RESOURCE BASE AND ECONOMY OF CHOTANAGPUR REGION: A GEOGRAPHICAL STUDY

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MASTER OF PHILOSOPHY

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CERTIFICATE

I Neeraj Singh certify that, the dissertation entitled **"Resource Base and Economy of Chotanagpur Region: A Geographical Study"** submitted by me for the degree of **Master of Philosophy** is my bonafide work and may be placed before the examiners for evaluation.

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Neeraj Singh

Contents

LIST OF TABLES

List of Figures

Chapter I

INTRODUCTION

Several economic plans for the development of various regions and expansion of agriculture, industry and other infrastructure were launched with a view to increase production and employment and to attain others goals such as equality and justice etc.

But there have been weaknesses in the planning and it is apparent that due to rapid exploitation of natural resources, physical environment has been degraded. Rapid economic development is converting India certain regions into a vast wasteland.

"If poverty in pre-independence India was the result of under-utilisation of resources, there is every possibility that poverty, unemployment and inequality would continue to persist due to destruction of environment".[1]

"Human development is the end-economic growth is the means. So the purpose of growth should be enrich people's lives" [2]

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1 Datta, R and Sundharam, K.P.M: (1988) Indian Economy; S.Chand and Company Ltd, New Delhi, pp.75-95.

2 (UNDP, Human Development Report, 1996).

The present study pertains to Chotanagpur Plateau, which geologically marks the north-eastern Projection of the Indian Peninsula. Some portions of this plateau extend into the States of Madhya Pradesh, Orissa and West Bengal, in contiguity with the boundary of Bihar.

Statement of the Problem

The irony is that despite of being rich in natural resources, no systematic progress has been made in the tribal areas Chotanagpur plateau region where primitive methods of subsistence cultivation are still practised. Whereas big achievements have been made in other parts of the country, which do not stand anywhere in comparison, as far as mineral resources are concerned.

Is theory of Economic Drain still operative in Chotanagpur region where the income from the minerals exploited gets diverted to other regions? Little sincere efforts have been made by the governments to diversify the tribal economy and development of human resources. Though a lot of endeavour has been put to develop or exploit the natural resources, which has led to the immigrants flooding from North Bihar, and other neighbouring states into this region. The tribal population of this region has been marginalised by immigrants from North Bihar and other states.

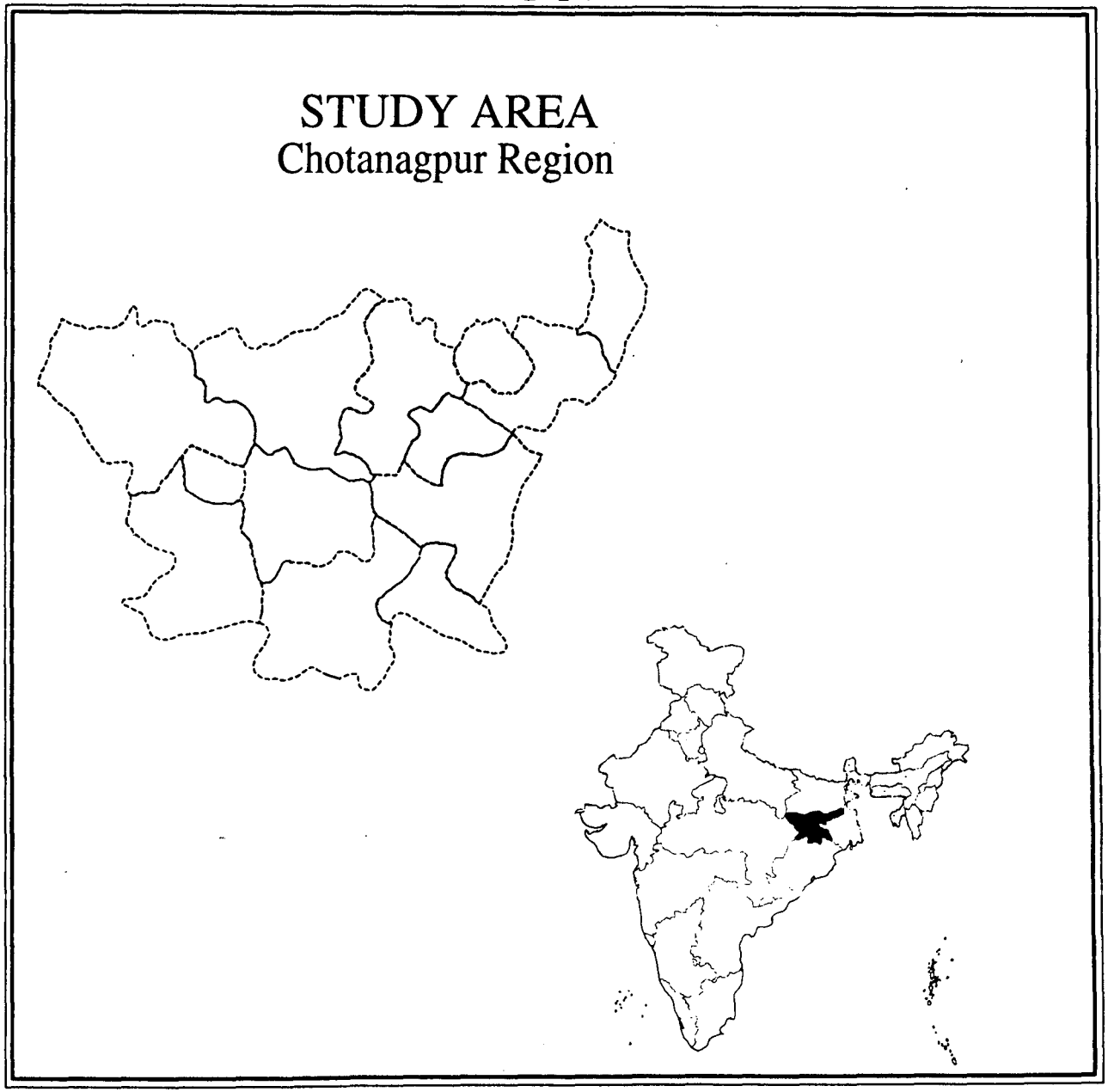
Whatever development projects have been launched has led to displacement of original tribal inhabitants who were never beneficiaries of the major projects in this region. Datt and Sundharam (1998)[3] call it *A Rootless Growth* "which causes people's cultural identity to wither. The major concern of development is to harness natural resources with the aim of maximisation of profit, the displacement of millions of indigenous people was a natural consequence of the growth process. Development in India, as the other countries of the world, is measured by the number of dams, factories, mines, railway lines, and such other projects. While these could be considered as the elements of growth, this process hides the displacement of millions of tribals, especially women, many of whom are rendered homeless and join the ranks of landed labourers and migrant domestic workers as a consequence of environmental destruction and displacement".

Study Area

The Chotanagpur Plateau region lies south of the Gangetic plain of Bihar. The Plateau is hilly and is characterised by shallow and infertile soils and extensive forest cover. The Chotanagpur

[3] Ibid.

FIGURE 1.1



region here is taken where the extreme points 22^0N' to 25^0 30' N latitudes and 83^0 47'E to 87^0 57' E longitudes. "Conventionally, Chotanagpur is limited within the bounds of Bihar as before the reorganisation of States which resulted in the merger of parts of former Manbhun, now Purulia district, in West Bengal on grounds of predominance of Bengali population, although there is no sharp change in the nature of terrain either across the Bihar – M.P. boundary traversing through the Pats (high level laterite plateaus) of across the Orissa-Bihar boundary which cuts indifferently across the drainage line".[4]

The Plateau is hilly and is characterised by shallow and infertile soils and extensive forest cover. Agriculture on the plateau is predominantly rainfed and a large proportion of the population is from tribal groups who have traditionally depended on the forests in a variety of ways. In the recent times, immigration from outside the plateau by settlers and people attracted by mining and related developments has put increasing pressure on the forest and land resources of the area. The tribal way of life has been altering in response to these changes, becoming more individualistic.

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[4] Singh, R. L (ed.) (1991), India: A Regional Geography, New Delhi, U.B.S. Publishers, pp.650-675.

The Chotanagpur region physically-geologically extends into States of Madhya Pradesh, Orissa and West Bengal also other than Bihar. Here, in the present study for convenience and adjustability in data analysis only districts from Bihar has been taken and the portion of plateau extending outside the political boundaries of Bihar has not been considered. And for the same purpose, the 13 districts of Chotanagpur Plateau (1991), namely Sahebganj, Godda, Dumka, Deoghar, Hazaribagh, Giridih, Ranchi, Lohardaga, Gumla, East Singhbhum, West Singhbhum, Dhanbad and Palamau have been clubbed on the basis of district pattern of 1971 census when these 13 districts were 6. The adjustment of the districts has been done as follows:

1) in 1971, Santhal Pargana district was there, which later splitted into four districts, Sahebganj, Godda, Dumka, Deoghar. These districts have been clubbed together on original pattern of Santhal Pargana for the purpose of adjustability of data analysis in this study. Similarly,

2) Hazaribagh and Giridih are clubbed together.

3) Ranchi, Lohardaga and Gumla are clubbed together.

4) East Singhbhum and West Singhbhum are clubbed together.

5) Dhanbad has not splitted politically in the past so taken as it is.

6) Palamau is also taken as it is, as it has not undergone any further political division during the study period.

Hence finally, we have six districts which are, Santhal Pargana, Hazaribagh, Ranchi, Singhbhum, Dhanbad, Palamau, which are on the basis of district administrative boundaries of 1971 census.

Choice of Study Area

1) The study region has a unique distinctiveness from its contiguous regions regarding physiography-geology and as well as economy and environment.

2) The region generates curiosity as what causes for its economic backwardness as it is immensely prosperous in terms of overall natural resources.

3) The region has remained in the limelight, often for several years from now for its demand for a separate state, popularly known as "Jharkhand'.

4) Distinct socio-cultural pattern of the tribals who are subjected to acculturation through in-migrated population and 'Modern technologies'. The region is well marked in the map of India due to its tribal organisation and distinct culture.

5) Environmental degradation due to exploitative economic activities, which has been affecting the lives of the indigenous tribal population of this plateau region.

Objective

It is evident from the literature that not much extensive study has been done by geographers on the Resource base and Economy of the Chotanagpur region, though there has been significant contribution by sociologists, anthropologists and historians about this region.

Here it is proposed to look into the resource base, and dynamics of economy and environment with a geographical perspective of Chotanagpur region from 1970 to 1991. The objectives of the present study are as follows:

1) To examine the landuse, forest and water resource of Chotanagpur region as located in Bihar.

2) To examine the changes observed during 1971-91 in the environmental of parameters of this region and to explore the possible strategies for economic development.

3) To study and understand the man-environment inter-relationship in Chotanagpur region.

Scope

This study attempts to understand the resource base and economy of Chotanagpur region with respect to land, water and forest. An attempt has been made to look into the variations or alterations, if any, has happened in the economy and natural resources of this region between 1971-1991.

Data Base

1) Census of India, 1971 (Ser 1, Pt II-A(i)): India: General population tables.

2) Census of India, 1991: India: General population tables (tables A-1 to A-3)/Registrar General and Census Commissioner, India, New Delhi.

3) Indian Agricultural Statistics, 1970-71 to 1973-74, vol.II (District-wise): Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

4) Indian Agricultural Statistics, 1989-90 to 1990-91, vol.I and vol.II; Directorate of Economic and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi.

5) Climatological Tables, based on observations from 1931 to 1960, Indian Meteorological Department, New Delhi.

6) Climatological Tables, based on observations from 1951 to 1980, Indian Meteorological Department, New Delhi.

Methodology

The present study involves the analysis of secondary data pertaining to economic indicators such as landuse, occupational structure i.e. classification of workers. It has been attempted to analyse qualitatively and quantitatively the resource based and economy of the study area on the basis of temporal trends (1971 and 1991) and spatial distribution of the selected indicators area and also their intra-regional variations.

I. In this pursuit, percentage differences and growth rates of the selected indicates have been worked out. The formula applied to calculate growth rate is as follows:

$$r = \frac{P0-P1}{P1} \times 100$$

Where r = Growth rate
P0 = value of the current year
P1 = value of the Base year.

For cropping intensity –

C.I = G.C.A/NCA x 100

Where C.I = Cropping intensity

G.C.A. = Gross cropped area

N.C.A. = Net cropped area

Irrigation intensity

I.I = G.I.A / N.I.A x 100

For various values of the selected indicators, simply percentages have been worked out for the two periods i.e. 1971 and 1991 and in some cases only differences in the percentages have been discussed where growth rate has not been calculated.

II. (i) Computation of water balance and moisture index for the chotanagpur region is done by thornthwaites approach. (The

complete methodology in detail for water balance computation is discussed in the chapter V of this study.

(ii) On the basis of water balance moisture index has been calculated for the study area. The equation of Moisture Index or Index of moisture effectiity is is as follows.:

$$Im = Ih - 0.6Ia.... \quad (1)$$

Where Im = Moisture Index, percent

Ih = Humidity Index, the percentage ratio of the total annual water surplus (WS) to the total annual water need (WN) ie. The Potential Evapotransation (PE).

$$i.e.\ Ih = WS/WN \times 100 = WS/PE \times 100... \quad (2)$$

and

Ia = Aridity Index. This is percentage of the total annual water deficit (WD) to the total annual water need (WN) or the PE.

$$Ie.\ Ia = WS/WN \times 100 = WD/PE \times 100... \quad (3)$$

With the use of above-mentioned methods, it has been attempted to understand and examine the underlying forces behind

the dynamics of resource base and economy of the Chotanagpur region.

Since there are thirteen districts in Chotanagpur region in 1991 and were only six were there in 1971, which were later splitted into more to form new smaller districts. Hence for the adjustability and to make data of two time-periods comparable, the new-formed districts and their values for selected indicators have been clubbed together on the pattern of the districts in 1971.

Here, in the present study due to less number of districts in the study area and only two time-periods are taken for the comparisons of the dynamics of economy and environment of the study region, extensive and rigorous statistical tools g. regression or correlation have been avoided because they are not suitable for very small size of data.

Hence simple quantitative techniques such as percentages of the values of various indicators and their temporal variations and their growth rates overtime have been calculated but still the theoretical proposition based on extensive literature survey forms the base of this study.

Limitations of the Study

While conducting a study like this where all the required information cannot be had from one place, one faces the problem of time constraint. This study is based on secondary data and information and a lot of difficulty and inability was faced in search of some data.

In the present study, resource base is taken in association with the environment and is equated with nature where physical components of the study region, land, water and forest of Chotanagpur region which support and influence life of the inhabitants of the region.

Due to the limitations of a geographer in the field of environment study of certain generalisations have been made in the discussions here and the study is based on secondary data and information instead of an in-depth study of various components of the resource-base of the region based on a field work or empirical approach of geographical study. Hence, the general approach of study here is deductive methodology based on secondary data and information.

Historical Background

"In ancient period the whole area was in the undisturbed possession of various tribes whom we know as Munda, Snthal, Oraon etc and was known to the Aryans as Jharkhand or the "Forest Territory'. Possibly the area was included in the Magadh empire during the reign of Ashoka (273-232 B.C.). The Chotanagpur Raj is believed to have been set up in fifth century A.D. after the fall of the imperial Guptas. Phanimuket was elected the first King. It is said that he was found by the side of a tank under the protection of 'Nag' (snake). Hence the dynasty founded by him was named the 'Nag Dynasty".[5]

This is how the things went in Ancient period in India, in this region. Though very little study has been done or is not readily available about history of this region. The relief of this region may be one of the cause that this region was never a major attraction for ancient and medieval rulers and invaders.

"The entire Chotanagpur region was referred to as, 'Jharkhand' by the Muhammedan historians. Throughout the Turko-Afghan period (1526), the area remained virtually free form

[5] Bhatt, S.C. (1998). The Encyclopaedic District Gazetteers of India: Eastern Zone (vol.8), Gyan Publishing House, New Delhi.

external influence. It is only with the accession of Akbar to the throne of Delhi in 1556 that Muslim influence penetrated Jharkhand, then known to the Mughals as Kokrah. In 1585, Akbar sent a force under the Command of Shahbaz Khan to reduce the Raja of Chotanagpur to the position of a tributary. Kokrah was included in the Subah of Bihar, as mentioned in the Ain-i-Akbari Bhatt, (1998).[6] There were small princely states such as those of Ramgarh, Kharadina, Kendy, etc with very local influence within the region, before the British period. In 1765, Shah Alam II granted Diwani to the East India Company authorising it to claim the tribute of such small states. The hold of the company was nominal. The first effective measure to integrate this hilly inaccessible tract to South Bihar plain was taken in 1772, when Capt. Camac invaded the region. In the succeeding period, roads linking Patna to Deosai (headquarters of Chotanagpur) through Gaya-Chatra and Hilsa-Mackundganj (Hazaribagh) – Ramgarh-Chutia (Ranchi) were constructed to exercise effective control over the region. Subsequently, the area was systematically surveyed which brought to light the vast deposits of coal, iron-ore and other minerals. The extension of railways prompted by the desire to exploit these

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[6] Ibid.

minerals brought further economic and administrative integration with the Bihar and Bengal plains".[7]

Physical Profile

Geologically on the north-eastern part of Deccan Plateau, lies the Plateau of Chotanagpur. Which has been benevolently endowed by nature with variety of mineral resources and forests. Its hilly and undulating terrain with a tropical monsoon regime is full of scenic beauties which it carefully developed has tremendous potential to attract large number of tourists in this region. Numerous waterfalls, and cascades has already developed certain tourist spots e.g. Jonha falls, Dasham falls, Hirni falls on the Outskirts of Ranchi which is a composition city and the heart of the Plateau.

Position and Extent

The present study is concerned with only that portion of the plateau which lies in Bihar. The latitudinal and longitudinal extent are previously mentioned in the 'study area'. The area includes the districts of Ranchi, Hazaribagh, Palamau, Singhbhum Dhanbad and Santhal Pargana. Its maximum length in the east-west direction is about 457 kms and width in North-South direction is about 310 Kms.

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[7] Ibid., n.3, p.651.

There are various rugged plateaus, scarps, ridges, valleys, hillocks, in the region. The general elevation vary from about 250 ft. in the lower valleys to 3,600 ft. in the Netarhat Plateau. The Parasnath hill is the highest peak in the region with a height of 4,480 ft.

Geology

The Chotanagpur Plateau consists of several geological formation. (Dunn, 1941).[8] They are as follows arranged in orders of age from youngest to oldest:

1. Alluvium
2. Laterite
3. Late Tertiary Gravels
4. Rajmahal Trap
5. Gondwana
6. Vindhyans
7. Newer Dolerite
8. Archaean

[8] Dunn, J.A. : (1941) "The Economic Geology and Mineral Resources of Bihar": Memoirs, G.S.I, Vol.I, LXXVIII, 1941, pp.15-16.

Archaean is the oldest rock formation and occupies most of the area of the plateau.

Archaean is the oldest rock formation and occupies most of the area of the plateau. Most of Chotanagpur consisting of crystalline gniesses and granites is supposed to represent an originally solidified crust. These gniesses and granites are known to belong to the Archaean era.

"Cropping out the remaining area are the Gondwana sediments rich in coal, and small areas of Vindhyans in the North-West and the Rajmahal traps in the North- East. The oldest sedimentary and metamorphic rocks are known as Dharwars. These occurs as schists, quartizites and limestones etc. and occur mainly two regions of Bihar, one region extending from Gaya to Hazaribagh and other region covering the major part of Singhbhum district and south-eastern Fringes of Ranchi district. The Northern belt of Dharwars is the chief source of high-quality mica in the world and the southern region is the main source of Bihar's iron, copper, chromite, kyamite and manganese, etc".[9]

[9] Ahmed, E.(1965): Bihar: A Physical, Economic and Regional Geography, Ranchi: Ranchi University.

It was during tertiary times that the Himalayas appeared in the north and the region to the South of the Himalayas was was converted into a depression and that the Chotanagpur region was successively uplifted, the result being a rather rejuvenated and rugged topography in the plateau region that we see at present. A number of lofty flat topped hills, called pats are there South of Palamau. These pats are capped by masses of laterite (Bhatt, 1998). The hilly South Bihar does not consist of one Plateau, but it is a series of Plateau. Each Plateau occurs at a height different from that of adjoining plateaus. There are four Plateaus (or, in other words, erosion surface) in the region. The highest surface is formed by the western or higher Ranchi Plateau or *Pat* region, 2500 to 3600 ft. above sea level. It covers the North Western corner of Ranchi and the Southern edge of Palamau district. Except the Parasnath hill it is the highest region in Bihar. It is believed to be composed of Deccan lava, but as a result of weathering the lara has been converted into laterite and bauxite. The *Pat* region consists of flat-topped dissected hills rising mostly about 1600 ft. above the lower plateau to the cast, known as Ranchi plateau. These flat topped hills are locally known as *'Pat'* whence the name of the region.(Ahmed)1965)

The second or the next lower plateau is known as Ranchi Plateau and roughly covers the whole Ranchi district except the area

covered by the *'Pat'* region. This Plateau, composed mostly of gneisses and granites, is about 2000 ft. above sea level. The topography is roughly undulating with terraced slopes ending on the one hand on the banks of a local stream and on the other in a local upland which may or may not have a low hill, or which may or may not consist of solid rocks exposed bare of soil. Ignoring miner variations the Ranchi Plateau characteristically lies at an elevation of 2000 ft. above the sea level. The Ranchi Plateau is separated from another surface of the same elivation by the Damodar trough. It is upper Hazaribagh plateau and is probably a continuation of Ranchi plateau. The next lower or the *Third* Plateau has an elevation of 1000 ft. above the sea level and may be teemed the outer or lower Chotanagpur Plateau. It consists mostly of gneisses and granites, but partly of schists and other Dharwar rocks. This Plateau occurs a wide area on the other pacts, the next lower or the *fourth* erosion level is ununiform surface formed by the river valleys, plains and lower parts of the over lower plateau lying between 500 and 1000 ft. above sea level. They again consists of geniuses and granites and partly of schists etc. Now each of these series of Plateaus, i.e. the 3600, 2000 and 1000 ft. Plateau, descend to the next lower plateau not by gradual slopes but by rather narrow and steep slopes known as scarps. (Ahmed 1965)

Climate

A characteristic monsoon climate prevails over Chotanagpur plateau having a seasonal rhythm running through all the elements of weather such as precipitation, temperature, pressure, wind and relative humidity.

