.

17 The *Sambalpur District Gazetteer* (1871) says: *Kata*- is an ordinary irrigation tank, which is constructed by throwing a strong earthen embankment, slightly curved at either end, across a drainage line, so as to hold up an irregularly-shaped sheet of water. The undulations of the country usually determine its shape as that of a long isosceles triangle of which the dam is the base. It commands a valley, the bottom of which is the *Bahal* land and the sides of which are the *Mal* terrace. *Munda*- is an embankment of a smaller size across drainage channel. These are very common and can be constructed by individual farmers for their own holdings. *Mundas* are useful only for limited use and for smallholdings. If rain scarcity is not very serious, they could provide enough water in later months to save the crop. *Bandh* - is a four-sided tank excavated below the *Kata*, from which it derives its water by percolation. They are almost invariably used to drinking purposes only, are properly regarded as suitable monuments of piety or charity, and are invariably consecrate or married to a god. Apart from their obvious sanitary advantages, they add to the irrigated area by spreading percolation and by rendering it possible in years of drought to empty the irrigation tank completely. *Sagar* – is just like *Bandh* (bigger than 150 hectares) and generally constructed by Kings and Zamindars. *Sara* – is a natural water logging/depressions.

18 Water an Overview – Issues and Concerns (1999): *National Commission for Integrated Water Resources Development Plan*, National Commission for IWRDP, New Delhi, p.6-7

19 Anabadi (Uncultivable fallow): Rivers, nalas, sands, hills, stone flats, marshes, tanks, ponds and any land containing natural collection of waters, land severely affected by erosion and flurial action of river on sea etc. These lands are generally not meant for private possession but for public who do not have any right over these lands.

20 Completion Report of Survey and Settlement of the Patna Feudatory State, p.58, Board of Revenue, Orissa.

21 L E B Codden Ramsay 1982, *Feudatory States of Orissa,* Calcutta, p.246-247

22 Vadivellu 1932, *Ruling Chiefs, Nobles and Zamindars of India,* Madras, p.389-392.

23 Anon 1937, *Orissa District and State Gazetteers, Bolangir*, Land Revenue of Patna State.

24 Anon 1937, *Orissa District and State Gazetteers, Bolangir*, Land Revenue of Patna State

25 Tanks in Balangir district even today are the most reliable source of water for human beings and cattle in the summer months (Sengupta S, 2000). However, their usefulness is severely restricted by ages and lack of maintenance.

26 Ruins of water reservoirs were noticed by an army officer, Major H E Impey, in 1863 (*Notes on the Gujarat State of Patna, Orissa District Gazetteers, Bolangir,* p.70). Close to Patna city, at distance

varying from 1.6-3.2 km there were about 100 tanks. And in the surrounding jungles beyond these at intervals of 6.4-9.6 km, there were remains of other tanks.

27 Dewar's Settlement Report, 1906, p. 182-90

28 Most of these commons property resources have over time, degraded into open access resources due to weak property relations. Encroachment, privatization and government appropriation of the resources has been the main outcomes of the failure of local authority system to enforce the institutional arrangements under common property resources management regime. The erosion of these institutions leads to drought more severe and acute.

29 The field survey was carried out at different phases during 2001-03 in the selected tank irrigated areas of drought prone regions of Bolangir district to examine the factors contributing to the deterioration of tank irrigation. 290 tanks have been selected covering 43 villages somewhat purposively to cover various reaches across main/branch channels as well as to capture various characteristics of supply, number of villages fed and so on.

30 The average depth of shallow wells is 15 to 30 feet. Now, some farmers are used diesel pumps and sprinkler to lift water from wells.

31 A number of factors which influence tank performance have been identified in the study of ten tanks by Palanisami and Easter (1983b), as well as by other studies (Oppen and Rao, 1987). These include farm size variation, the existence of water users association (WUA), the number of private wells, the depth of water in the tank, the amount of encroachment, rainfall, expenditure on tank maintenance, water storage capacity, and the tank type, size, location and age.

32 For variables water supply conditions and prevalence of TII, the meaning of the score is slightly different.

33 On the basis of relative score, tanks can be grouped into four system (effective, less effective, exists but not functioning and defunct).