1) In the winter season the region experiences anti-cyclonic conditions. The high pressure system of North Western India sends an arm in the South-East which includes the Plateau. The wind blows from the north-west to South-East, the relief features. The temperature remains between 35^0 C. Lowest temperature goes around 5^0 C in Ranchi in Winters. The Winters are usually clear, and have fine weather with pure air and azure blue sky. The days are slightly warm and sunny and nights are cold.

2) From March to mid-June is summer reason. The sun comes over the *tropic of Cancer* on the 21st June which passes through the northern portion of the plateau. As a result low pressure area develops on the plateau. Temperature rises upto 41^0 C-42^0C around Ranchi.

By the end of May the low pressure intensifies and extends towards the West. Now the westerly winds begin to fade away.

Slight precipitation starts taking place and a characteristic feature is afternoon or evening storms which consequences after the heat of the day and form the chief source of rain of the season.

3) Rainy Season: The temperature begins to decrease with the onset of S-W monsoon in mid-June. The seasonal trough of low pressure which lies in the Ganga plain in July, shifts to the south, over the plateau. In August-September. The winds generally blow from east and South-East. The wind velocity decreases gradually with the advance of the season. Heavy rainfall, account for over 80% of the annual rain, is the most characteristic feature of this season.

Table 1.1

Chotanagpur

The average annual rainfall 1951-1980

District	Rainfall (in Cm.)
Ranchi	143.2
Jamshedpur	132
Hazaribagh	128
Santhal Pargana	139
Dhanbad	137
Palamau	115

Source: Climatological Tables (1951-1980), India Meteorological Department, New Delhi.

Soil

In Chotanagpur plateau contains high contents of ferric oxide and bauxite which imparts red colour to them. These soils vary regionally in colour, texture and fertility and ways range form laterite or lateritic soils on the high plateau surfaces to yellow-grey loams and black or brown soils in valley beds or predominantly lowland areas. The soils of Ranchi, Santhal Parganas, Dhanbad and Hazaribagh districts are generally red soils, while parts of Dhanbad and Singhbhum have mixed red and black soils.

The chief soils forming factors are the parent materials, climate with its alternating humidity, natural vegetation, soil fauna, topography and human interference. Homogeneity in soil owes to the fact that there is not much difference or variations in the claim of Chotanagpur plateau. Red soil is found in the whole plateau with the exception of Damodar basin where the Gondwana Sandstone have developed loose sandy soils and laterite over the *pats*. While the soils of Damodar basin contains large particles of Slate and Sandstone, the Rajmahal soils abound in laterites. The depth and fertility of the different soils are highly variable according to the details of topography and rock constituents.

Natural Vegetation

In strictly botanical sense, the natural vegetation of India or for that matter Chotanagpur plateau, is forest and not grasses. Though much of the original forest has been depleted by the extension of cultivation in accessible areas, still valuable forests are conserved in the hilly and rugged terrain. The areas receiving more than 125 cm. of rainfall in Chotanagpur highlands, is occupied by forests ranging from stunted open growth on slopes base of soil, or southern drier slopes facing the sun, to fair-sized dense jungle in more favourable situations, e.g. areas of thick soil, moist valleys rivers, etc. The natural vegetation of Chotanagpur and the rest of Bihar is largely deciduous marked by shedding of leaves in early summer, and there are several evergreen trees also among all the vegetation types of the state. Thus the Sal goes side by side with an undergrowth which is mostly evergreen. In the upper Canopy also there are some evergreen companions of Sal, e.g. mangoes (Mangifera indica), Jamun (Eugenia jambolana), Piar (Buchanania latifolia), Kathal or jackfruit (Artocarpus integrifolia) etc.

If we see district wise, in Singhbhum three types of forests are i) Dry Throny type ii) Semi-evergreen type, and iii) Moist tropical deciduous type. Sal is the main tree species in all types of

forests in the district. Other tree species found associated with Sal are asan, dhaura, jamun, bija, karam, simal, kendu, arjun, gamhar and bamboos. In the dry open hills salai, jhingam and bamboo are commonly found. Mahua and Kusum are found near the cultivable lands. In Dhanbad forests are largely confined to the north, bordering on the districts of Giridih and Dumka. Some of the important trees in the forests are sal, sisoo, siris, palas, mahua, jamun, and simal. Bamboo are also common.

In Santhal Pargana, Dumka has sal. Some teak of inferior variety is also found. Other trees are jack fruit, murga, simal bamboo, asan and satsal. Sal and Simal logs and jackfruits are exported in large quantities to the neighbouring districts and to place outside Bihar. Among the forest products of consequence are lac, sabai grass and tassar silk cocoons. Godda was once known for its thick and extensive forest is now bereft of much of its jungle wealth. There has been large scale destruction of forests in the past few years. The most common tree of the district is Sal. Some teak of inferior variety is also found. Other trees are jack fruits, simal and bamboo. Among the forest products of consequences are lac, sabai grass and tassar silk cocoons. The erstwhile Santhal Pargana was a sanctuary of wild animals upto the 19^{th} century. Hazaribagh is a predominantly forest district and nearly half of the total area is

covered by forests which are distributed almost uniformly throughout the district. Sal is the most famous and predominant species of tree in the jungles of the district. Among others common species are bamboo, khair, salai, simal, mahua, palas, kusum, asan, piar and bhelwa.

Water Resources

Several projects have been set up for water resource development in this region. These are DVC (Damador Valley Corporation), the Chotanagpur Irrigation Project, special projects for Industries, Koel-Karo project is being developed. Chotanagpur is geologically a plateau area and being less porous the plateau goes dry in summer as far as underground water is concerned. River valleys are exceptions where underground water nearer form the surface (water-table is high). (Water resource is discussed in detail in Chapter IV and V)

Mineral Resources

The Archaean terrain of Chotanagpur plateau possesses largest concentration of several ore deposits such as iron, manganese, copper, thorium, uranium, aluminium, chromium, industrial minerals like mica, phosphates, and maximum of India's reserves of coal including coking coal. This region provides

minerals as raw material and supports many of our industries, transport, buildings, river-valley projects, power generation and transmission and defence.

Coal

There are twenty-one promising coal fields in Chotanagpur region of which three are in Dhanbad, seven in Hazaribagh, three in Palamau and eight in Santhal Pargana (Dumka, Godda, Deoghar and Sahebganj). Most important are Jharia, Bokaro, Giridih and Karanpura. Lying south-west of Dhanbad town and covering an area of 453 sq. km., working at seams of over 1 meter thickness each, the Jharia coal field has been recognised as the storehouse of the best metallurgical coal in India.

The coal fields of Bokaro are in form of a narrow but long strip in the catchment of Bokaro river. It was an area of about 674 sq. km. The 30-metre thick Kargali coal seam in east Bokaro also bears coking coal. To the South-West of Giridih lies the Giridih coalfield also known as Karharbari coal field. Its field of 28.5 sq. km. has three main seam of varying thickness: i) The lower Karharbari, ii) the upper Kaharbari, and (iii) The Badhua seams, of which the 3 to 7.5 m. thick lower Karharbari provides one of the finest coking coal in India for metallurgical purposes.

Karanpura and Ramgarh coal fields lie to the west of Bokaro and cover an area of about 1550 sq. km. The coal production is being undertaken by the Central Coal Fields Limited (Ranchi) Eastern Coal Fields Ltd. (Asansol) and Bharat Coking Coal Ltd. (Dhanbad).

The total coal reserves is estimated in the region to be more than 55000 crore tonnes.

Iron-Ore

In Jamshedpur came the first blast-furnace into operation in 1911 and since then TISCO has made rapid progress. The iron-ore of Singhbhum and Bonai is of the highest quality and the reserves available are immense and would last for hundreds of years. In Singhbhum district the most important group of iron-ore deposits forms a range nearly 50 km long, extending from near Gua to near Pantha in Bonai, Orissa.

In this region the ore is mainly of hematite quartzite phyllite types spread in the ancient pre-Cambrian rocks in Kolhan series and of series of Singhbhum-Orissa belt of iron-ore. This region supplies ore to steel plants at Jamshedpur, Bokaro, Durgapur, Bhilai, Kulti and Rourkela.

Copper

Copper-bearing rocks persist along a zone of over-thrust in the Dharwar schist and intrusive granite. The deposits worked at the Mosabani mines, Singhbhum, consist of sulphide-ore. Besides Mosabani in Rakha, Kendadih, Surda and Dhobani mines copper is being worked. The ore produced at Mosabani is concentrated and smelted at the plant situated at Maubhandar. Copper is also found in Baragandha, Jaradih and Hozadu in Hazaribagh district.

Gold

Gold has been obtained from the alluvium of the rivers and streams of Southern Chotanagpur region. The Subarnarekha (gold streak) river at it name suggests, is known for gold contents in its sands. 'Sona nadi' in the Singhbhum district and the streams draining the Sonapat valley have gold contents in sands. In the Archaean quartzites near Lowa in Singhbhum district some occurrences of gold has been reported. There was recovery of gold from Copper slime at Ghatsila copper smelter of HCL, at 111 Kg in 1986.

Manganese

Occurrence is over a belt extending southward from Gua to Limtu and beyond into Orissa, between Chaibasa and Jamda and between Jama and Noamundi. About a third of the deposits contain more than 40 percent manganese.

Limestone

It is the chief raw material for cement industry and also, imp. For lime, iron and steel industry, sugar refining, chemicals, paper, glass, textiles and ceramic industries. Occurrence is in Hazaribagh, Ranchi, and Singhbhum districts.

Bauxite

Lohardaga mines in Lohardaga district (previously Ranchi district) and Palamau district. This region is highest producer of Bauxite and mines are at Barupet, Dudha, Sarendog, Banjari, Pakhar, Banda, Dhakri and Auranga.

Kynite

Important refractory mineral for iron and steel industry and glass industry. Deposits are at Laps, Buru in Singhbhum stretching from Saraikela to Shikhai Pahar.

Fire Clay

Used for making fire-bricks. Occurs in the Damodar basin (Singhbhum), Palamau, Ranchi districts.

Mica

Important mines are in North Hazaribagh, Jhumri Tilaiya, Kodarma, Donchanch, Jamira and Giridih.

Chromium

Important chromite deposits occur in Singhbhum district. There are sporadic occurrences in Silli in Ranchi district. It is used in Iron and steel industry and chemical industries.

Lead and Silver

Occurrences of argentiferous lead ore had been located in Hazaribagh district. The ore yielded a few ounces of silver perton of lead. Galena is found in parts of Singhbhum, Ranchi, Hazaribagh and Palamau districts.

Cobalt and Nickel

Nickel-ore has been found in small but significant proportion associated with uranium-ore in Singhbhum. Nickel is recovered as

by-product in the form of nickel sulphate during smelting of copper at Ghatsila Copper smelter of HCL.

Quartz and Silica

It is raw material for glass industry, for fluorescent tube lights, wireless transmission sets, and several others uses. Found and produced in Singhbhum district.

Steatite

It is used as pot stone, slate pencil, toiled powder and paints, papers industry, rubber, pesticides, textiles, chemical industries etc. The districts of Singhbhum and Giridih has reserves of it.

Dolomite

It is a refractory mineral and used as a flux in the iron and steel industry, paper, glass, rubber and several other industries. The production comes from Palamau, Singhbhum, Dhanbad.

Asbestos

It is used for the manufacture of corrugated and other sheets and pipes by mixing asbestos with cement. It is mined in Singhbhum, Ranchi and Santhal Pargana districts.

Tungsten

It is extracted from the ore and used in high resistant steel and other electronic elements. The possibility in the district of Hazaribagh.

Zircons

It has an adamantine lustre and high dispersion power, its refractive index being very high, 1.92 to 1.98. It occurrence is the alluvial soils in Ranchi and Hazaribagh districts.

Tourmaline

Pellucid and beautifully coloured varieties of tourmaline, red, green or blue are worked as gems. The green variety, known as indicolite, occurs in Hazaribagh.

Barytes

They occur in the form of veins and as beds in shales. The rather uncommon heavy mineral barytes is the sulphate of barium. It uses as a pigment for mixing with white lead, as a flux in the smelting of iron and manganese, in paper manufacture, in pottery glasses etc. The whites and better quality barytes is used in the local

manufacture of paints (lithophone); the coloured variety is used in making heavy drilling mud by the oil companies.

Occurrence is at Kolpotke in Singhbhum district and in a few isolated localities in Ranchi district. Reserves has also been calculated from Palamau district.

Corundum

Transparent variety used a gems is next to diamond in hardness. Used in manufacture of abrasives, a common example of which is the corundum powder-coated wheel of the knife-sharpener. In Chotanagpur some deposits are in Singhbhum.

Feldspar

Important deposits associated with quartz are found south of Giridih-Madupur railway line and near Karmatar and Minijam railway stations. Feldspar occurs also in pegmatites of mica-belt, in districts of Hazaribagh, Giridih. Some occurs in Palamau also. These however have no market in view of their prohibitive distance from the railway line.

Graphite

Occurrence is in Daltonganj in Palamau district. It is naturally occurring, soft, light, blackish mineral with a metallic sheen and greasy feel, consisting of carbon.

Phosphates

Massive appetite occurs as an abundant constituent of the mica-pegmatites of Hazaribagh and of the mica-periodotite dykes of the coal fields. Fairly, large deposits in northern Singhbhum

Uranium

It has strategic as well as industrial importance, in atomic reactors, power generation. Singhbhum is the only producer of uranium.

Tellurium

It occurs in telluride in combination with copper ores in Singhbhum.

Apart from these minerals found in Chotanagpur region there is possibility of tin to be found in Hazaribagh and Ranchi. There is a possibility of golden layers in he Chotanagpur plateau which is

illustrated in the form of golden particles in the sands of Subarnrekha and few other river.

The Chotanagpur region though physically extends into states of M.P., Orissa and West Bengal also but a major part of its lies in the Southern part of Bihar. For convenience in study for adjustability only districts of form Bihar has been taken for data-analysis in one chapter of this study and the portions of Plateau extending outside Bihar have been not considered.

Chapter II

CONCEPTUAL FRAMEWORK AND LITERATURE SURVEY

Human beings are now a powerful agent of geographical dynamics and more effective than the collective strength of rest of all the erosional – degradational forces of environment.

The present study of the Resource Base and Economy of the Chotanagpur region has been attempted from a geographical point of view and the dynaimcs of the environment of the region has also been focussed upon but here it differs from from an ecological approach. As Gerasimov (1980)[1] stated "The purview of ecological approach has been enlarged to digest relevant information and results of studies in biology, sociology and anthropology etc. under such a changed set-up, geography has equally emphasized aspects of spatial variation and relationship and biological science are no more the sole custodian of ecological approach it has rather displayed a well marked tendency to become in other fields of science".

"Primarily, the concern of all geographers is with the environment of man. But man cannot exist or be understood in isolation from the other forms of life and from plant life"[2].

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1 Gerasimov,I.P. (1980)Giving Modern Science an Ecological Orientation : Methodological Aspects; Society and Environment; Progress Publishers, Moscow; p55.

2 Strahler, A.N and Strahler,A.H (1976) Geography and Man's Environment; John Willey; New York.

"Environment refers to the sum total of conditions which surround man at a given point in space and time"[3].

Natural Resource Exploitation

Different regions/nations are reaping the adverse consequences of growth – generated activities in various forms as a result of modern technology based development.

In many cases natural resources such as minerals are mined to the last limit. Mining is one of the chief economic activity of the Chotanagpur region. Though state and central government have largely benefited from the abundant mineral resources of this region but little attention is paid to environmental considerations whose negligence often leads to loss of life and property. "The reckless mining by the BCCL (Bharat Coking Coal Ltd.) Which owns the right of mining in Jharia caused Chasnala or Gajlitand disaster. In this incident land subsidence took place and Cracks developed in the houses of the entire area of Husainabad locality of Jharia".[4] Though the finer points of the cause of such land subsidence could not be ascertained , it is almost certain that it was caused due to the heavy underground blasting of coal in the Jharia coal field.

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3 Park.C.C. (1980) Ecology and Environment Management, Butterworths, London.

4 Kumar Sanjay (1997) Humans Suffering in Jharia; Does development necessitates destruction, Mainstream vol. XXX, no.40 Sep. 13, 1997.

Such incidents happen and for a brief period mining is stopped in the colliery but often and most of the times the sufferers are common people, the labourers who loose their lives, houses and worst part is that due to unawareness, and lack of knowledge of the legal proceedings to such cases, they also remain uncompensated.

Environmental Degradation

Components of the environment land, water and forest are dynamic and constantly undergoing a process of change. This dynamism is both the outcome of natural processes as well as man's interference for his economic needs and greeds. Throughout the history of civilization, the surrounding environment has undergone change but the last century has seen excessive interference by man into the domain of nature.In the Chotanagpur region also this is threatening the environment to dangerous levels, and in many cases over-exploitation and complete exhaustion of natural resources. The study done by Misra and Misra (1986)[5] attempts to highlight the importance of land water and mineral resources, to mankind and their degradation, causing threat to human existence in some areas. The study highlights the increasing pressure of population on natural endowments and the recent developments in technology have given man,

[5] Misra, R.P. and H.N. Misra (1986) "Human survival and Development: Focus on Land, water and Mirebla", Annuals of the National Association of Geographers, India, vol.VI , no.2, pp.21-38.

tremendous power to exploit the natural resources indiscriminately.

Increase in population in the last century have created manifold complex problems of environmental degradation. India's population is growing at a rate of more than 2 percent a year. Further, per-capita availability of arable land is declining. And in view of the expanding demand for water for non-Agricultural purposes, water is becoming a scarce resource and already facing acute degradation stress. Concerted efforts must be placed on scientific land use planning for judicious exploitation of the degrading natural resources.

India's present population has crossed the one billion mark. "This implies that the per capita cultivable land holding is 0.14 ha and will be 0.1 ha in 2020 A.D. More then 50 percent of the geographical area of the country is beset with different types and degrees of land degradation problems".[6]

"The twin-character of space and environment is mainly caused by the fact that environmental externalities unpaid burdens imposed by the pollutants on others – are usually transmitted to others (individuals, cities, regions, continents, ecosystems, etc) Through the medium of space. In other words environmental externalities tend to show-up as spatial

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[6] Paroda (R.S.) : 1997 Options and Priority Areas ; The Hindu Survey of Indian Agriculture; 1997; pp.13-18 (Dr. R.S. Paroda, Secretary DARE, and Director General, Indian Council of Agricultural Research.

spillovers; there is hardly any situation in which polluters would spoil their own living area. This means essentially that all the space related activities (e.g. residential patterns, locational structures, transportation flows etc.) are directly related to the existence or origin of environmental problems".[7].

There are few European scholars who believe that whatever alteration has taken place to the environment of Chotanagpur plateau is more the contribution of the indigenous people and government has lesser role played in it as Arnold and Others (1990)[8] say, "The inhabitants of the Chotanagpur region and new settlers in this region has directly or indirectly, deliberately or inadvertently /unintentionally or accidentally, has affected and modified the environment of this region. That may be through activities such as deforestation for domestic, agricultural and industrial purposes, forest fires etc. Mining activities has done a great and irreparable damage to the forest resources of this region. But there has been several attempts by state government or central government or other agencies to replenish the forest resource of this region and to maintain the equilibrium or the symbiosis of the man environment coexistence."

"The Bihar Forest Department has long been active in forest

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7 Nijkamp,P:(1997) Environment and the Space Economy, Indian Journal of Regional Science, vol.XXXIX 1997 no.1

8 Arnold, M. et al (1990) Evaluation of the SIDA supported Bihar social forestry project for Chotanagpur and Santhal Parganas , India ; Swedish International Development Authority ; Mar.1990

management , rehabilitation and reforestation in the area .In the late seventies ,in the response to the growing need to promote tree growing need to promote tree growing outside the forest , a "social forestry programme " was initiated under which the department planted trees on farmers land .By 1984 - 85 about 5100 ha were being planted under employment generating programmes of the Government of India ,and nearly 7,900 ha under a central government fuelwood scheme."[9]

The original inhabitants of the region , the tribals may or may not have destroyed the forests of this area it may be left to speculations.Some increase in population will inevitably affect the surrounding environment to some extent As Qureshi and Pratap(1996)[10] say, "Historically , forests have been considerd as a renewable resource and their abundance during the pre-settled and till late in the settled agriculture period,had led to the common belief of their continuity in perpetuity." "In the hill areas of U.P,perticularly low population density and vast forest areas did not bring into focus the question of decrease in forest cover till late 18th century. The population went on increasing more and more areas were brought under agriculture and the pressure increased on forests to meet the local demands. Added to it was the commercial exploitation in natural regeneration began

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9 ibid

10 Qureshi ,M.H and Pratap,D. (1996) Anthropogeographic intervention and resultant changes in landuse and forest cover in Utter Pradesh Himalayas ; Indian journal of regional science ; Vol.XXVIII 1996. pp- 33-38

the process of deterioration and degradation of forest cover. While on the one hand, the areas under forest started Shrinking, on the other, the composition showed some Changes".[11].Is there any relation between poverty in the rural and tribal areas on one hand and environmental degradation on the others/ As Mellor (1988)[12] claims, "There is a clear interrelationship between the levels of agricultural development and rural poverty, on the one hand, and ecological degradation on the other hand."