34 For more information on Migration and Labour Market see Bharadwaj (1985), Breman (1985).

35 They or their sub agents accompany them to the place of destination. The kuli sardars trusted labourers who have worked with the owners earlier. He receives a fee as commission per lakh of bricks made by the group.

36 A sum of Rs. 8000 to Rs.8500/- is paid during *Nuakhai* and/or *Dushera* festival to a group. The group utilizes the sum during this time for consumption/repayment of loan taken earlier and so on. During the period of their stay at the place of work, for six months, they spent around Rs 7500 to Rs. 8000 to maintain the family/group. During this period a group makes 1.5 to 2.5 lakhs bricks by working during day and night time. The making charge per lakh of bricks during the survey year was about Rs.90 to Rs.100/- per thousand. On average a group generally earns about Rs. 10 to Rs.12 thousand per season. After deduction of expenditure incurred by the group at the place of work as well as the advanced taken, it is left with about two or four thousand rupees. Thus group is left with a paltry sum.

37 1 bcm = 35.31 tmc ft

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APPENDIX

A.I. Rainfall and Natural Calamities in Orissa

Year	Normal rainfall	Actual rainfall	Deviations from normal		Natural Calamities
			in m.m.	in %	
1901	1482.2	1091.67	-390.53	-26.35	Drought
1902	1482.2	1211.21	-270.99	-18.28	
1903	1482.2	1258.29	-223.91	-15.11	
1904	1482.2	1225.56	-256.64	-17.31	
1905	1482.2	1178.16	-304.04	-20.51	Drought
1906	1482.2	1699.07	216.87	14.63	
1907	1482.2	1100.41	-381.79	-25.76	Drought
1908	1482.2	1482.22	0.02	0.00	
1909	1482.2	1680.54	198.34	13.38	Flood
1910	1482.2	1266.24	-215.96	-14.57	
1911	1482.2	1077.31	-404.89	-27.32	Drought
1912	1482.2	1699.47	217.27	14.66	Flood
1913	1482.2	1568.55	86.35	5.83	
1914	1482.2	1200.06	-282.14	-19.04	Drought
1915	1482.2	1491.19	8.99	0.61	
1916	1482.2	1367.93	-114.27	-7.71	
1917	1482.2	2231.56	749.36	50.56	Severe Flood
1918	1482.2	1517.14	34.94	2.36	
1919	1482.2	1436.30	-45.90	-3.10	
1920	1482.2	1805.95	323.75	21.84	
1921	1482.2	1706.60	224.40	15.14	Flood
1922	1482.2	1471.31	-10.89	-0.73	
1923	1482.2	1500.73	18.53	1.25	
1924	1482.2	1691.64	209.44	14.13	
1925	1482.2	1350.43	-131.77	-8.89	
1926	1482.2	1485.69	3.49	0.24	
1927	1482.2	1602.07	119.87	8.09	
1928	1482.2	1785.56	303.36	20.47	Flood
1929	1482.2	1499.22	17.02	1.15	
1930	1482.2	1150.64	-331.56	-22.37	Drought
1931	1482.2	1906.48	424.28	28.63	Flood
1932	1482.2	1600.83	118.63	8.00	
1933	1482.2	1609.73	127.53	8.60	
1934	1482.2	1315.64	-166.56	-11.24	
1935	1482.2	1117.04	-365.16	-24.64	Drought
1936	1482.2	1576.17	93.97	6.34	
1937	1482.2	1380.61	-101.59	-6.85	
1938	1482.2	1730.65	248.45	16.76	Flood
1939	1482.2	1350.51	-131.69	-8.88	
1940	1482.2	1400.00	-82.20	-5.55	
1941	1482.2	1560.41	78.21	5.28	
1942	1482.2	1421.63	-60.57	-4.09	
1943	1482.2	1520.10	37.90	2.56	
1944	1482.2	1305.06	-177.14	-11.95	
1945	1482.2	1480.67	-1.53	-0.10	
1946	1482.2	1780.82	298.62	20.15	Flood
1947	1482.2	1506.13	23.93	1.61	
1948	1482.2	2003.19	520.99	35.15	Flood
1949	1482.2	1349.55	-132.65	-8.95	
1950	1482.2	1278.72	-203.48	-13.73	

1951	1482.2	1346.24	-135.96	-9.17	
1952	1482.2	1479.12	-3.08	-0.21	
1953	1482.2	1337.31	-144.89	-9.78	
1954	1482.2	1121.14	-361.06	-24.36	Drought
1955	1482.2	1598.69	116.49	7.86	
1956	1482.2	1530.07	47.87	3.23	
1957	1482.2	1272.27	-209.93	-14.16	
1958	1482.2	1616.15	133.95	9.04	
1959	1482.2	1344.40	-137.80	-9.30	
1960	1482.2	1408.83	-73.37	-4.95	
1961	1482.2	1262.80	-219.40	-14.80	
1962	1482.2	1169.90	-312.30	-21.07	Drought
1963	1482.2	1467.00	-15.20	-1.03	
1964	1482.2	1414.10	-68.10	-4.59	
1965	1482.2	997.10	-485.10	-32.73	Severe drought
1966	1482.2	1134.90	-347.30	-23.43	Drought
1967	1482.2	1326.70	-155.50	-10.49	Cyclone, Flood
1968	1482.2	1296.10	-186.10	-12.56	Cyclone, Flood
1969	1482.2	1802.10	319.90	21.58	Flood
1970	1482.2	1660.20	178.00	12.01	Flood
1971	1482.2	1791.50	309.30	20.87	Severe Cyclone, Flood
1972	1482.2	1177.10	-305.10	-20.58	Flood, Drought
1973	1482.2	1360.10	-122.10	-8.24	Flood
1974	1482.2	951.20	-531.00	-35.83	Severe Drought, Flood
1975	1482.2	1325.60	-156.60	-10.57	Flood
1976	1482.2	1012.50	-469.70	-31.69	Severe Drought
1977	1482.2	1326.90	-155.30	-10.48	Flood
1978	1482.2	1261.30	-220.90	-14.90	Hailstrom, Whirlwind, Tornado
1979	1482.2	950.70	-531.50	-35.86	Severe Drought
1980	1482.2	1321.70	-160.50	-10.83	Flood, Drought
1981	1482.2	1187.70	-294.50	-19.87	Whirwind, Tornado, Flood, Drought
1982	1482.2	1179.90	-302.30	-20.40	Severe Flood, Drought & Cyclone
1983	1482.2	1374.10	-108.10	-7.29	
1984	1482.2	1302.80	-179.40	-12.10	Drought
1985	1482.2	1606.80	124.60	8.41	Flood
1986	1482.2	1566.10	83.90	5.66	
1987	1482.2	1040.80	-441.40	-29.78	Severe Drought
1988	1482.2	1270.50	-211.70	-14.28	
1989	1482.2	1283.90	-198.30	-13.38	
1990	1482.2	1865.80	383.60	25.88	Flood
1991	1482.2	1465.70	-16.50	-1.11	
1992	1482.2	1344.10	-138.10	-9.32	Flood & Drought
1993	1482.2	1421.60	-60.60	-4.09	
1994	1482.2	1700.20	218.00	14.71	Flood
1995	1482.2	1471.50	-10.70	-0.72	Flood
1996	1482.2	988.90	-493.30	-33.28	Severe Drought
1997	1482.2	1463.30	-18.90	-1.28	Drought
1998	1482.2	1279.80	-202.40	-13.66	Drought
1999	1482.2	1433.80	-48.40	-3.27	SUPER CYCLONE
2000	1482.2	1022.80	-459.40	-30.99	Severe Drought