"Across different states in India, the extension of areas under cultivation and the denudation of forests seem to be high where the progress of yield increasing technology is slow. In such regions the levels of agricultural income and wages are low and poverty levels high. Similarly, the pressure from animals such as goats and sheep on forests and common lands has been increasing in regions where growth in crop production is slow. This is because the rural poor supplement their incomes by rearing these animals".[13]

"Unlike in the intensive systems of agriculture where pollution of environment has been caused by the intensive use of chemical inputs. The ecological degradation in rural India can be attributed mainly to the

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11 ibid

12 Mellor, J.W:(1998) The interwining of Environmental problems and poverty; The Environment; Nov.98

13 Jalan,B (ed) (1992) Article by Rao,C.H.H; agriculture :policy and performance; pp-116-140.

extension of cultivation to the marginal and sub-marginal dry land and to deforestation. In India, the proportion of rural population below the poverty line is highest for areas not irrigated and declines with the increase in irrigation. Therefore, the degradation of the already fragile environment has further accentuated the poverty problem".[14]

Jodha.N.S (1986) also associates poverty and environment, "The rural poor have been the prime victims of this ecological degradation. This is because they derive a significant part of their income from village commons and forests in dry regions".[15]

What Jodha (1986) has said, does it apply only for the semi-arid /dry regions or can we say that this is applicable elsewhere also?

It is believed by some well known academicians that the rural people or the tribal /forest dwellers destroy forests for their basic requirements, such as fuelwood. Infact they only use dry twigs or branches for their everyday fuel requirements and they are allocated some dead and dry trees by the village head for any greater requirement of fuelwood such as occasions of marriage etc. Mostly by all tribals cutting green tree is considered a transgression in their villages.

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[14] ibid

[15] Jodha,N.S:(1989)Dry farming Research: Issues and approaches, in N.S Jodha, ed., Technology options and economic policy for dryland agriculture : potential and challenge; The Indian society of agricultural economics, Delhi; Concept publishing house.

Chandi Prasad Bhatt, one of the progenitors of the Chipko Andolan and the 1982 Magsaysay Award Winner says that, "No villager is ever involved in the plans (to save the forest and maintain environment). What the government does is plant eucalyptus trees in the name of forests. Which is quite useless for the villagers". Regarding the protection of Forest by the villagers, his observation is quite revealing : "One thing we must understand is that no person will get involved in a movement (for maintaining the forest) unless his own interests are served. A human being is not interested in the welfare of mankind. He wants personal benefits. But what benefits does a villages derive from the forests now? All the traditional rights have been taken away. So how can you expect him to work for the forest welfare? The thing to be done now is to get the people involved in the preservation of the jungle by letting them benefit from it". Das,V(1992)[16].

When we see the current scenario of the existing forest resources and opposition from many quarters regarding Environment unfriendly projects e.g. Huge Capital–intensive dams and other developmental projects now Bhatt's argument doesn't seem very logical? That for a better environment, only people's participation will lead to there rather than individual leadership.

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[16] Das,V:(1992) Jharkhand: Castle over graves, pp-177

And isn't it true that the working of various minor or major projects are prepared by high officials and Technocrats who are often not properly aware of the people's sentiments regarding their homeland i,e. Forest and they have never really have done a thorough study of the Project area and its ramifications.

Bhatt's suggestions are pertinent in context of the indigenous tribal population of Chotanagpur region. The current policy of the government is that, if there is a need for displacement then the displaced tribals or farmers are to be allotted productive lands but in reality they are allocated usually unproductive and waste lands.

The displaced people should be allotted a land area within the command area of the respective project so that he may be a beneficiary of that. After all why a poor tribal pay for someone else's prosperity? And this question is a universal one, which includes trial people of Chotanagpur or of any part of our country or world.

As Singh, R.L (1986)[17] puts it, "Modern agencies of development and patterns of resource utilization are largely responsible for disturbing the ecological balance between physical and cultural systems of landscape in tribal dominant habitat, such as Damodar, Mahanadi, Narmada and Son

[17] Singh,R.L:(1986)Ecological Processes of rural habitat transformation in India; Geographical Review of India; VolXLVII,No.1, pp-1-11

basins or penninsular uplands as also the Himalayan habitats of unprivileged people. The tribal habitat still suffer from relative ecological isolation from the other people and even the spill-over of the modern developments has not yet entered into their "little world".They continue to practise 'shifting cultivation' and rudimentary sedentary agriculture in rain-fed arable lands coupled with food and fuel gathering from the adjoining forests and woodlands."

Das (1992)[18] says, Forests have not improved but further deteriorated in the post-independence period. "One might have thought that with the independence the British imperialistic logic of restricting the rights of the tribals would vanish and the decision – makers of independent India would concentrate more on the welfare of the tribals. But contrary to that, the Jharkhand was deforested more vigorously in the name of development, urbanization and industrialization. And to facilitate the process section 49 of Chotanagpur Tenancy Act, 1908 was amended in the year 1947, to the Chagrin of the tribals."

Since the ancient times and during Moghul period also Chotanagpur plateau was named 'Jharkhand' which means forested area. So for the generations, the forests have grown up in a harmony with tribals. And it were Britishers who realized that they needed to save the forests from tribal

[18] ibid

inhabitants.

"Prior to the independence it was British government which was so adamant about changing the culture of the Adivasis. Santhals mode of agriculture was shifting cultivation and colonial actions against them were guided by an inherent suspicion of impermanent populations. This distrust of shifting cultivators did not germinate in India; rather it was imported from Europe. The only comparable group the British had dealt with in the past were the gypsies, so they too did rely on their sense that vagabonds were dangerous and untrustworthy...hence the use of criminal castes and tribes Act. They attempted in radically altering the adivsai society. Also as with nature, they brought about these changes all under the guise of nobles oblige."[19].

Has this subjugation of the indigenous tribals of the indigenous tribals of Chotanagpur region, ended with Indian independence? It tells something about nature and society that, while the ideology of rules has been credited, the ideology foe the utility of nature has not.

Hill (1997)[20] says further "It was , after all, India's first Prime minister, Jawaharlal Nehru who proclaimed dams to be the 'new temples"

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19 Hill,C.V:(1997) The Peasants of Jharkhand and the peasants of Jharkhand: A preliminary appraisal;peasant symposium draft; may 1997; (http\\: www.yahoo. com\ search\chotanagpur)

20 ibid

of India. Social groups which refuse to accept this view of ecosystems as Commodities are still labeled as either dangerous or uncivilized". Will the government understand the truth that there is not the need to save or protect the forests from the tribal people but it is these people who abone can save the forests from the illegal felling of trees and from industrial –commercial interests of certain groups. Because they are the people who alone have a vested interest in the very survival of the forests.

The entire privately owned forest was declared protected forest by the Bihar Private Forest Act 1947 and by 1967-70 almost the entire Forest Came under the ownership and management of forest Department; government of Bihar. After that Chotanagpur has witnessed wanton destruction of forests. Those loosing the ownership helped themselves with timber because they lost interest in persevering the forest resources. Though at policy level the traditional right of tribals for timber and fuel – woods for their domestic use and other gatherings from forest were almost kept intact, but for all practical purposes there was increase in harassment of tribals after the management was taken over by the forest department of the government.

"The loss of forest on account of extravagant Subarnarekha Multipurpose Project (SMP) is also an instance of so-called development being anti-environment. The clearing of forests much in excess of the

mining requirements by the captive mines of Bokaro Steel Plant at Kiriburu is another example of Wanton destruction of forests that is being condoned by the government. The denial of employment to the local tribals on large – scale in many of the mining and industrial units situated in Jharkhand further augments the antipathy of the tribals and prompts them to destroy forests for their livelihood". [21]

The outcome of the degradation of environment is that rural and poor tribals have to go to farther distances to collect fuelwood and fodder and drinking water has become more scarce owing to the decline in the water table in many tribal areas of India.

As the forests are lost, so are their beneficial natural effects, in stabilizing soils and slowing water run-off; the unfortunate result may be landslides during rainy season, alongwith rapid sedimentation of hydroelectric reservoirs, irrigation canals. Loss of forests makes it difficult to meet the growing demands for papers, building materials, and most serious of all, fuelwood. Also is increasing scarcity of drinking water and water for other uses.

In India soil is being eroded at an average rate of 16.35 tonnes /ha /year which is far more than the highest tolerance limit of 12.5 /tonnes/ha/year. On account of deforestation the present rate of erosion in

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[21] ibid

the catchment area of Himalayan rivers (100cm/100 yrs) has gone 5 times higher than the rate (21cm /1000years) prevailing during past 40 million years. About 130 million hectare of land (45% of total geographical area) is affected by serious soil erosion through ravine and fully, shifting cultivation, cultivated wastelands, sandy area, deserts, and water lodgings. Under favourable conditions in the India, it takes almost a thousand years to form only 6 2.3 cm of a soil layer from weathered rocks".[22]

It is well known that the Chotanagpur region is extremely rich in mineral resources and is a leading producer of a variety of minerals in India and also in the world.

Infrastructure was developed first by the Britishers. Then by "Our own government". Roadways and Railways was treated better than the rest of the India in this region by the colonial rulers whose prime interest not the development of this region but to exploit its mineral and other Wealth expanding routes. It can be a matter of debate as to how far this has contributed to the development of the tribals. On the other hand the expansion of roads in forest areas is a non-development syndrome, has resulted in destruction of forests and exploitation of other resources as well.

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[22] Menard, H.W. (1961)Some rates of regional erosion, Journal of Geology, Vol.69,p-154.

Instead of a piecemeal, solution to one problem followed by another an integrated approach is required for the overall development of this region.

Raichudhuri (1992)[23] says, "the socio-economic development of the tribal people in some parts of the country has taken an ironic twist in the sense that the predominantly tribal regions are still about as rich in natural and economic resources as any other yet the local Adivasi populations are not deriving the benefits of this wealth. A remarkable example is provided by the loosely identified Jharkhand region. Most of the Indian Steel Plants both in the private and public sectors – and rich mineral deposits are located in this region"[24]. And still, most of the tribals of this region are living below poverty line and are directly dependent on the natural resources for their basic needs such as food, fuel, Shelter, Cattle -fodder etc.

Singh (1995)[25] has talked is detail about forest and forestry in India and he says, "Majority of the Indian people, especially poor section of the society depend on immediate surrounding forests to meet their basic needs. About 80 percent of the women are directly dependent on forest, crop and

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23 Raichaudhuri, S.(1992) The Jharkhandis: Vision and reality: A micro study of singhbhum; Economic And Political Weekly; November 21, 1992, pp-51-55

24 Singh,R.B, (1995)Forest and Forestry in India :spatial nature uses and issue of sustainability; National Geographical Journal of India; Vol41,pt.1,Mar.1995,pp-55-67

25 ibid

common land as mangers of local resources base. As the forest Coverage decreases, the quality of life declines accordingly. Subsequently the flora and fauna are vanishing and the question of Biodiversity is looming ahead. The earning of the rural poor from forests have substantially declined has also been accelerated because of deforestation and the degradation of the village commons". Further he says, "Forest survey of India (1991) the actual forest cover is 63.99 million ha (11.71%) of which only 38.50 million ha. Consists dense forests (crown density 40 percent and above) and 24.99 million hectare are open and degraded forests (crown density 1o to less than 40 percent)."

There has been depletion of forest at a rate more than its replenishment. "In India forests have depleted at he rate of 47500 ha/year during 1976-77 to 1988-99 period has been only at the rate of 28,000 ha/year". [26]

Constitutional Provisions

The Indian constitution is clear and categoric in making the state responsible to protect and improve the environment and to safeguard the forests and the wildlife of the country (Article 48-A). More emphatically, Article 51-A makes it the fundamental duty of every citizen of India: "To

[26] Singh, M.B.,et,al:(1995) An Approach to Study Global Changes; National Geographical Journal of India; vol.41, p.4, Dec1995

protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures." (Article 51A (g)

"A committee of members of parliament and experts was constituted in June 1994 to make recommendations on the law concerning the extension of provisions of the 73rd constitutional amendment to the scheduled areas. The Committee under the Chairmanship of Dileep Singh Bhuria, MP, submitted its report in February 1995. The committee felt that "while shaping the new Panchayati Raj structure in tribal areas, it is desirable to blend the traditional with the modern by treating traditional institutions as the foundations on which a modern superstructure should be built. Thus it recommended that the Gram Sabha should be given complete command over natural resources, ie. land, water and forest. This bill finally came into being in December 1996 and hopefully they should satisfy the needs and aspirations of the tribal people".[27]

Jharkhand Issue

At one time in history, the resources of Chotanagpur region gave in Bihar the forward thrust that enabled it to grow into becoming the heart of India. The minerals, metals and forests materials themselves and the economic surplus generated through their use provided the foundations to

[27] Mukul (1997). Tribal Areas: Transition to Self-Governance, Economic and Political Weekly; vol.XXXII, no.18,May 3, 1997, pp-928-929

erect empires, construct philosophical systems and build elaborate social structures.

But the vulnerability of original inhabitants the tribals to exploitation by minor government officials, as well as moneylender, landlords and other agents of vested interests continued. They were illiterate and ignorant of the world outside the narrow confines of their traditional environment. Their income –low and unstable, problems like unemployment, primitive methods of cultivation, isolation from the developed areas and society due to defective communication system.

The leaders of the Jharkhand agitation have claimed that 75 percent of the revenues of Bihar are extracted from Jharkhand. Even a cursory look at the major revenue sources of the state –sales tax, excise, electricity duty, royalty on minerals, proceeds from sales of forest produce, etc. indicate that the major if not the preponderant sources of revenue are located in Jharkhand. Political problems cannot of course be divorced from their cultural moorings and economic compulsions.

The rate of growth of the country's GNP have jumped from below 3 percent upto the 1980s to above 5 percent during the 1990s. But has this jump been enough to make a substantial impact on the lives of the poor tribals of this 'rich yet poor' region.

Now in the era of globalization, there has been initiatives for the development of this region, not by 'Our government' but from the world Bank.

According to PIRG (Public Interest Research Group) "the world bank has launched a huge project named BPDP (Bihar Plateau Development Project) in the Chotanagpur region. This project is meant to promote 'sustainable development' and 'improve living standards of poor tribals in this region through construction of Roads, irrigation and agricultural development and drinking water schemes".

"While recommending Rs. 350 crore ($117 million) credit for B.P.D.P. Mr. Lweis Preston, President WB, acknowledge the poor performance of the Bank funded projects in this plateau. He admitted that, "most of these projects have experienced implementation problems causing delays in projects mobilization and procurement, poor quality construction and maintenance of infrastructure (Irrigation, rural roads etc.), inadequate preparation and implementation of resettlement plans for affected families".

Here, interesting point is that, the B.P.D.P. is a part of the tribal sub-plan reduced to an area plan and other schemes, As a result, most resources all used for development of the region (such as roads, infrastructure, development, etc) rather than tribals.

The tribals directly benefit upto a mere 20% of the funding. The rest 80% goes towards the development of infrastructure and maintenance of services. Hence the direct beneficiaries are the big industrial houses, transnational corporations and local elites".[28]

As there has been advancement in technologies, these has been better surveying and monitoring of our natural resources. Remote sensing is quite usful in making inventory of land use data and mapping. Utilization of high resolution imagery could reduce both the time and cost involved in securing the desired land information. And we all know that many potential applications of remote sensing have been established in major sector of the economy such as agriculture, forestry, geology human settlement, ecology etc. Remote sensing can be used for chotanagpur region to detect, identity, measures and monitor the agricultural phenomena such as land use potential, agricultural land use change, soil surveys, water resource surveys, transportation network, crop identification, crop acreage, crop vigour, crop density, growth rate yield forecasting, actual yield, soil fertility, drought prediction, plant disease infestations, flood warning, agricultural land –use mapping etc.

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[28] (PIRG Public Interest Research Group), 142 Maitri Apt. Plot No. 28, Indeaprastha Ext. Delhi 110092 India phy. 232054 Fax 2224233, email: kaval@pirg.unv.ernet.in).

Chapter III

DYNAMICS OF LANDUSE AND OCCUPATIONAL STRUCTURE

The economy of Chotangpur has two aspects one is where indigenous tribals practise sedentary subsistence farming with most primitive tools and equipments and it is barely enough for their survival and no commerce plays any role here. Another is where the government apparatus has applied machines, equipments, tools and instruments of production e.g. mining, industries services etc. The former are rural areas and later has urban centres and towns attached to them.

To examine the dynamism of economy of Chotanagpur region, let us first see the Land use pattern of this region.

Landuse

Land is the most basic natural resource upon which various economic activities are dependent.

"By landuse we mean the relative portion of lands put under different uses and the appearance of their regional distribution on the landscape. The relative proportions of the different landuse types give us an idea of the nature of the landuse balance".[1]

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[1] Sinha, R..N.P. (1965) "Present land use pattern in Canal irrigated areas of patna district, Bihar", The Geographical outlook, Vol.4, p.63.

Forest

In the whole region, forest area has remained almost the same with very minute increase in 1991. In 1971 forests accounted for 29.21% of the total reporting area and it became 29.24% in 1991, and the difference in percentage terms is only 0.03% between 1971 and 1991, whereas simple growth rate of forest area in 20 years i.e. (1971 and 1991) has been 0.19%.

Now the districtwise scenario of forest area as proportion of reporting area is somewhat varying. In three districts out of six districts the forest area has decreased in the last 20 years from 1991 and these districts are Palamau, Dhanbad and Ranchi. In Palamau 48.05% area was under forests in 1971 but it reduced to 43.68% in 1991. The difference in percentage is -4.37 in 1991. The growth rate in forests in last 20 years in Palamau is –9.08%.

Another district is Dhanbad where 8.38% area in 1971 and 7.83% area in 1991 was under forests as percentage of reporting area. The growth rate in last 20 years form 1971-1991 is –6.51%.

Ranchi has serious decline in forests i.e. from 23.54% in 1971 to 18.69% of the reporting area in 1991 which is a difference of –4.85%. The growth rate between 1971-1991 is –20.61%.

Three district which show some increase in forest area are Hazaribagh, Santhal Pargana and Singhbhum.

Hazaribagh had 40.17% in 1971 and 43.04 in 1991, area under forests as percentage of reporting area and the growth rate is 7.14 .Santhal Pargana had 10.26% in 1971 and 13.47% forest area in 1991 as percentage of reporting area of the district. The growth rate is 31.91. Singhbhum had 29.07% and 32.9% in 197 and 1991 respectively and here growth rate of forest area is 13.18%.

The decline in forest should be due to outward expansion of the urban areas in Ranchi and Palamau and mining may be the cause in Dhanbad where various operational coal mines are there are and other industrial activities might have led to depletion of forests. On the country it seems that there has been satisfactory work done by the forest department in some districts in checking the felling of trees on large scale and several other factors have led to increase in area of forests in 3 districts such as social forestry programmes etc.

Area not Available for Cultivation

This category of landuse has increased in all the districts except Hazaribagh where there is a minor decrease i.e. from 15.1% in 1981 to 14.55% in 1991. In all other districts it has increased such as Palamau the increase is from 9.18% of the reporting area in 1971

to 10.63% in 1991. The difference in 1.45%. The growth rate in 20 years is 15.78%.

In Dhanbad it has increased from 32.18% in 1971 to 39.93 in 1991. A difference of 7.75% in the 20 years. The growth rate of the area not available for cultivation in this district is 24.09%.

In Santhal Pargana it is 14.68% and 14.81% in 1971 and 1991 respectively which shows a slight growth rate of 1.34. Whereas in Singhbhum there has been growth from 15.83 (1971) to 21.26 (1991) and shows an increase of 5.43% in between 1971 to 1991, the period of 20 years. The growth rate is 34.24%.

Ranchi has 10.41 (1971) and 11.97 (1991). A growth rate of 14.96. The area has increase 1.56% of the reporting area in 20 years.

Overall if we see in the whole Chotanagpur region 'the area not available for cultivation' was 13.77% of the reporting area in 1971 and it increased to 15.47% in 1991 i.e. increase of 1.7% in the time-period of 1971 to 1991. The growth rate is 12.43%.

Actually, this category of landuseit covers a wide range of uses which can be buildings, factories, river, paths railways and roadways or under water, e.g. rivers, canals, reservoirs and tanks and various other use. This type of land is bound to increase in most of

the developing areas where due to urbanisation more and more land is put under constructions installations e.g. building, factories etc. And also there is an inevitable expansion of village and towns due to increase in population. Due to migration from rural areas to urban areas the urban areas are growing fast and this region is no exception in this regard. Hence one can see indiscriminate encroachment on the cultivated land in sub-urban areas due to outward expansion of towns and cities e.g. Ranchi, Jamshedpur, Bokaro steel city, Dhanbad. All have be facing areal expansion in last several decades. The reason is natural increase in population and also more importantly there has been immigration to these areas from rural areas of Chotanagpur as well as from North Bihar. People come here in search of employment and then tend to settle here and the result is that the selective industrial towns are swelling in size and expanding.