Source: 1. Board of Revenue, Cuttack, Orissa

2. Directorate of Agriculture & Food Production Orissa, Bhubaneswar

A.II. Rainfall and Natural Calamities in Bolangir District

Year	Normal	Actual	Deviation from NRF		Natural Calamities
			in mm	in %	
1901	1443.5	1051.69	-391.81	-27.14	Drought
1902	1443.5	1182.23	-261.27	-18.10	
1903	1443.5	1220.29	-223.21	-15.46	
1904	1443.5	1392.24	-51.26	-3.55	Drought
1905	1443.5	1089.13	-354.37	-24.55	Drought
1906	1443.5	1618.43	174.93	12.12	
1907	1443.5	1105.92	-337.58	-23.39	Drought
1908	1443.5	1416.41	-27.09	-1.88	
1909	1443.5	1643.58	200.08	13.86	Flood
1910	1443.5	1210.11	-233.39	-16.17	
1911	1443.5	1091.42	-352.08	-24.39	Drought
1912	1443.5	1672.82	229.32	15.89	Flood
1913	1443.5	1533.27	89.77	6.22	
1914	1443.5	1158.64	-284.86	-19.73	Drought
1915	1443.5	1440.46	-3.04	-0.21	
1916	1443.5	1325.16	-118.34	-8.20	
1917	1443.5	2165.25	721.75	50.00	Severe Flood
1918	1443.5	1506.09	62.59	4.34	
1919	1443.5	1405.11	-38.39	-2.66	
1920	1443.5	1780.14	336.64	23.32	
1921	1443.5	1182.55	-260.95	-18.08	Flood
1922	1443.5	1546.63	103.13	7.14	
1923	1443.5	1406.50	-37.00	-2.56	
1924	1443.5	1644.36	200.86	13.91	
1925	1443.5	1121.63	-321.87	-22.30	
1926	1443.5	1361.11	-82.39	-5.71	
1927	1443.5	1581.49	137.99	9.56	
1928	1443.5	1770.16	326.66	22.63	Flood
1929	1443.5	1415.22	-28.28	-1.96	
1930	1443.5	1167.82	-275.68	-19.10	Drought
1931	1443.5	2052.47	608.97	42.19	Flood
1932	1443.5	1478.41	34.91	2.42	
1933	1443.5	1659.12	215.62	14.94	
1934	1443.5	1271.15	-172.35	-11.94	
1935	1443.5	1026.81	-416.69	-28.87	Drought
1936	1443.5	1554.17	110.67	7.67	
1937	1443.5	1464.63	21.13	1.46	
1938	1443.5	1743.48	299.98	20.78	Flood
1939	1443.5	1319.16	-124.34	-8.61	
1940	1443.5	1418.32	-25.18	-1.74	
1941	1443.5	1506.34	62.84	4.35	
1942	1443.5	1435.68	-7.82	-0.54	
1943	1443.5	1585.14	141.64	9.81	
1944	1443.5	1272.20	-171.30	-11.87	
1945	1443.5	1405.62	-37.88	-2.62	
1946	1443.5	1718.51	275.01	19.05	Flood
1947	1443.5	1483.90	40.40	2.80	
1948	1443.5	1927.85	484.35	33.55	Flood
1949	1443.5	1391.42	-52.08	-3.61	
1950	1443.50	1228.12	-215.38	-14.92	