The category of 'the area not available for cultivation' also includes Barren and uncultivable land. This type of land is high in those areas where deforestation has been high and rocky ground or land which is infertile exists. Here Dhanbad has highest percentage of reporting area under this category i.e. 32.18% in 1971 and 39.93% in 1991 which can be explained in this way that there has been a lot of coal mining in this district which has converted vast

areas as "caves' or barren land after the coal has been extracted from below. These areas cannot be put to cultivation and are left barren after mining is over and the area is abandoned.

More or less similar reasons explained above has led to the increase in the area not available for cultivation as percentage of the total reporting area, in all the other districts of Chotanagpur region.

Other Uncultivated Land Excluding Fallow Land

This category includes permanent pastures and other grazing lands as well as cultivable wastes. In all the districts there has been some decline in this category of landuse.

In the whole region the area under this category was 7.52% in 1971, which declined to 6.22% in 1991 which shows a decline of 1.3%. The growth rate is negative i.e. –17.29%.

Now districtwise pattern for this category is like this: In Hazaribagh it was 8.11% (1971) and reduced to 5.45% (1991). The decline is 2.66%. The growth rate is negative i.e. –32.82%.

Palamau had 3.2% in 1971 and 3.08% in 1991. It is showing very little decline of 0.12% in 20 years and growth rate is –3.79%.

Dhanbad has 9.76% in 1971 and has come down to 7.31% in 1991 which shows decline of 2.45% in 20 years (from 1971 to 1991). The growth rate is negative i.e. –25.08%.

Santhal Pargana had 12.23% under this category in 1971 and declined to 10.95% in 1991 and the percentage decline is 1.28% of the total reporting area in last 20 years (1971 to 1991). The growth rate is –10.01%.

Singhbhum has 8.26% (1971) to 21.26 (1991) which is 1.57^% less than the former and the growth rate is negative i.e. – 19.01%.

Ranchi had this category 5.37% of the reporting area in 1971 and declined to 4.92% in 1991 which shows a decline of 0.45% of. The growth rate is –8.43%.

In Chotanagpur the area under pastures is somewhat more than other parts of the Bihar. But the quality of these pastures and grazing is poor because the relief is such that over drainage happens during rains and soil moisture is low there for the major part of the year. Thus livestock rearing is also not an economically profitable endeavour here and it seems that livestock are famished despite of relatively large percentage of land under pastures.

Culturable wasteland is also included in this category. This category includes the land which has not been cultivated for last five years. Such land is not under plough at present, though it can be cultivated through reclamation measures like deep ploughing or levelling and application of fertilisers and sufficient watering. Mining activities in Dhanbad and other district such as Singhbhum has done considerable damage to agriculture and such land is considerably there in the forested districts of Chotanagpur region where in the past shifting cultivation was practised and even now there might be abandoned fallow lands in many areas. But here we see that the percentage of landuse category of 'other uncultivated land excluding fallow' is decreasing and we can say that it may further decrease also. It also appears that in such areas has been subjected to replenishment of forests have been attempted and that is why a few districts such as Hazaribagh, Santhal Pargana and Singhbhum show some increase in their forest area.

Fallow Land

This category refers to two types:

i) All such land which is normally under cultivation but which was not sown during the year under report. This type is known as current fallow.

ii) The poorer type of land which require some longer period of uncultivation (not exceeding five years).

Here we have taken both these categories together and we observe that percentage of fallow land is fairly high in Chotanagpur region in comparison to few other categories. And the area under follow has considerably increased as percentage of reporting area in the period of twenty years of 1971 to 1991.

In 1971 there was 19.23% of land area under fallow which increased to 31.36% in 1991. Now this is a tremendous increase of 12.38% of the reporting area in only 20 years. The growth rate is 25.09%. There has been overall increase in fallow land in all the districts except Singhbhum.

What can explain this phenomenon? Well we can say that being as a plateau region and the relief is uneven so agricultural infrastructure is poorly developed here. The inhabitants of this region practise has a sedentary, subsistence farming which is dependent on monsoon rains and no adequate, alternatives for irrigation is available. Whatever may be the reason for that (we will discuss in the following chapter) the agricultural productivity here is lower in comparison to Northern Bihar and other parts of the country. Farmer doesn't have any profit in cultivating the whole land