1951	1443.50	1354.25	-89.25	-6.18	
1952	1443.50	1454.25	10.75	0.74	
1953	1443.50	1290.75	-152.75	-10.58	
1954	1443.50	1165.00	-278.50	-19.29	Drought
1955	1443.50	1634.00	190.50	13.20	
1956	1443.50	1496.50	53.00	3.67	
1957	1443.50	1247.25	-196.25	-13.60	Drought
1958	1443.50	1618.75	175.25	12.14	
1959	1443.50	1377.75	-65.75	-4.55	
1960	1443.50	1377.75	-65.75	-4.55	
1961	1443.50	1426.25	-17.25	-1.20	
1962	1443.50	1179.50	-264.00	-18.29	Drought
1963	1443.50	1206.00	-237.50	-16.45	
1964	1443.50	1647.50	204.00	14.13	
1965	1443.50	1008.00	-435.50	-30.17	Severe drought
1966	1443.50	1213.98	-229.52	-15.90	Drought
1967	1443.50	1407.59	-35.91	-2.49	Cyclone, Flood
1968	1443.50	1077.19	-366.31	-25.38	Cyclone, Flood, Drought
1969	1443.50	1272.10	-171.40	-11.87	Flood
1970	1443.50	1696.30	252.80	17.51	Flood
1971	1443.50	1646.80	203.30	14.08	Severe Cyclone, Flood
1972	1443.50	1096.56	-346.94	-24.03	Flood, Drought
1973	1443.50	1149.46	-294.04	-20.37	Flood
1974	1443.50	684.73	-758.77	-52.56	Severe Drought
1975	1443.50	1153.04	-290.46	-20.12	Flood
1976	1443.50	1202.21	-241.29	-16.72	Severe Drought
1977	1443.50	1086.60	-356.90	-24.72	Flood
1978	1443.50	1037.10	-406.40	-28.15	Hailstrom, Whirlwind, Tornado, drought
1979	1443.50	668.90	-774.60	-53.66	Severe Drought
1980	1443.50	1171.50	-272.00	-18.84	Flood, Drought
1981	1443.50	881.80	-561.70	-38.91	Whirwind, Tornado, Flood, Drought
1982	1443.50	1046.40	-397.10	-27.51	Severe Flood, Drought & Cyclone
1983	1443.50	1017.00	-426.50	-29.55	
1984	1443.50	1123.60	-319.90	-22.16	Drought
1985	1443.50	1802.60	359.10	24.88	Flood
1986	1443.50	1519.50	76.00	5.26	
1987	1443.50	870.00	-573.50	-39.73	Severe Drought
1988	1443.50	929.00	-514.50	-35.64	Drought
1989	1443.50	1046.00	-397.50	-27.54	Drought
1990	1443.50	1720.00	276.50	19.15	Flood
1991	1443.50	1114.85	-328.65	-22.77	
1992	1443.50	1407.00	-36.51	-2.53	Flood & Drought
1993	1443.50	1293.40	-150.10	-10.40	
1994	1443.50	1785.20	341.70	23.67	Flood
1995	1443.50	1443.22	-0.28	-0.02	Flood
1996	1443.50	1168.21	-275.29	-19.07	Severe Drought
1997	1443.50	1266.20	-177.30	-12.28	
1998	1443.50	900.48	-543.02	-30.62	Drought
1999	1443.50	960.19	-483.31	-33.48	
2000	1443.50	1001.50	-442.00	-38.93	Severe Drought

Source: 1. Board of Revenue, Cuttack, Orissa
2. Directorate of Agriculture & Food Production Orissa, Bhubaneswar

B. Operational Holding Area Operated by Size, Class of Operational Holding in Orissa, 1995-96

District	Area Under Different Operational Holdings (in ha.)						% of No. of Holdings with total Population	Average size of holdings
	Marginal (< 1.0)	Small (1.0-2.0)	Semi med (2.0-4.0)	Medium (4.0-10.0)	Large (> 10.0)	Total (All Groups)		
Angul	36508	56056	43433	20603	6596	163196	14.33	1.19
Balasore	56224	75135	66019	37597	7502	242477	11.99	1.15
Bargarh	39420	70959	83381	67856	24745	286361	21.27	1.62
Bhadrak	38889	47751	55615	30142	3460	175857	13.20	1.20
Bolangir	**48946**	**71706**	**79343**	**59299**	**18477**	**277771**	**24.79**	**1.43**
Cuttack	36147	54378	42157	15384	3958	152024	6.49	1.15
Dhenkanal	26487	54139	38910	15772	4580	139888	13.12	1.29
Ganjam	102372	88453	77464	41557	15143	324989	10.36	0.98
Gajapati	16659	18639	11612	6873	1721	55504	10.72	0.98
Jagatsinghpur	31893	51466	37059	11746	1648	133812	12.67	1.19
Jaipur	28344	50047	49988	25565	4075	158019	9.74	1.41
Kalahandi	39545	69549	87330	73315	24063	293802	22.02	1.74
Kendrapara	31038	51822	49399	23036	4565	159860	12.28	1.31
Keonjhar	55810	76674	59855	31783	6173	230295	14.74	1.18
Khurda	37954	37952	26216	9906	1472	113500	6.06	0.93
Koraput	34907	57967	68927	46338	20426	228565	19.40	1.65
Malkangiri	12662	33275	43258	20928	5014	115137	23.99	1.74
Mayurbhanj	85165	123199	104574	61800	12827	387565	17.44	1.24
Nawapara	16032	35974	40365	28111	8364	128846	24.31	1.77
Nowarangapur	35112	46562	50690	22796	5914	161074	15.82	1.25
Nayagarh	33423	35759	23109	7751	1519	101561	11.75	0.92
Phulbani	22677	33449	32553	14434	3658	106771	16.48	1.27
Puri	43829	44043	32559	14506	3554	138491	9.25	0.96
Rayagada	31136	39081	39435	30688	10385	150725	18.31	1.50
Sambalpur	21549	34493	43330	37385	11394	148151	15.95	1.65
Sonepur	19810	26148	27778	19117	5615	98468	18.20	1.36
Sundargarh	42197	82566	80322	55505	15581	276171	15.09	1.55
Jharsuguda	13359	13838	15922	12315	3598	59032	11.57	1.24
Boudh	16809	22238	22097	13193	4594	78931	21.16	1.40
Orissa	**1054903**	**1503318**	**1432700**	**855301**	**240621**	**5086843**	**13.86**	**1.3**