FIGURE 3·1

LAND UNDER VARIOUS USES

CHOTANAGPUR REGION

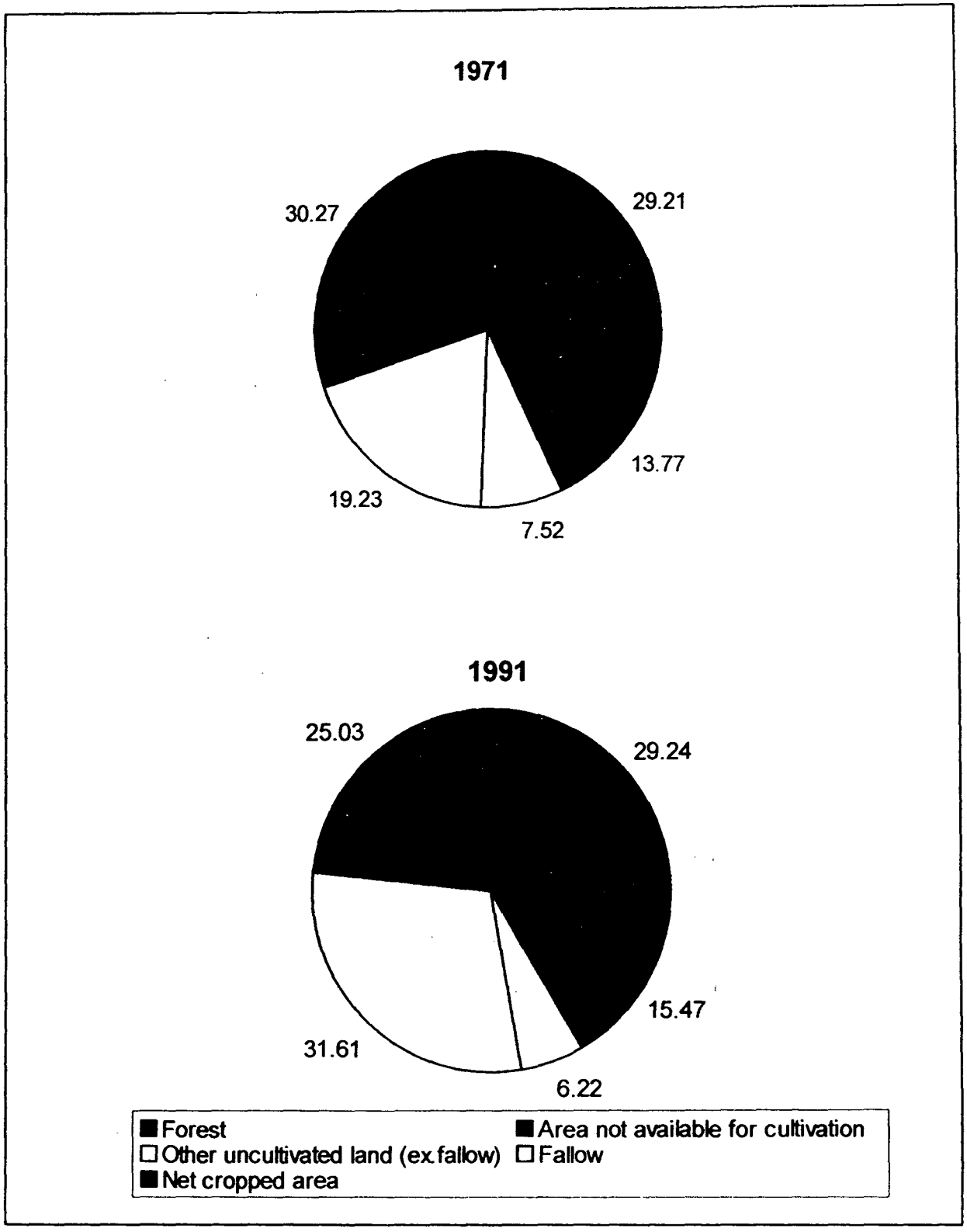


FIGURE 3.2

LAND UNDER VARIOUS USES

HAZARIBAGH

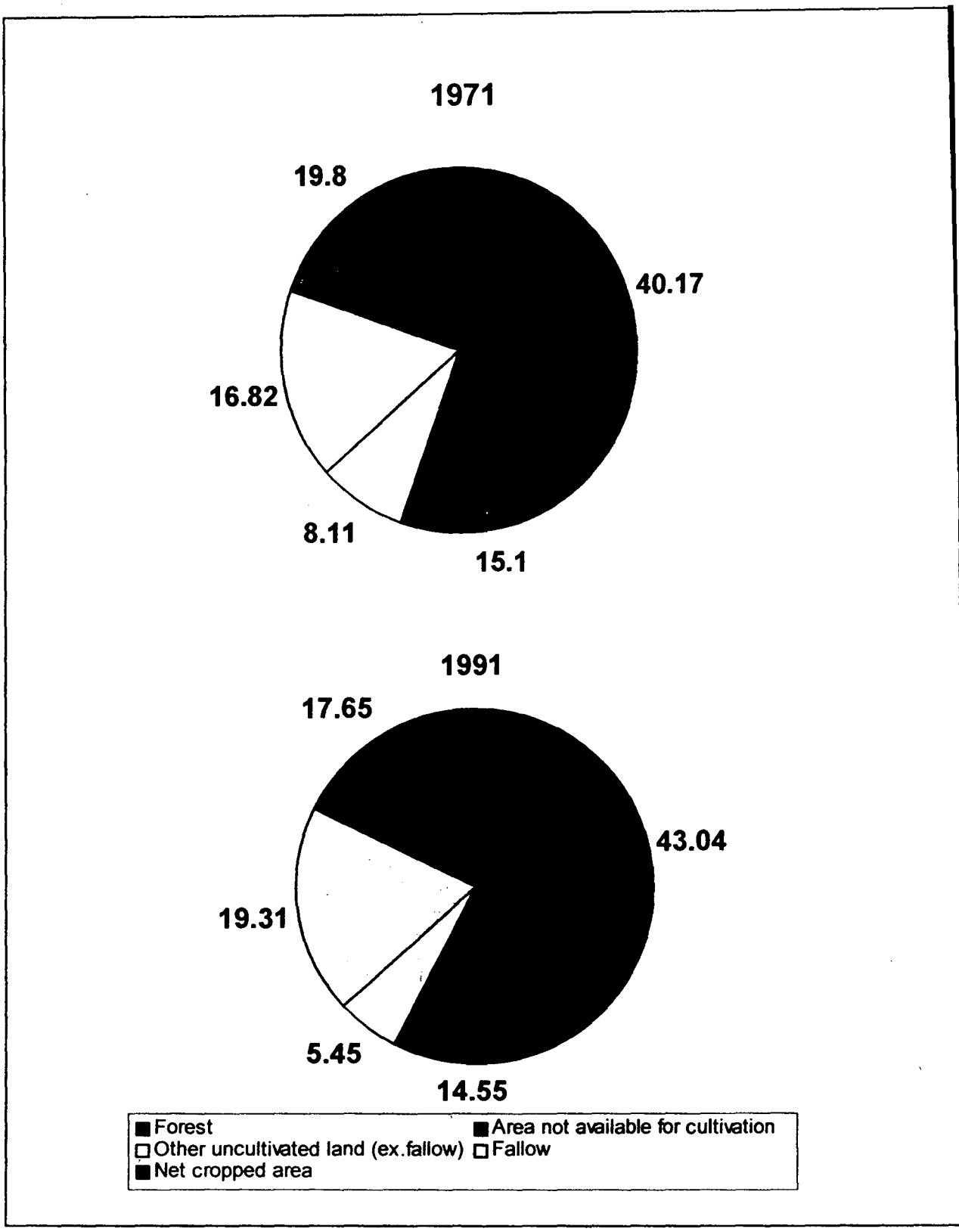


FIGURE 3.3
LAND UNDER VARIOUS USES
PALAMAU

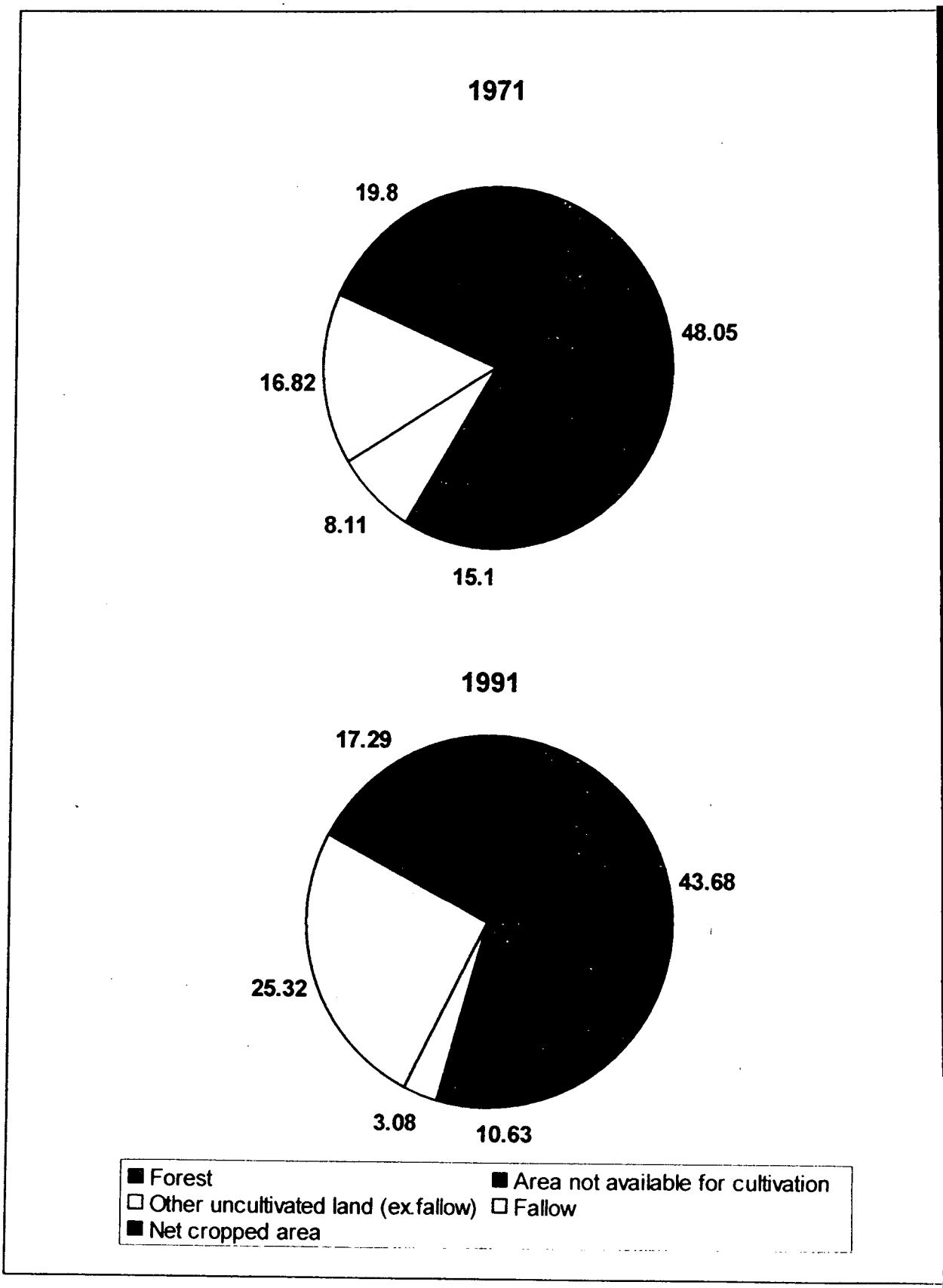


FIGURE 3.4

LAND UNDER VARIOUS USES

DHANBAD

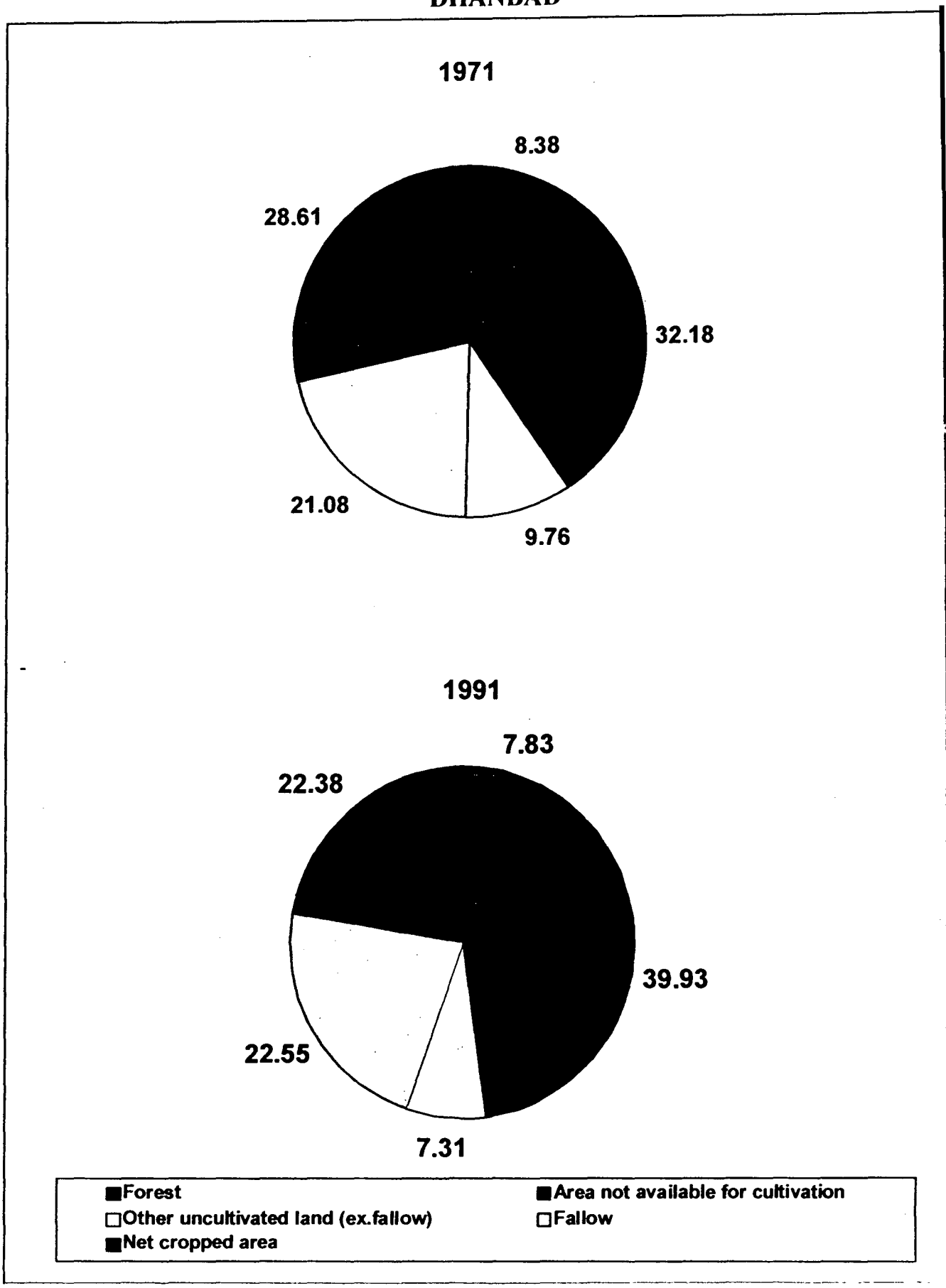


FIGURE 3.5

LAND UNDER VARIOUS USES

SANTHAL PARGANA

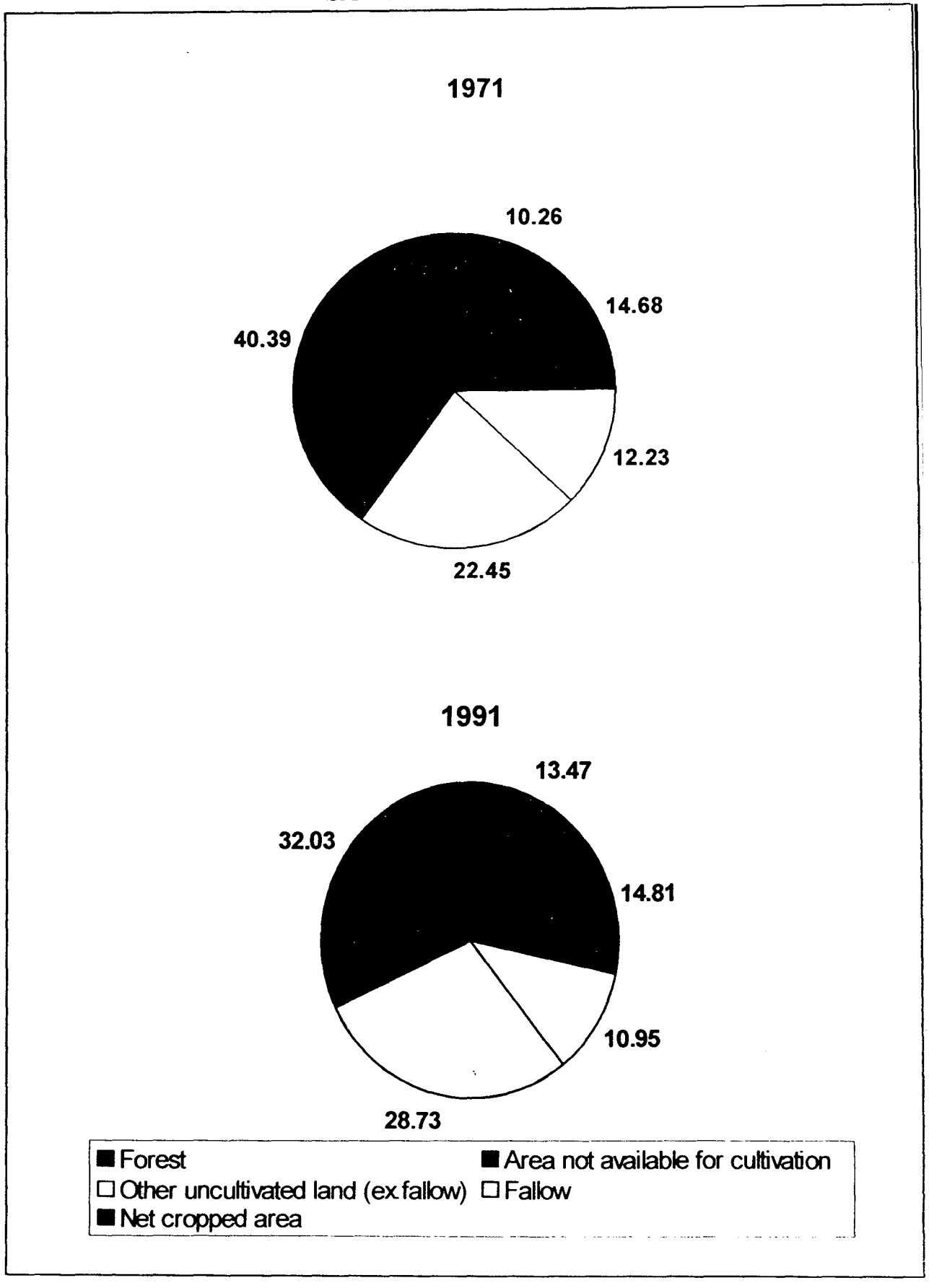


FIGURE 3·6

LAND UNDER VARIOUS USES

SINGHBHUM

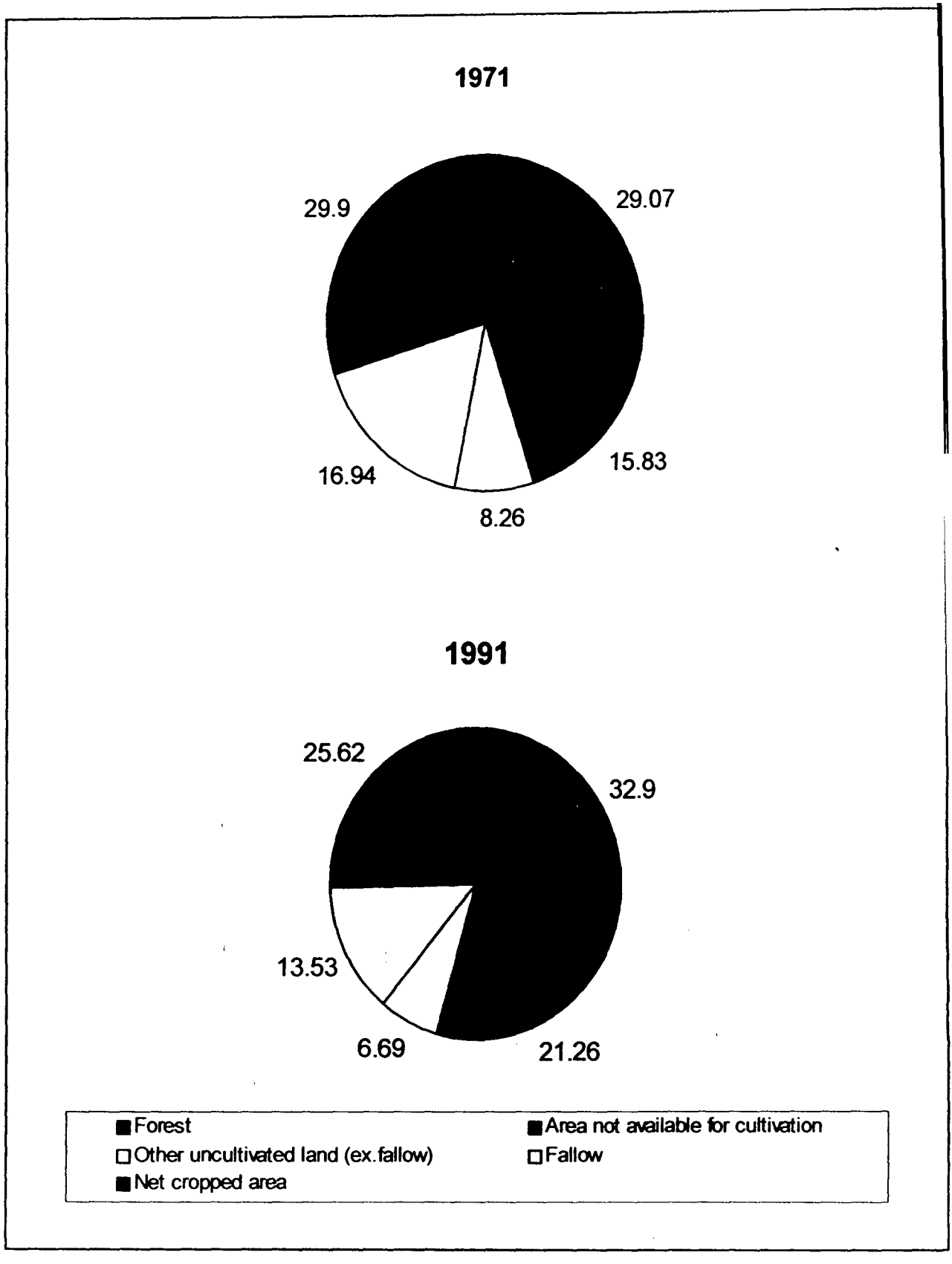
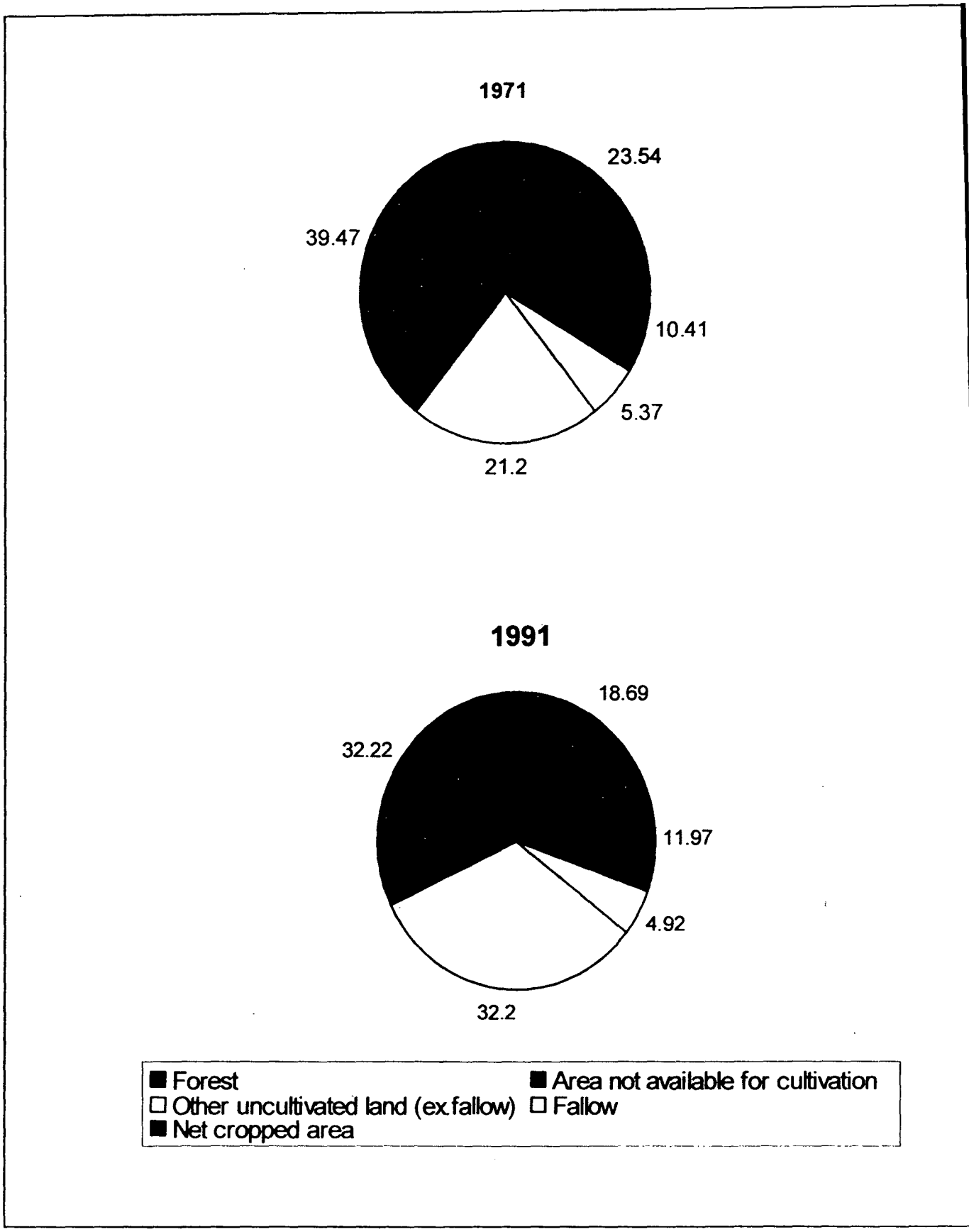


FIGURE 3.7

LAND UNDER VARIOUS USES

RANCHI



he acquires because land only cannot support his family due to the above mentioned reasons. This may be one of the reasons of increase in area under fallow land. In this region there is also less pressure on land so the farmers may be leaving the land for some period to let it regain it fertility through natural process.

Net Sown Area

Entire Chotanagpur region has experienced decline in Net area sown between the period 1971 and 1991. Due to undulating relief and rocky terrain this region has otherwise also relatively very less area under crops and that too is declining.

In the Chotanagpur region as a whole there was 30.27% of reporting area as net sown area in 1971 which reduced to 25.03% of the reporting area in 1991. This is a decline of 5.24% in 20 years period i.e. 1971 to 1991. The growth rate is negative i.e. –17.23%.

Districtwise, among these six districts, Santhal Pargana had maximum area of 40.39% as net sown area in 1971 which reduced to 32.03% in 1991. The decline in net sown area in 20 years is 8.36%. The growth rate is negative i.e. –20.34%.

Ranchi also has also comparatively much area under crops but its declining here also. It has 39.47% in 1971which declined to

32.22% in 1991. This decline is of 7.25%. And the growth rate is –18.36%.

Hazaribagh had 19.8% (1971) and 17.65% (1991). The difference in percentage between two time periods is 2.15%. The growth rate is –10.84%.

Palamau had 21.34% in 1971 and came down to 17.29 in 1991 which is a decline of 4.05% as percentage of reporting area of landuse. The growth rate is –19%.

Dhanbad had 28.61% in 1971 which came to 22.38% in 1991, a reduction of 6.23% as percentage of reporting area. The growth rate is negative i.e. –21.77%.

Singhbhum had 29.9% in 1971 and is 25.62% in 1991. The difference is 4.28% and –14.3% is the growth rate for 20 years.

The net sown area is high in Ranchi and Santhal Pargana because the extent of undulating topography is vast and forest cover in Santhal Pargana and Ranchi is relatively lesser than other districts of Chotanagpur.

Generally speaking, in all the districts the proportion of the net sown area varies according to the proportion of area under forest. There is more or less an inverse relationship between the two. In

1971, in Santhal Pargana the forest area was only 10.26% and net sown area was 40.39%. Then in 1991 the forest area increased to 13.47% whereas net sown area declined to 32.03%. Though it cannot be said that these two categories are having cent percent inverse relationship but to the trend shows that if one has increased, then other has shown decrease in areal extent.

Gross Cropped Area

Gross cropped area is net sown area + area sown more than once. Since 'area sown more than once' is declining in all the districts so gross cropped area is following the same pattern.

In Hazaribagh Gross cropped area was 22.1% in 1971 which declined to 19.78 in 1991. The decline by 2.23% and growth rate shows negative trend of –10.53%.

Whereas in Palamau 26.55% (1971) has declined to 19.36% (1991) and decline is 7.2% and growth rate is –19%.

In Dhanbad from 30.53% in 1971 to 23.54% and growth rate is –22.89. In Santhal Pargana the decline is from 46.25% in 1971 to 34.59% in 1991. The decline is of 11.66% in 20 years and Growth rate is showing negative sign which is –24.89%.

Singhbhum had 30.98% in 1971 which came down to 26.95% and difference is –4.03%. The growth rate is –13.01 and Ranchi had 43.05\7% in 1971 and 35.80% in 1991. The decline is of 7.27%. The growth rate is –16.86%.

Overall in Chotanagpur there was 33.74 area gross cropped which cam down to 27.38%. So it shows a decline of 6.36% and growth rate is –18.78%.

The sown area or the cropped area is land used for standard production of grains, vegetables, and other plants consumed by people or fed to animals for human consumption. Adequate soil and water supply through rain or by other means is required for crops and most of the crops have a limited range of temperatures to which they can be exposed. Net sown area or gross crop area (NSA + Area sown more than once) also includes land that is not naturally fertile but can be used agriculturally through some application of manures, fertilisers and water supply for irrigation of the land. Hence the area covered by cropland is dynamic and keeps changing i.e. expanding or contracting from year to year. Expansion is caused by conversion of some other land to agriculture by applying technology or human efforts. Some expansion of area under crops is also accomplished through clearing forests e.g. slash and burn.

According to Roger and Feiss (1998).[2] In many developed countries the shrinking of area under crops is many a times a deliberate decision to reduce overproduction of food and allow some cases in all over the world an unfortunate reason is environmental degradation e.g. erosion of soil, nutrients leached out from the soil, or contamination of soil or water by human actions.

The landuse of Chotanagpur reflects the influence of several physical and human factors. Forests are almost some in both the time periods (1971 and 1991) but there has been serious depletion of forests in some districts such as Ranchi and Palamau but overall due to increase in some districts the picture of forests has become satisfactory. Area not available for cultivation has increased overall and area of other uncultivated land except fallow has decreased. The trends reflect an increasing pressure of population on land in some areas owing to which fresh areas are being brought under plough. Net sown area, the largest component of landuse has, however, declined and there appears to be a diversion of landform forest, trees and grass to that in the agricultural sectors. However a better way of extending agriculture would be to convert cultivable waters and fallow lands (which is showing an overall increase in all the

[2] Rogers (J.W.) and Feiss P.G.: (1998) People and the Earth: Basic Issues in the sustainability of Resources and Environment, Cambridge University Press; p.4.

districts) to net sown area, presumably by higher inputs of irrigation and fertilisers etc. The presence of forest is incommensurate with the habit and policies of the tribal people who derive their livelihood also from the collection of forest products. Wherever there is a lowland area, there net sown are increases. In Santhal Pargana the net cropped area is more than 46% of the reporting area in 1971 and 35% in 1991. It seems that some area of net sown area of 1971 has been transferred to fallow and some to forest because these two show a high positive growth rate of 29 and 32 respectively.

The overall increase in fallow land is partly on account of poor agricultural practices in certain areas and also to the infertile character of the soil. The percentage of agricultural land can be raised by bringing the 'fallow' and 'other uncultivated land excluding fallow' under plough every year. The tribes living in more rugged terrain and hilltops and ridges have also comparatively less interest in agriculture, and lowlanders are basically engaged in agriculture activities.

Irrigation

The distribution of the rainfall in the plateau is not with much variation. Because of higher elevation the winds crossing the plateau have to ascend a height of 1000-3000 ft. and consequent cooling,

cloud formation and rain must result in this region. Though due to undulating terrain, surface run-of is high and quick hence the soil is devoid of enough moisture except for the rainy season. Irrigation is needed but infrastructure for irrigation is not developed. Primitive methods like wells, tanks are predominant.

Net Irrigated Area

In Chotanagpur region, overall net irrigated area was only 8.07% of the net sown area in 1971 which further declined to 7.51% in 1991. This was a decline of 0.57% and the growth rate is – 23.03%.

District wise pattern for irrigated area is as follows:

In Hazaribagh in 1971 5.59% was net irrigated area which increased to 8.97% and this is an increase of 3.38% which shows a growth rate of 42.99% in the period of 20 years. Which shows a growth rate of 42.99% in the peered of 20 years (1971 and 1991). In Palamau however there is decline from 25.77% in 1971 to 23.31% in 1991 which is a decline of 2.46% in 1991 has a decline of 2.34% and growth rate is –72.58% in 20 years period.

Santhal Pargana and Singhbhum also show a decline in net irrigated area. In 1971 there was 9.53% and 5.68% net irrigated area

of these two districts respectively, and in 1991 it was 6.24% and 3.44 percent respectively. Hence for Santhal Pargana there was a decline of 3.29% and for Singhbhum a decline of 2.24%.

Ranchi had 3.32% in 1991 and came up to 4.90% which is a 1.57% increase in net irrigated area. This is a growth of 20.26% in 20 years.

"In India, statistics of irrigation is collected along with the land utilisation. In using these data, it must be remembered that besides the area under irrigation, there are other areas which have assured in adequate rainfall and which are now classed as unirrigated land. Further, the more fact that a certain area was irrigated does not necessity imply that the irrigation water was adequate was adequate. (Husain, 1999).

Gross Irrigated Area

Gross irrigated area is also showing almost similar trend as net irrigated area and except for Hazaribagh and Ranchi it is also declining in all other districts. In Ranchi it was 3.30% in 1971 which increased to 5.10% in 1991 and in Hazaribagh it was 6.28% in 1971 which increased to 10.88% in 1991. The increase in Hazaribagh is of 4.6% in between 1971 and 1991 which shows a growth rate of 55.10%.