Source: Orissa Agricultural Statistics 2001-02, Directorate of Agriculture and Food Production, Orissa, Bhubaneswar.

C. Average money wage rate paid in different activities in different categories of labourers in study villages 2002-03

Name of the Village	Agricultural work		Non-agricultural work	Public work
	Peak	Lean		
Bangabahal	M = 30, F = 25	M = 25, F = 20	M = 23, F = 18	M = 35, F = 35
Jharnipali	M = 30, F = 25	M = 25, F = 20	M = 23, F = 18	M = 35, F = 35
Telenpali	M = 30, F = 25	M = 25, F = 20	M = 23, F = 18	M = 35, F = 35
Loisingha	M = 30, F = 25	M = 25, F = 20	M = 23, F = 18	M = 35, F = 35
Salevata	M = 30, F = 25	M = 25, F = 20	M = 23, F = 18	M = 35, F = 35

Source: Field Survey, M – Male, F – Female.

D. Bolangir District in compared to other states of India

States/District	Per Capita Income at cuurent prices (2000-01)	Population Below Poverty Line (1999-00)	Sex Ratio (2001)	Literacy rate (2001)	Female literacy rate (2001)	Infant Mortality Rate (2000)	% of urban population (2001)	Density per sq. kilometer (2001)	Fertilizer consumption (kg\ha) 2000-01	Yield Per Ha/Kg. in 2000-01	Foreign Direct Investment in 2003-04 (Rs. in crores)
Andhra Pradesh	16373	15.77	978	61.11	51.17	65	27.08	275	179.2	1972	526.66
Bihar	5108	42.60	921	47.53	33.57	62	10.47	880	98.6	1535	0.00
Gujarat	19228	14.07	921	69.97	58.60	62	37.35	258	70.8	1270	148.04
Haryana	23742	8.74	861	68.59	56.31	67	29.00	477	151.4	2941	248.29
Karnataka	18041	20.04	964	67.04	57.45	57	33.98	275	115.3	1348	449.41
Kerala	19463	12.72	1058	90.92	87.86	14	25.97	819	58.3	1970	21.22
Madhya Pradesh	10803	37.43	920	64.11	50.28	87	26.97	196	36.9	1077	0.44
Maharashtra	23726	25.02	922	77.27	67.51	48	42.40	314	75.8	889	1527.34
Orissa	**8547**	**47.15**	**972**	**63.10**	**50.51**	**95**	**14.97**	**236**	**36.9**	**1019**	**0.10**
Punjab	25048	6.16	874	69.95	63.55	52	33.95	482	163.4	3935	465.50
Rajasthan	11986	15.28	922	61.03	44.34	79	23.38	165	29.8	941	28.03
Tamil Nadu	19889	21.12	986	73.47	64.55	51	43.86	478	146.8	2213	815.18
Uttar Pradesh	9721	31.15	895	57.36	42.98	83	20.78	689	115.7	2078	102.32
West Bengal	16072	27.02	934	69.22	60.22	51	28.03	904	117.8	2014	303.45
Bolangir	**5451**	**61.01**	**983**	**54.93**	**39.27**	**123**	**11.52**	**203**	**10.2**	**714**	**0.00**
India	**16742**	**26.10**	**933**	**65.38**	**54.16**	**68**	**27.78**	**324**	**87.6**	**1646**	**6223.52**

Source: a. Census of India, 2001, Government of India, New Delhi
b. Complied from various Publication of Government of India
c. www.indiastat.com