FIGURE 3.8

CHOTANAGPUR PLATEAU REGION OF BIHAR

GROSS IRRIGATED AREA AS PERCENTAGE OF TOTAL CROPPED AREA - 1971 & 1991

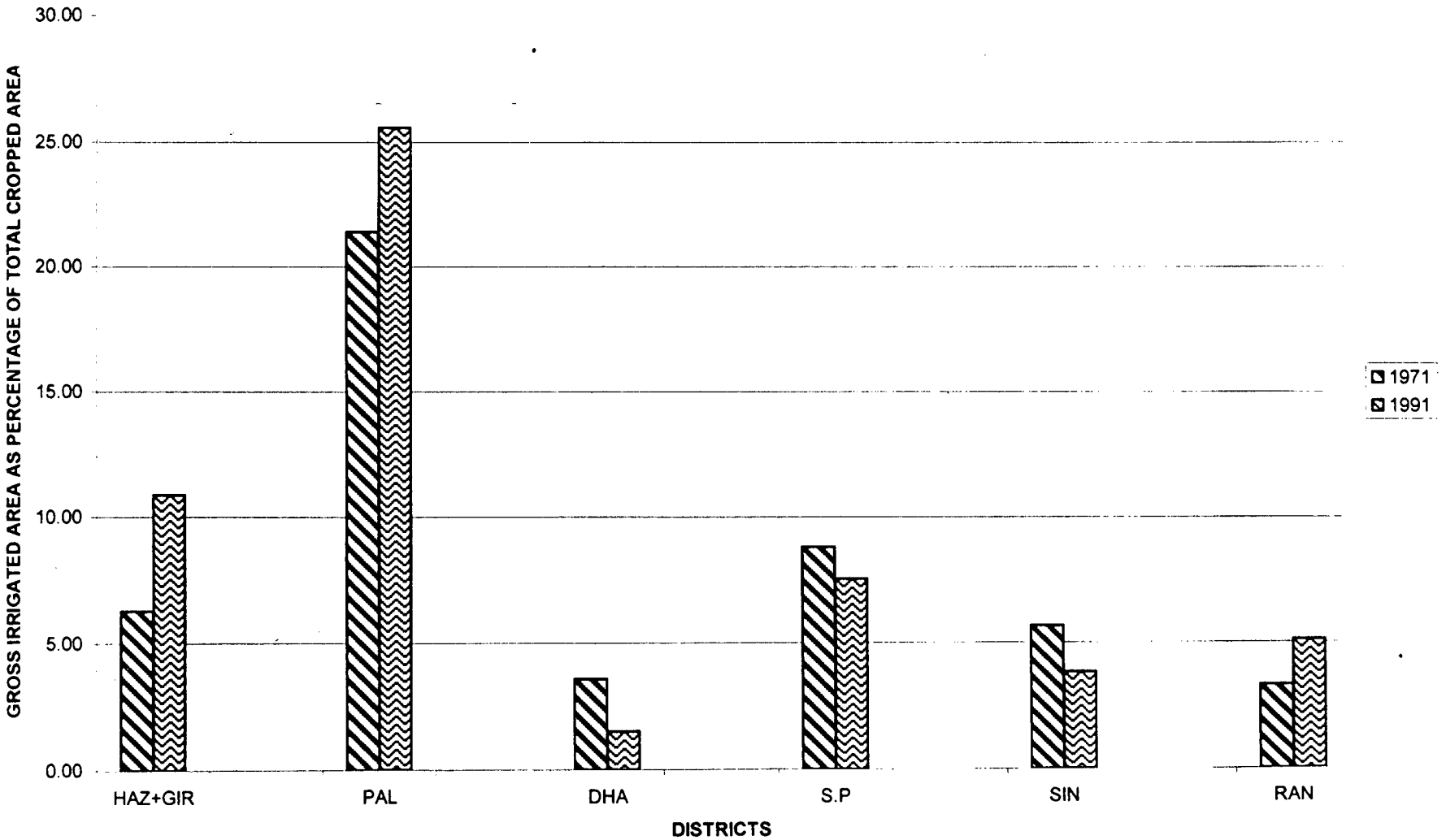
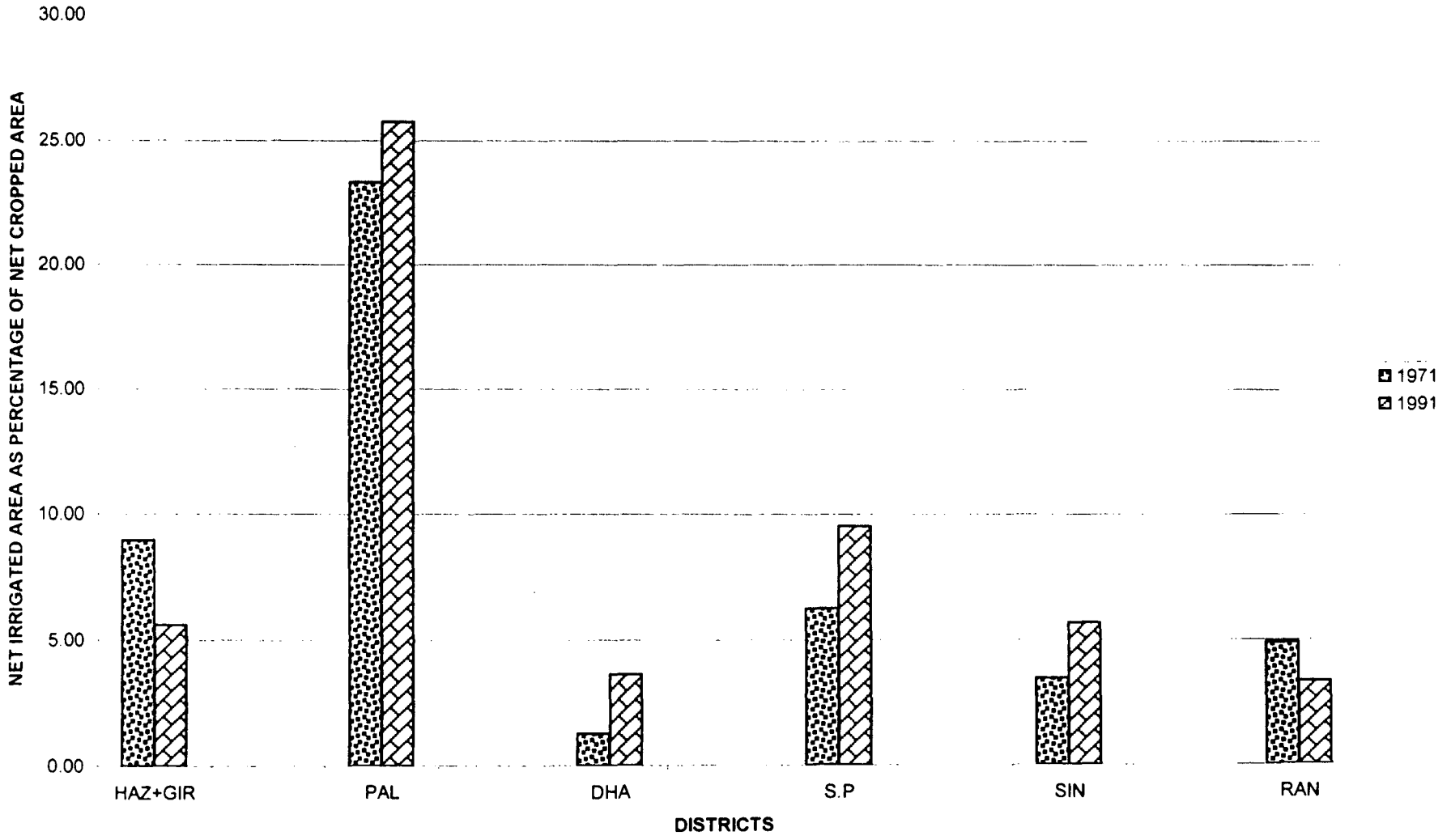


FIGURE 3.9

CHOTANAGPUR PLATEAU REGION OF BIHAR

NET IRRIGATED AREA AS PERCENTAGE OF NET CROPPED AREA - 1971 AND 1991



Rest of the districts are showing similar declining trend as of net irrigated areas (as shown in the tables 3.1 to 3.7).

Cropping Intensity

Overall cropping intensity was 111.5 in 1971 which declined to 109.42 in 1991. This is a decline of 2.08% and growth rate is cropping intensity is –1.87% during the period of 1971 to 1991.

Since entire region has experienced a decline in net cropped area between the two time periods (1971-91) and so has declined the area sown more than once in almost all the districts as discussed in the previous pages. This is why there is low cropping intensity in all the districts. From tables (3.1 to 3.7) it is clear that cropping intensity is 112 for Hazaribagh and 111 for Palamau. 105 for Dhanbad, 107 for Santhal Pargana, 105 for Singhbhum and 111 for Ranchi during 1991 period. Except Singhbhum and Hazaribagh it has declined from 1971 period. In Palamau the maximum decline of 12.4% is observed during the study period. This may be due to the dry climatic condition of the district. It may be due to large portion of the district falling under the rain shadow zone of Parasnath hill. Low irrigation intensity and poor development of agricultural infrastructure may also be one of the reasons for low cropping intensity in the entire region.

The low cropping intensity has directly affected the occupational structure of the region. Workforce in the primary sector has declined in accordance with cropping intensity and except Singhbhum. This has resulted in the increase in the workforce under secondary sector also. All this we will discuss in the following pages.

Irrigation Intensity

This has shown an overall increase in all the districts. In Hazaribagh in 1971 it was 125.32 and increased in 1991 upto 135.93 which is 10.6 more than the previous time-period. The growth rate is 8.47%.

In 1971, Palamau has 103.28, Dhanbad has 105.39, Santhal Pargana, 105.78, Singhbhum has 103.21 Ranchi has 106.9. In 1991 in the same order it is 122.87 for Palamau, 125.33 for Dhanbad, 130.11 for Santhal Pargana, 117.11 for Singhbhum, 115.73 for Ranchi.

There is high growth rate in Santhal Pargana 23$ followed by Palamau 18.97%, Dhanbad, it is 18.92% then Singhbhum it is 13.47% then Hazaribagh 8.47% and lastly Ranchi has growth rate of 6.68%. (Table 3.1 to 3.7)

Whereas highest irrigation intensity is in Hazaribagh in 1991. It is 135.93 followed by Santhal Pargana which has 130.11 in 1991.

Overall Chotanagpur has 106.9 in 1971 and 124.92 in 1991 which shows an increase of 18.02. The growth rate of irrigation intensity in the 20 years period is 16.85% for the whole region.

TABLE-3.1

CHOTANAGPUR
LAND UNDER DIFFERENT USES - 1971 AND 1991

(In Percentage)

CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	29.21	29.24	0.03	0.19
Area not available for cultivation	13.77	15.47	1.7	12.43
Other uncultivated land (ex.fallow)	7.52	6.22	-1.3	-17.29
Fallow	19.23	31.61	12.38	25.09
Net cropped area	30.27	25.03	-5.24	-17.23
Gross cropped area	33.74	27.38	-6.36	-18.78
Area sown more than once	3.53	2.36	-1.17	-33.15
Net irrigated area	8.07	7.51	-0.57	-23.03
Gross irrigated area	7.74	8.57	0.83	-10.05
Cropping Intensity	111.5	109.42	-2.08	-1.87
Irrigation intensity	106.9	124.92	18.02	16.85

TABLE-3.2

HAZARIBAGH LAND UNDER DIFFERENT USES - 1971 AND 1991 (In Percentage)				
CATEGORIES	1971	1991	Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	40.17	43.04	2.87	7.14
Area not available for cultivation	15.1	14.55	-0.55	-3.62
Other uncultivated land (ex.fallow)	8.11	5.45	-2.66	-32.82
Fallow	16.82	19.31	2.49	14.78
Net cropped area	19.8	17.65	-2.15	-10.84
Gross cropped area	22.11	19.78	-2.33	-10.53
Area sown more than once	2.3	2.12	-0.18	-7.87
Net irrigated area	5.59	8.97	3.38	42.99
Gross irrigated area	6.28	10.88	4.60	55.10
Cropping Intensity	111.67	112.06	0.39	0.35
Irrigation intensity	125.32	135.93	10.61	8.47

TABLE-3.3

PALAMAU LAND UNDER DIFFERENT USES - 1971 AND 1991 (In Percentage)				
CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	48.05	43.68	-4.37	-9.08
Area not available for cultivation	9.18	10.63	1.45	15.78
Other uncultivated land (ex.fallow)	3.2	3.08	-0.12	-3.79
Fallow	18.23	25.32	7.09	38.92
Net cropped area	21.34	17.29	-4.05	-19
Gross cropped area	26.55	19.32	-7.34	-27.12
Area sown more than once	5.23	2.06	-3.17	-60.35
Net irrigated area	25.77	23.31	-2.46	-26.74
Gross irrigated area	21.40	25.59	4.19	-12.85
Cropping Intensity	124.41	111.95	-12.46	-10.02
Irrigation intensity	103.28	122.87	19.59	18.97

TABLE-3.4

DHANBAD

LAND UNDER DIFFERENT USES - 1971 AND 1991

(In Percentage)

CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	8.38	7.83	-0.55	-6.51
Area not available for cultivation	32.18	39.93	7.75	24.09
Other uncultivated land (ex.fallow)	9.76	7.31	-2.45	-25.08
Fallow	21.08	22.55	1.47	6.97
Net cropped area	28.61	22.38	-6.23	-21.77
Gross cropped area	30.53	23.54	-6.99	-22.89
Area sown more than once	1.93	1.17	-0.76	-39.37
Net irrigated area	3.61	1.26	-2.34	-72.58
Gross irrigated area	3.56	1.51	-2.06	-67.40
Cropping Intensity	106.75	105.23	-1.52	-1.42
Irrigation intensity	105.39	125.33	19.94	18.92

TABLE-3.5

SANTHAL PARGANA

LAND UNDER DIFFERENT USES - 1971 AND 1991

(In Percentage)

CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	10.26	13.47	3.21	31.91
Area not available for cultivation	14.68	14.81	0.13	1.34
Other uncultivated land (ex.fallow)	12.23	10.95	-1.28	-10.01
Fallow	22.45	28.73	6.28	28.56
Net cropped area	40.39	32.03	-8.36	-20.34
Gross cropped area	46.25	34.59	-11.66	-24.89
Area sown more than once	5.91	2.58	-3.33	-56.08
Net irrigated area	9.53	6.24	-3.29	-47.82
Gross irrigated area	8.80	7.52	-1.28	-35.82
Cropping Intensity	114.54	107.99	-6.55	-5.71
Irrigation intensity	105.78	130.11	24.33	23

TABLE-3.6

SINGHBHUM
LAND UNDER DIFFERENT USES - 1971 AND 1991

(In Percentage)

CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	29.07	32.9	3.83	13.18
Area not available for cultivation	15.83	21.26	5.43	34.24
Other uncultivated land (ex.fallow)	8.26	6.69	-1.57	-19.01
Fallow	16.94	13.53	-3.41	-20.11
Net cropped area	29.9	25.62	-4.28	-14.3
Gross cropped area	30.98	26.95	-4.03	-13.01
Area sown more than once	1.39	1.34	-0.05	-3.52
Net irrigated area	5.68	3.44	-2.24	-48.16
Gross irrigated area	5.66	3.83	-1.83	-41.18
Cropping Intensity	103.63	105.2	1.57	1.51
Irrigation intensity	103.21	117.11	13.9	13.47

TABLE-3.7

RANCHI
LAND UNDER DIFFERENT USES - 1971 AND 1991

(In Percentage)

CATEGORIES	1971	1991	% Difference	Growth rate
	(a)	(b)	(b-a)	
Forest	23.54	18.69	-4.85	-20.61
Area not available for cultivation	10.41	11.97	1.56	14.96
Other uncultivated land (ex.fallow)	5.37	4.92	-0.45	-8.43
Fallow	21.2	32.2	11	51.86
Net cropped area	39.47	32.22	-7.25	-18.36
Gross cropped area	43.07	35.80	-7.27	-16.86
Area sown more than once	3.58	3.58	0	-0.4
Net irrigated area	3.32	4.90	1.57	20.26
Gross irrigated area	3.30	5.10	1.79	28.29
Cropping Intensity	111.5	111.13	-0.37	1.84
Irrigation intensity	106.9	115.73	8.83	6.68

Occupational Structure

To understand and examine the dynamics is occupational structure as a part of the study of dynamics of economy of the Chotanagpur region, here we have taken the nine categories of workers form the census which are as follows:

i. Cultivation
ii. Agricultural labour
iii. Forestry, fishing, plantations
iv. Mining and quarrying
v. Manufacturing in household industry
vi. Manufacturing in other than household industry
vii. Construction
viii. Trade and Commerce
ix. Transport, storage and communication
x. Service.

The industrial category of workers here include, primary, secondary and tertiary economic activities. The first four categories represent primary activities. Categories V (a), V (b) and VI represent the secondary sector, while categories, VII, VIII and IX represent tertiary service. The categories I and II relate to agriculture, which is considered to be a rural activity by most scholars. The category III and IV has a combination which is both urban and non-urban nature. Especially category IV which is mining of metallic and non metallic

minerals which are abundant in our study region, represents an organised industrial sector and has a definite urban connotation, though not in all cases. In similar way plantations of the III category also have an urban character whereas forestry, fishing are rural in character. Next categories i.e. V (a), V (b), VI, VII, VIII and IX have a certain association with urban locations. However, household industry, construction, trade and commerce, and services are all represented in rural areas as well.

Occupational Structure in Chotanagpur Region

The occupational structure in Chotanagpur has been dynamic in the period of 20 yeas of our study period and there has been changes in the percentages of worker engaged in primary, secondary and tertiary occupation. The following table, (Table No.3.8) if we see we find very interesting trends:

Table 3.8
Chotanagpur
Occupational Structure (in percent)

	Primary		Secondary		Tertiary	
District	1971	1991	1971	1991	1971	1991
Santhal Pargana	87.70	84.00	4.83	5.82	7.47	10.18
Hazaribagh	85.27	73.96	5.04	7.17	9.69	18.87
Dhanbad	65.22	54.84	14.58	16.46	20.19	28.71
Ranchi	81.11	63.62	7.43	7.09	11.45	29.30
Palamau	90.20	81.59	3.22	4.72	6.58	13.70
Singhbhum	72.87	90.44	15.36	4.12	11.77	5.45
Chotanagpur	81.23	81.12	8.09	6.15	10.65	12.73

The only districts which shows an increase in the Primary occupation is Singhbhum and overall in the Chotanagpur region we see that in the last 20 years (1971-1991). There is an increase in tertiary occupation significantly. There is an increase of 2.05% from 1971 to 1991 in the tertiary occupation in the whole region. There is a decrease of 0.11% in Primary occupation in the region, (in 1971 it was 81.23% and in 1991 it is 81.12%) whereas in secondary occupation there is a decrease of 1.94% (in 1971 it was 8.09% and in

1991 it is 6.15%). So in the region tertiary sector is going up (as it was 11.77% in 1971 and 12.73% in 1991).

In the district wise pattern, we can see from the table that Dhanbad. There is lowest number of workers in primary occupation as percentage of total workers. In 1971 there were only 65.22% in primary whereas in 1991 it further declined to 54.84%. The district has maximum proportion of secondary of the total workers in the districts i.e. 16.46% and it has increased by 1.87% in 1991 from 1971.

Other conspicuous change is in Ranchi where tertiary sector has boomed up. There is sharp increase of 17.84% from 1971 to 1991 in tertiary occupation in the district. And it shows sharp decline in primary occupation of 17.50% decrease from 1971 to 1991. The secondary occupation in more or less same in this period as the change is only of 0.35% decline during the 20 years.

Hazaribagh also shows an increase of 9.18% as tertiary occupation during this period and Palamau has 7.11% increase in the same.

The Singhbhum Primary sector has an enormous increase which is 17.56% in 20 years. It was 72.87% in 1971 which became 90.44%.

Here overall primary workforce has declined in all the districts except Singhbhum. This has resulted in the increase in secondary and tertiary sector. Workforce under secondary sector has increased in Santhal Pargana, Hazaribagh, Dhanbad and Palamau districts and large number of heavy as well as small scale industries have been set up in these districts in recent years which may be the reason behind this shift in workforce.

More gains has been observed in tertiary sector and this may be due to large scale migration of rural people from neighbouring areas to the districts of Ranchi, Hazaribagh, Dhanbad, Palamau and Santhal Pargana.

Only the change in Singhbhum is somewhat ambiguous. East Singhbhum is a highly industrialised district and Jamshedpur, Ghatsila, Mushabani, Dhalbhumbagh, Baharagora are important centres of industries and mining. Whereas West Singhbhum is a lesser-developed district of the region which has influenced the data which had been clubbed to make it comparable, overtime and reasons already explained in the introductory chapter. Except this district the results of other district are quite apparent and understandable.

FIGURE 3.10

OCCUPATIONAL STRUCTURE 1971
CHOTANAGPUR REGION

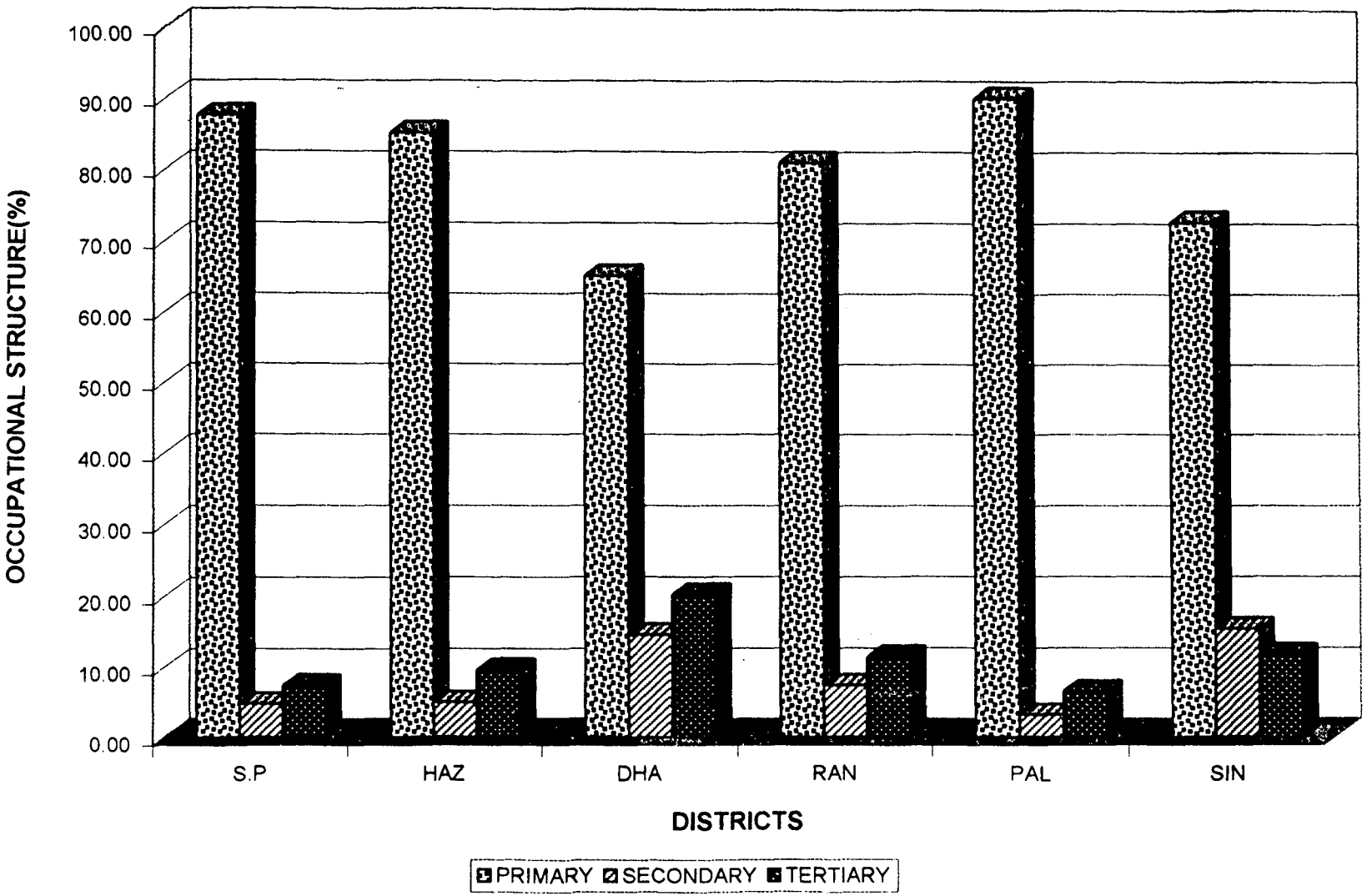
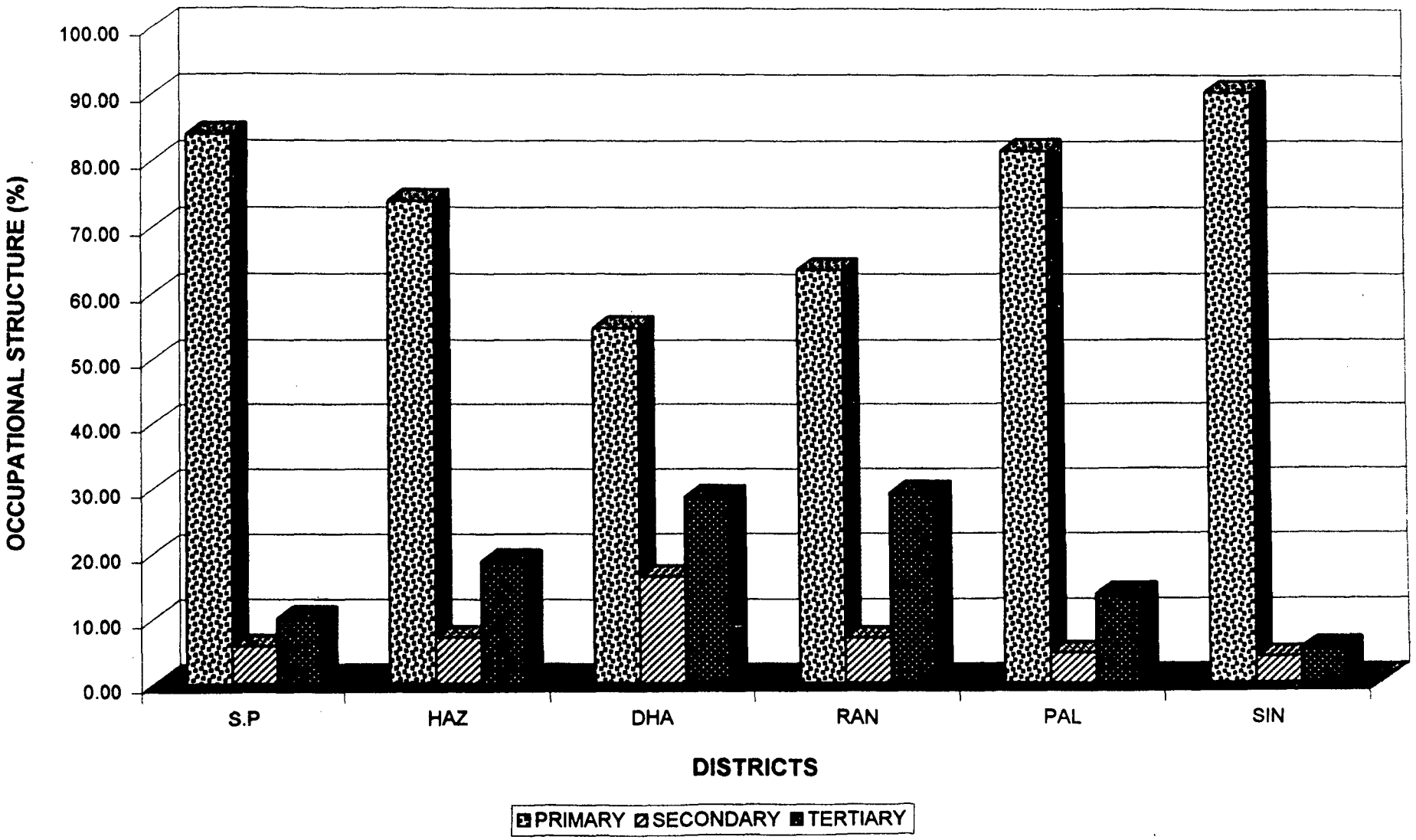


FIGURE 3·11

OCCUPATIONAL STRUCTURE 1991
CHOTANAGPUR REGION



Occupational Structure and Rural-Urban Population Composition

The trend is quite apparent from the table no.3.9 that there is an overall increase in the urban population in all the districts and a decline in rural population.

Table No 3·9

Chotanagpur

Rural and Urban Population

(In percent)

	Urban		Rural	
District/year	1971	1991	1971	1991
Santhal Pargana	5.76	7.33	94.24	92.67
Hazaribagh	12.87	16.91	87.13	83.09
Dhanbad	43.51	51.30	56.49	48.70
Ranchi	13.67	22.30	86.33	77.70
Palamau	4.69	5.34	95.31	94.66
Singhbhum	26.24	33.43	73.76	66.57
Chotanagpur	16.01	21.35	83.99	78.65

The percentage increase in urban population is maximum in Ranchi and Dhanbad i.e. 8.63% increase and 7.79% increase in the period of 1971-1991.

Lowest increase in urban population is in Palamau i.e. 0.65 in the period of 20 years.

Overall in the region the increase in urban population is 5.34% in the period 1971-1991.

Here we can see that the rural urban structure is quite similar to the occupational structure of the region. For instance Palamau has highest percentage of rural population, i.e. 95.31% in 1971 and 94.66% in 1991 where also the maximum percentage of workforce is engaged in primary occupation. And the trend is more or less in accordance with occupational structure for all the districts of the region.

Chapter IV

MAN AND ENVIRONMENT INTERRELATIONSHIP

"Generally speaking the environment is equated with nature wherein physical components of the planet earth viz. Land, air, water etc. support and affect life in the biosphere". Goudie (1984).[1]

The environment has always been dynamic and human beings have survived to date with a long history of interaction and interrelationship with the environment but humans are also directly or indirectly responsible for environmental degradation.

"Environmental and economic interdependence is strongly linked to the development and diffusion of technology. For sustainable development and environment protection, clean technologies and management practices have a significant role to play as liberalisation of economy and institutional reforms that encourages consumerisms". Singh (1998).[2]

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1 Goudie, A., (1984) Nature of the Environment, Basil Blackwell Publishers Ltd. 33, pp.

2 Singh,Ak . (1998) Indian Environmental Marketing: Issues and Prospects: Kurukshetra, June 1998, pp.31-33.

But nevertheless there has been a growing awareness in India of the fragility of the environment and that there is need to save and protect the forest resources, water resources and the land. Various lobbies and non-governmental organisations are trying to persuade the government to adopt environment friendly policies.

Forest Economy in Chotanagpur

Trees have a rightful place in the general economy of the Chotanagpur region as well as in all other tribal regions of India. Forests have had a sacred place in India since ancient times and scientifically also trees mean water, water means bread and bread is life. Tribals of Chotanagpur are very much dependent on forest to supplement their income and to them its importance can hardly be exaggerated. Hence it is paramount concern of our forest policy that area under forest should be over 33% of the land area whereas, in the region only 29.24% area is under forests and only two districts, viz., Hazaribagh and Palamau have more than 33% forest cover.

The existing 29% of the area under forests is much less, even to maintain some amount of balance in the economy, environment and society in the region. The felling of the trees is like an added fuel to the fire to the degenerated and dissipated forest resources.

Saving the Forests

The National Forest Policy introduced by the government in 1988 to improve the forest base in the country is one among the many measures taken in this direction. There has been restructuring of forest departments to protect and regenerate forest wealth through social forestry and other programmes.

The tribals also backed by the Christian minorities in Chotanagpur area are spearheading the tribal movements against Mega projects in the forest areas. The past experiences of the Mega Projects shows that these had resulted in displacement of large numbers of tribals. The uprooted tribals after living in hapless situations without proper rehabilitation had become frustrated and are now becoming apprehensive. It is right that the government has made efforts for the development of the nation but it is also true that the government failed to provide alternative arrangements for the displaced tribals in many cases of minor dams and major projects. Thus such protests from the tribals are creating aspersions suspecting their integrity and the voluntary organisations supporting them are branded anti-nationals.

Forest Fire

Forest fire is one of the degrading factors which extensively

damage the growing stock and leaving the area open for erosion of the soil. In India, no accurate statistical data is available about the forest fire. The available data, if any is not so reliable as there is no systematic approach adopted to gather such data. Besides there is also no forest fire forecasting system available.

It is opined, "As per an estimate by Forest Survey of India (FSI), 51% of forest area in Assam, 93% in Andhra Pradesh, 67% in Bihar, 51% in Gujarat, 69% in Himachal Pradesh, 46% in Jammu and Kashmir, 45% in Gujarat, 69% in Himachal Pradesh, 46% in Jammu and Kashmir, 45% in Karnataka, 76% in Madhya Pradesh, 99% in Manipur, 94% in Meghalaya, 87% in Nagaland, 94% in Orissa, 37% in Sikkim, 58% in Uttar Pradesh and 33% in West Bengal gets affected by ground fire every year." satendra(1999)[3]

Forest and Hydrological Cycle

It is well known that forests influence the hydrological cycle and studies have shown that precipitation over forested areas are higher compared to non-forest areas. This can be observed everywhere and also in Chotanagpur region. (A water balance has been computed to argue this aspect in Chapter V of this study, which

[3] Satendra: (1999) Forest Fire: Problem and Solution; Kurukshetra; Ministry of Rural Areas and Employment, vol.47, no.7, April 1999, pp.50-51.

is a hydrological exercise on the basis of Thornthwaite's approach of computing water balance and moisture index for the region .There is a definite connection between forests, soil, humidity or simply we can say more forest bring more rains and that leads to water sufficiency in any region which further determines vegetation, crops of that region hence influences economy of that particular area. (Nevertheless relief also plays an important role here as it determines surface-run off and Ground Water storage).

Tribals of Chotanagpur and Forest Management

In India there is 23% of the total geographical area under forests and the recorded area is 77.01 mha. In Chotanagpur there is 29.21% of the reporting area under forests which plays a vital role in the socio-economic and cultural life of the tribal inhabitants. They live near or in the forests with harmony for several centuries in symbiosis with forests. Forest is their shelter, habitat and they derive raw materials for their day-to-day life,wood to build their abode and other tools and equipments. Though in Chotanagpur the tribals who depend on primitive hunting and gathering to earn their livelihood and the primary occupation trends and net sown area data show that most of the tribals are now sedentary, cultivators and indulged in subsistence farming. But their survival is also dependent on minor

forests produce like Mahua flowers, sal seeds, sal and tendu leaves, edible roots, wild fruits, bamboo etc. Santhal, Munda, Oraon, are settled agriculturists and are better off than the minor tribes living closer to or inside the forests.

In 1952, the new forest policy declared by the Government of India was, in a way, extension of the policy adopted by the Britishers which laid down the claims of the communities living near forests should not override the interests of the nation. The policy makers did not take into consideration the need of the minor forests produce by the tribals or the forest dwellers.

In 1980 the Indian Forest Bill declared several forest areas as protected and reserved and harsh punishments for the invaders.Thus the worst affected group were mainly tribals.

National Forest Policy was announced in 1988.It was different from the previous ones and the principal aim of this policy, was stated to ensure environmental stability and ecological balance. The important aspect was that this policy made provisions for the involvement of the tribals and similar communities of the forests in the forest management.

So it is obvious now, that in the past the policy of forests and stringent penal measures have been unsuccessful. Idea is that the

need is to "decentralise" the forest management and make it "participatory" with the tribals and other forest dwellers. And this is,now a days,a new concept in forest management, known as "Joint Forest Management". Not only the government but other organisations also participating in conservation of forests are decreasing the distance between the forest-dwellers and the guardians (forest officials) of the forests.

II Water

आदित्य पश्याम्युत वा शृणोम्या मा घोषो गच्छति वाड्. मासाम्।
मन्ये भेजानो अमृतस्य तर्हि हिरण्यवर्णा अतृपं यदा वः।।

अथर्ववेद 3:13:6

The ability to see, hear and speak are useless in the absence of adequate water. Water is the basis of life. Most life forms are born in water and live on it. O water stream, come near me. You are the elixir of immortality.

In Chotanagpur rivers and streams are hilly in character and cannot be used for irrigation unless water is stored. There is very quick run-off of rain water because of the steep gradient and undulations everywhere. The water-level in these streams subsides quickly after a spell of rain and most of the streams dry almost completely after the monsoon rains. Due to the rocky surface wells

are difficult to construct and the process is expensive also. 'Bundhs' or 'Ahars' (artificial reservoirs) constitute main storage of water in which rain water is stored and which can be further led to the crop-fields by channels.

Separate figures for a quantitative estimate of the flow of water in Chotanagpur is not readily available. The rivers of Chotanagpur descend across steep scarps and thus, provide suitable head for hydro-power generation by constructing storage reservoirs.

Water availability is largely dictated by the climate and it fluctuates seasonally. Seasonal water scarcities have been reported from areas having high rainfall in India and the classic example is Cherapunji which has one of the highest rainfall in the world but all rainfall is during monsoon. Hence hilly areas may face water shortage due to reckless deforestation on large scale because regions ability to retain rainfall/water-precipitation is affected badly.

Potential Pollutants of the Natural Waters

There can be many sources from which the potential pollutants may mingle with the water courses and pollute them. There can be one source or an accumulated contribution from several sources e.g. municipal and industrial waste water, sewer out falls, general land run-off etc.

In an industrial region like Chotanagpur the rain falling through the atmosphere may pick up substantial amounts of acid constituents, mercury, other metals and concentrations of these and other constituents always increase substantially through air pollution from industries and mining-quarrying operations.

Extended underground water passage adds high concentrations of dissolved chemicals to ground water through process of leaching. Aquatic growths in streams, and other minor or major water bodies is a natural phenomena.

according to some opinion, "In the water courses of Chotanagpur, the phosphorus entering the water courses originates in run-off, much of that from agricultural lands. The significance of that in pollution control activities is apparent when one considers the major efforts now underway to remove phosphorus from municipal and industrial discharges into the water bodies to show its eutrophication rate. Even complete success in removing nutrients from point sources would still leave a significant per cent of the present total contribution intact because it is contributed in land run-off. This makes it clear that to retard the entrophication sharply, it will be necessary to suppose effective controls on land run-off as

well as on point sources". Mehta(1998)[4]

There are several other pollutants which cannot be overlooked and caused by the activities of human beings such as, use of pesticides in farm which joint the streams through run-off.

Municipal and industrial waste are chief contributes to the pollution of streams and underground water, open defecation near the rivers and other water bodies and it contaminates water and poses serious health threat if that water is used for drinking purposes.

"In many areas of Chotanagpur, drainage from operating or abandoned mines contributes heavy loads of acids and metals, sometimes rendering the river below them largely devoid of life. This situation is found in many streams that are polluted by "acid mine drainage" from abandoned coal mines"Mehta(1998)[5]

Lift Irrigation

Unlike the plains of north and Central Bihar, the Chotanagpur Plateau is not suited for tubewells because of hard rocky strata formation. The rivers are all rain fed and only the big rivers have

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4 Mehta,M.c.(1998)sources of potential pollutants of the natural waters:A general view,kurukshetra vol.zlvi,no.6,March 1998,pp.17-19

5 ibid

some discharge upto the end of March and in some cases up to April very few rivers can be called perennial worth its name.

"For irrigation of lands along the banks of streams and rivers, River Lift Irrigation Schemes are being constructed by the State Minor Irrigation Department and also by the Bihar Hill Area Lift Irrigation Corporation Ltd. It has been estimated that on an average, one Lift Irrigation Scheme can irrigate economically a strip of land about ½ a mile wide from the bank of river. Since the rivers do not carry perennial non-monsoon heavy discharge like rivers in the Ganga plains, big irrigation schemes cannot be contemplated, on these rivers". CWC Report (1980).[6]

"The percentage of cultivators to total population is 60% in this region most of the inhabitants are tribals who are economically backward". CWC Report(1980)[7]

Present Practices

"In this hilly area, water is lifted from available water sources viz., river, rivulets and reservoirs. The rivers of this area carry very meagre discharge of water during non-monsoon period so it has been

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6 Report of the Committee for Formation of Norms for Operation and Maintenance Charges of Lift Irrigation Schemes; Central Water Commission, New Delhi: Dec. 1980; pp.26-29.

7 ibid

felt essential to construct intake wells in the river bed with sufficient number of weep holes to inlet the sub-surface water. Water from these resources is lifted to the higher elevation of the command. Centrifugal pumps are installed on ground level or below ground level depending upon the flood hit lift of the river. In some cases, submersible pumps are also installed. In this area, the lift irrigation schemes are designed to irrigate an area of 20 to 80 hectares. The capacity of pumps varies from 0.5 cusecs to 3 cusecs, depending upon the cropping pattern proposed to be irrigated" (CWC Report (1980)[8].One major operational problem is irregular power supply.

Damodar Valley Project

In the eastern part of Palamau rises river Damodar and runs a course of 538 kms before its confluence with the Hoogly .288 Kms of her course falls in Chotanagpur region and the basin is 12800 sq km of which 11136 falls in Chotanagpur.

In the first phase of the programme four dams at Tilaiya, Konar, Maithon and Panchet Hill with hydro power stations attached to each of them (except Konar). Three Thermal Power Stations at Durgapur, Bokaro and Chandrapura, a grid for transmission lines and number of sub-stations and receiving stations were installed.

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[8] ibid

In the second phase four dams at Balphari, Bokaro, Aiyar and Bermo together with hydroelectric stations and corresponding extensions to transmission system. Some subsidiary initiatives such as forestry, soil conservation, fishery development were also taken up.

In Chotanagpur region the 'Tilaiya Dam' is on river Barakar about 205 Km above its confluence with the Damodar river. The 'Konar Dam' has been constructed across Konar river in Hazaribagh. The "Maithon Dam' is an earthen dam on the river Barakar mainly designed for flood control. The 'Panchet Hill Dam' has completed in 1959, across the river Damodar in Dhanbad district.

The project was patterned on the Tennesee Valley Authority was adopted in 1948 and is managed by Central, Bihar and West Bengal governments.

Soil Conservation

In the upper Damodar valley soil erosion has become perennial problem and this has resulted in denudation of soil veneer, thereby rendering many a productive land barren. There has been sedimentation in the reservoirs of the Damodar valley.

Table 4.1

Run-off and Sedimentation in Reservoirs in the Damodar Valley

Reservoir	Year	Year since Impounding	Run-off (Centimetre)	Water Inflow (Cubic Metre) June-Oct.	Sediment Deposit (Cubic Metre)
Panchet	1962	6	38	138,752	3454
Panchet	1966	10	43	59,465	2763
Maithon	1963	8	124	31148	2922
Maithon	1965	10	97	33980	3663

Source: Soil Conservation Working Plan (1972), Damodar Valley Corporation .

Silting of reservoirs is an universal phenomenon and is a major drawback of such endeavours. In the above table which shows the rapid siltation of the two reservoirs and this narrows down the future socio-economic development of the command area. Though there has been treatment of land for soil conservation by Damodar valley corporation by undertaking afforestation efforts in the areas affected severely and in many cases the corporation has been more successful in this endeavour than the government launched programmes for treating badlands (gullies etc). There has been reclamation of land to considerable extent.

Storage Build-up of Reservoirs

Though various reservoirs under DVC multipurpose project were designed with certain storage capacities but usually the storage build up is lesser than the designed storage. Only in a few reservoirs the storage build-up has been hundred percent of the designed storage as given in the table 4.2 The Dams have a gross storage capacity of:

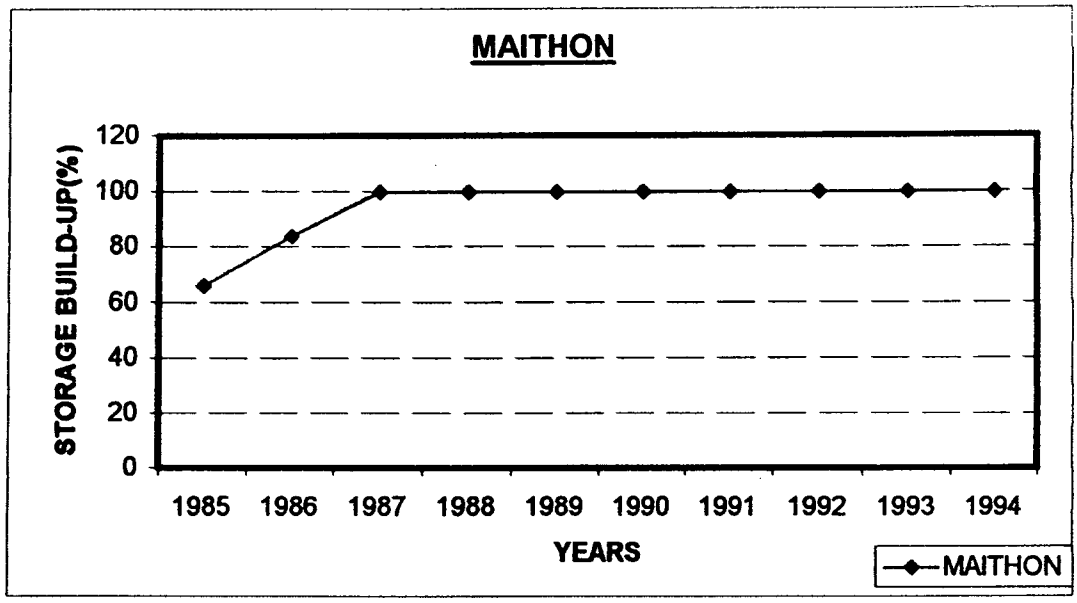
1) Tilaiya dam - 394.7 m. Cu. m.
2) Konar Dam - 337 m. cu. m.
3) Maithon dam - 1357 m. cu. m.
4) Panchet Hill dam- 1497 m. cu. m.

If we see Table 4.2 we see that in Maithon and Panchet Hill there has been 100% storage build-up since 1987 till 1994 (according to the available data).Whereas in figure 4.2 we see that the line showing storage build up has been fluctuating and in these two dams (Konar and Tilaiya) storage build up has never reached 100% of the designed storage (only in 1992 Tilaiya had 99% of storage).

Except Konar all the three reservoirs are designed for power production also and if the storage is not upto the designed one. Then power production will also not be the same as the potential capacity of these projects.

Figure 4.1

STORAGE BUILD - UP DURING VARIOUS YEARS AS PERCENTAGE OF DESIGNED STORAGE



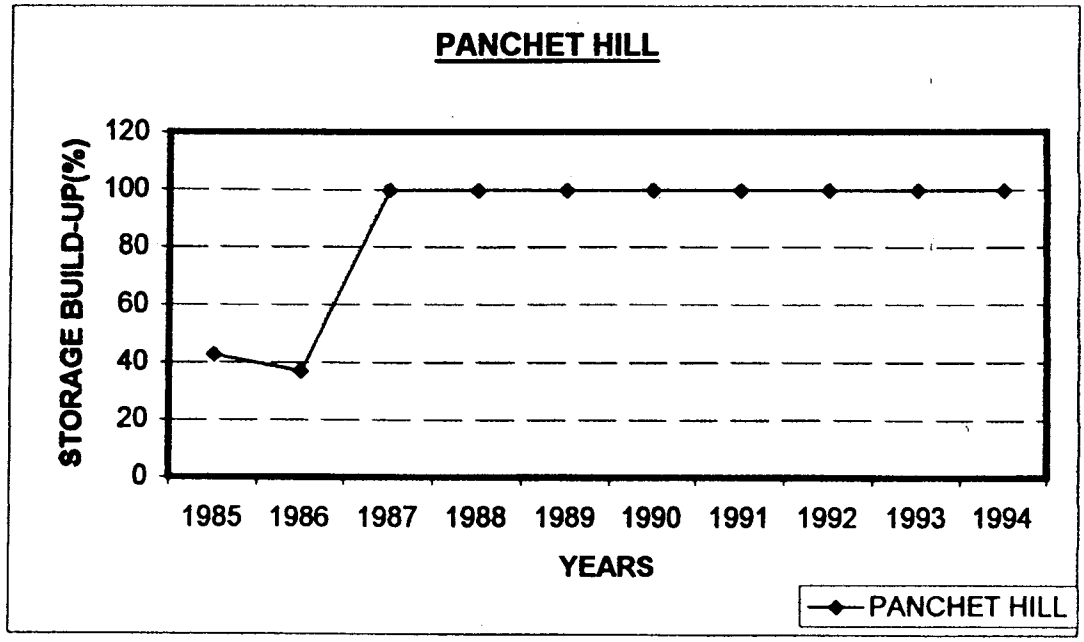
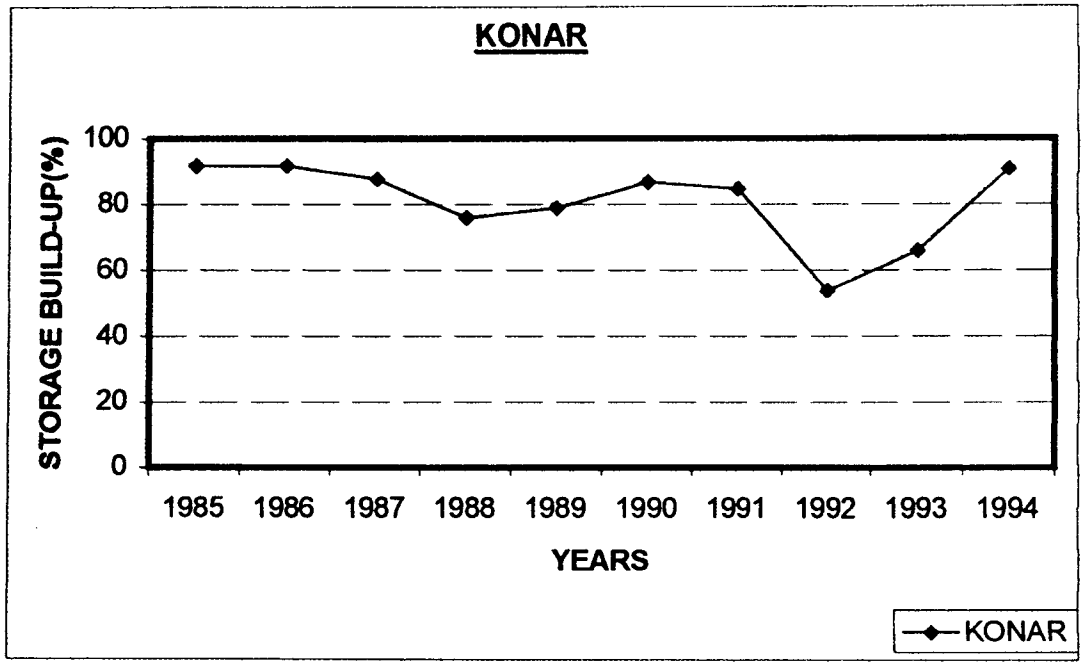
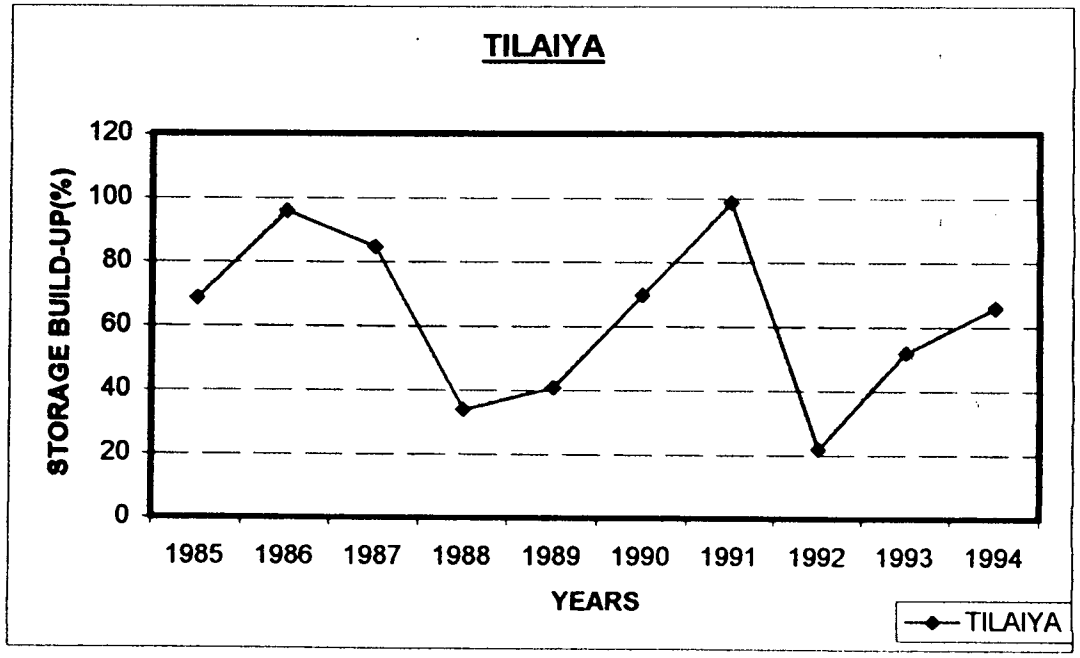


Figure 4.2

STORAGE BUILD - UP DURING VARIOUS YEARS AS PERCENTAGE OF DESIGNED STORAGE





There can be a variety of causes for this situation and fluctuation in monsoon rainfall is one which is the source of water (rivers are rain-fed) in these reservoirs as none of the rivers on which these dams are built are completely perennial in nature.

There has been a number of erosion resisting structures built in the catchment area of these rivers (Barakar, Damodar, Konar) e.g. Adivasi dam Deochanda Dam, Bachhi Dam and Gauria Karma Dam to hold back rain water, prevent gully erosion and supply water for irrigation. Denuded forests need to be scientifically maintained also e.g. there can be plantation of fast growing trees in these areas for this purpose. Lac culture can also be beneficial.

Even though the major industries located in Jamshedpur, Durgapur, Burnpur and Kulti and Coal mines of Jharia depend upon the DVC power. This power supports the electric trains in this region also first started in 1958.

Irrigation

Expansion of irrigation is difficult in the region due to hilly terrain. In many areas of Chotanagpur the underground water level is deep (but not overall) and the underlying layers are hard basement rocks and hence it is difficult and expensive to dig wells. And this affects cultivation also. The areas situated near banks of the rivers

have facility of irrigation water where generally stream flow are checked across the rivers and 'nalas' at few places and water is lifted over the fields by water pumps easily. Tanks are also important which store the rain water and sometimes can be used throughout the year also but usually only for a few months after the rainy season. Tanks are generally constructed on the higher areas so that lower areas can be irrigated. (Here all these sources are also for drinking water purposes). Near the urban centres such as Ranchi, Jamshedpur, Bokaro made the land suitable for agriculture for market-gardening on small-scale. Though the existing means are still short of coping up with the increasing demands of these urban centres. Obstacles are irregular and insufficient supply of electricity and inefficiency of the employees for this purpose.

Ground Water

In the Chotanagpur region level of Ground Water development as compared to other states is one of the lowest. The following Table (4.3) shows the level of Ground Water development in India.

Table 4.3

Aggregate Ground Water Resource Estimates of Tribal Districts of Each State as per norms of Ground Water Estimation Committee

State	Total Replenishable Ground Water Resources (MCM/Yr)	Net Draft (MCM/Yr)	Level of Groundwater Development (%)
Andhra Pradesh	12873.06	1974.31	18
Assam	6709	183.88	3.20
Bihar	2139.16	35	1.90
Gujarat	9290.22	2712.82	34.40
Karnataka	2814.12	637	26.60
Kerala	5222.08	616.19	14.30
Madhya Pradesh	33209.38	3295.68	11.70
Maharashtra	14607.23	3573.26	35.80
Orissa	9538.91	753.56	9.28
Rajasthan	2411.96	798.91	38.97
Tamil Nadu	10841.33	6417.68	69.60
Tripura	2512.03	96.60	4.50
Uttar Pradesh	2754	935.60	39.90
West Bengal	21295	3978.42	22
Grand Total	139371.71	25948.31	22.42

Source: Ground Water Statistics, 1996 (Central Ground Water Board)

*Some States have been excluded e.g. Manipur, Sikkim for which estimates are not available.

Here it is clear from this table that groundwater development is one of the lowest in the tribal area of Chotanagpur in comparison to other tribal areas of the country. Only 1.9% of the total groundwater potential is developed. Tamil Nadu has highest Ground Water development (69.6%).

In Chotanagpur there is potential of replenishing groundwater by several methods. Small earth dams can be made and watersheds

can be developed. For irrigation and other purposes the hilly and rugged terrain are discouraging for the alignment of canals. Tanks are generally constructed on the uplands to irrigate the lowlands. Though there has been efforts but existing means and systems of irrigation facilities are still short of the existing need of arable land to cope with the increasing demands of the adjacent urban areas and for their own livelihood.

The Chotanagpur region is among lowest in developing groundwater resources has institutional factors also resposible for this other than geographical factors. Striking obstacles are – irregular and insufficient supply of electricity for pumping of water and inefficiency of the concerned government departments.

Table 4.2

Storage Build-up During Various Years as Percentage of Designed storage of four reservoirs of DVC.

			Year													% of Year of almost full filling
S.N.	Name of Reservoir	Benefits	1985	86	87	88	89	90	91	92	93	94	Max	Min	Ave.	
1	Maithon	Irrigation and Power	66	84	100	100	100	100	100	100	100	100	100	66	60	80
2	Panchet Hill	Irrigation and Power	43	37	100	100	100	100	100	100	100	100	100	37	88	80
3	Konar	Irrigation	92	92	88	76	79	87	85	54	66	91	92	54	81	0
4	Tilaiya	Irrigation and Power	69	96	85	34	41	70	99	22	52	66	99	22	63	20

Source: Compilation of Storage Behaviour of Important Reservoirs of Indian (Water Year 1994-95),Government of India, Central Water Commission, Water Management Directorate, 1997, p.151.

Chapter 5

WATER RESOURCE AND WATER BALANCE

Introduction

Water supply to a region is primarily through precipitation and evapotranspiration leads to the loss of entire water received through precipitation. Therefore, relative magnitudes of precipitation and potential evapotranspiration determine the dryness or wetness of any region/place. A book-keeping procedure was developed by Thornthwaite for the comparison of P.E. (Potential Evapotranspiration) and precipitation and also the characteristic of soil in storing rainwater and which is used for evapotranspirational purposes when there is inadequate water supply through precipitation. The procedure of book-keeping yields important information about the elements of water balance, namely, actual evapotranspiration, water surplus and water deficit, and this plays an important role in the studies of hydrology, agriculture, ecology, forestry and other environmental studies. Thornthwaite evolved a semi-empirical formula for the computation of Potential Evapotranspiration from the records of air temperature and length of

the day. The P.E. is a thermal parameter as well as a moisture parameter for water balance and it is an unique way of water balance concept which is widely accepted for related studies.

On account of the wide applicability of water balance concepts and its use in several fields, in the present study to understand the moisture regime of Chotanagpur region, water balance computation for two stations, namely Ranchi and Dhanbad has been done and analysed here, in this study.

Thornthwaite defined the term "Potential Evapotranspiration" as the maximum amount of evaporation from the soil surface and transpiration from the plant cover when there is no dearth of moisture for full use. When the water need i.e. P.E. is less than the precipitation then the climate is moist and when P.E. (Potential Evapotranspiration) is more than the precipitation then the climate is dry and there is water deficiency. To obtain moisture index of a place the P.E. must be compared with precipitation rather than the actual evapotranspiration. If the P.E. is equal to precipitation then the climate will be neither moist nor dry which means there will be neither water surplus nor water deficiency.

To prepare water balance of a station, precipitation (rainfall/water supply) is compared with PE (Potential

evapotranspiration) i.e. water need. At some stations precipitation is more than PE and water surplus is there and in other places precipitation is less than PE and there is water deficiency. At stations where soil remains full of water there a water surplus and where moisture is not enough for vegetation, there a moisture deficit occurs. But stations with seasonal variations of both deficit as well as surplus of moisture are there and they show:

a) A season of few months when full soil moisture storage is there and precipitation is more than PE. Providing water surplus is situation.

b) A season when soil moisture and precipitation are used up in evapotranspiration and there is steady decline in soil moisture storage and moisture deficiency prevails.

c) Again a season of precipitation starts and soil moisture is recharged. The values of 'S and 'd' could be computed by using the budgeting procedure.

In 1948 (Thornthwaite 1948)[1] attempted climatic classification using water balance procedure and achieved very satisfactory results but the assumptions used were only approximation. Later on in 1955

[1] Thornthwaite, C.W. (1948). An approach toward a Rational Classification of Climate, Geographical Review, vol.38, no.1.

he revised his work and assumptions so that it now gives us more true values of the moisture parameters.

The texture of soil differ and so is the moisture holding capacity of soil e.g. it varies in sand from clay or from loam etc. More importantly it is also assumed that rate of evapotranspiration is proportional to the amount of water remaining in the soil or as the soil moisture content decreases, so also does the rate of evapotranspiration.

Water balance computation for Ranchi and Dhanbad are shown respectively in tables 5.1 and 5.2. The precipitation data is based on 1931 to 1960 climatological tables of IMD. When we subtract the monthly values of PE from P it results in a series of positive and negative differences which represent potential addition or losses to or form soil moisture storage. Some negative values indicate a potential loss of water from the soil now have to be converted into values of actual change in soil moisture storage as the soil becomes dry water is lost from the soil at a rate somewhat lesser than the potential rate.

At Ranchi for example, in January P.E. (80.9 mm) is greater than precipitation (15.8 mm). Thus, while 65.1 mm is the potential loss of water from the soil, actually only 27 mm of moisture is

exhausted. This is so because, recent findings say the evapotranspiration cannot go at the potential rate when the soil moisture does not remain optimum or at field capacity for maximum evapotranspiration to occur.

When the precipitation (202.3 mm) is greater than the P.E. (134.9 mm) in June at Ranchi, the actual evapotranspiration equals the P.E. It is so because during this period there is sufficient moisture available both from precipitation and in the soil so that there is an unhindered evapotranspiration.

When precipitation is less than PE, then the A.E. (Actual Evapotranspiration) is equal to the total precipitation plus any moisture contribution (ΔS i.e. change in soil moisture storage) available from the moisture stored in soil for evapotranspiration purpose. WD (water Deficit) is the difference between the PE and AE when precipitation and moisture available from the soil are together less than PE while WS (Water Surplus) is the excess of precipitation over the PE when there is saturation with moisture. Here for the two stations, Ranchi and Dhanbad, a field capacity value of 250 mm has been assumed because different soils have different moisture retention capacity. Here for the soil type (Loamy

–silty) of Chotanagpur region it is assumed that field capacity should be 250 mm.

Here, in the table 5.1 for Ranchi and table 5.2 for Dhanbad to determine the periods of moisture surplus and deficiency, the difference between Precipitation (P) and P.E. is obtained. A negative value of (P-PE) as in the months of November to May (in case of Ranchi) indicates the amount by which the precipitation fails to supply the potential water need of a vegetation-covered area. A positive value of (P-PE) in the months from June to October (in case of Ranchi) indicates the amount of excess water which is available for soil moisture replenishment and also perhaps for the run-off and Ground Water recharge.

Like most of India, the Chotanagpur region also has only one so called 'wet' season and one 'Dry' season during the year. Hence, only one series of consecutive negative Δ's and one set of positive Δ's.

In both these selected stations, namely Ranchi and Dhanbad, only two possibilities exist: either the excess of precipitation, i.e. sum of positive (P-PE) monthly values during the year may be greater than the potential water loss, i.e., sum of negative (P-PE) monthly values or vice-versa. The latter situations will occur in dry

area but in both those stations at least one month or more are there when the soil has attained its field capacity.

To compute APWL (Accumulated Potential Water Loss) the negative values of (P-PE) representing a potential deficiency of water are summed up month by month as an aid in the computational steps that follows.

Table 5.1 : Ranchi

n=12

Wet, $\sum_{n=1}\Delta$ = +ve

Since the sum of all the 12 values (P-PE) is positive (+159.3) the value of accumulated potential water loss with which to start accumulating the negative values of (P-PE) is zero.

Table 5.2: Dhanbad

n=12

Dry, $\sum_{n=1}\Delta$ = -ve

The sum of (P-PE) values is negative (-351)

Soil Moisture Storage (St)

It gives the values of amount of moisture retained in the soil after given amount of accumulated potential water losses have occurred.

Here, using soil moisture retention table by Subrahmaniyam (1982)[2] we see the soil moisture retention table for 250 mm and look up each value of APWL (Accumulated Potential Water Loss) in the table and enter the values of soil moisture retention in the appropriate place in the water balance sheet. For each month the soil moisture storage is found from the table. After the Soil moisture storage in each months with negative values of (P-PE) has been found from the table of 250 mm, field capacity, the positive figures from the (P-PE) representing additions of moisture to the soil will be included here. If cumulative adding brings the value more than 250 mm (water holdings capacity in this case) then 250 mm is entered on the storage line until we reach the next negative value of (P-PE) in the series of months. This is because it is assumed that for these stations soil cannot hold more water than its field capacity in storage (while computing water balance for any station field capacity is assumed depending on the type of soil there and field capacity is the maximum limit of a moisture soil can store).

Change in soil moisture storage (Δ St)

For further computations, the difference in the amount of soil moisture storage from one month to next is obtained. In case of

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2 Subrahmaniyam, V.P.(1982) Water Balance and its Applications; Andhra University Press, Waltair, p.42.

value being above the water holdings capacity, the assumption is that no change has occurred in soil moisture storage. (A change in above surface storage is not denied here).

Actual Evapotranspiration (AE)

AE will be equal to the PE when precipitation is greater than PE. When P drops below PE, the soil starts drying out and the AE becomes lesser than what is potentially possible.

Water Deficit (WD)

The difference in amount of AE and PE in any month is WD. This is AE subtracted from P.E.

Water Surplus (WS)

In these two tables (5.1 and 5.2) when St reaches the field capacity (i.e. 250 mm) any excess precipitation is taken as water surplus and is assumed to be subjected to Surface Run off and Ground water recharge (half of surplus is assumed to be run-off and rest half to be ground-water recharge).

II Moisture Index

Thornthwaite (1948) coined the term "Potential Evapotranspiration" which has been discussed previously in

evaluation and computation of water balance for Ranchi and Dhanbad. It is accepted that the actual evaporation and transpiration from the soil is not what must be compared with precipitation but the potential evapotranspiration in order to obtain moisture index for any station.

"Moisture index value gives the first step in the climatic classification. Positive values indicate moist climates and negative values dry climates. The zero value of moisture index value separates dry and moist climates. The index value +100 is used to demarcate the humid from the very moist (per-humid) climates. By dividing the moisture index range into 20-unit intervals, 6 types of moist climates are evolved. Similarly, by dividing the negative moisture index values at intervals of 33.3, three types of dry climates are obtained. Thus the value of moisture index of the station provides the first capital letter of the classification". Thornthwaite (1948)

A station where there is only water surplus and no deficit, the relation between water surplus and PE constitutes an index of humidity (In). Similarly Index of Aridity (Ia) for water deficit. These are expressed as percentages.

But in the present study of Chotanagpur the two stations, Ranchi and Dhanbad has different seasons for water surplus and water deficit. "A water surplus in one season though cannot prevent a deficiency in the next season except as ample moisture is stored in the soil. Water surplus is simply seasonal additions to the Soil moisture and ground Water. In a period of drought or water deficiency deeply rooted plants will make out from sub-soil moisture and thus the effect of drought will be minimised also the transpiration will occur at reduced rates. This explains that a surplus of only 6 inches in one season will counter act a deficit of 10 inches in another".[3]

Thus, in an overall Moisture Index (Im), the Humidity Index (Ih) has more weight than the Aridity Index (Ia) the latter has only six-tenths the value of the former. In equation of Moisture Index or Index of moisture effectivity is given by the equation

$$Im = Ih - 0.6\ Ia \qquad (1)$$

Where Im = Moisture Index, %

[3] Thornthwaite, C.W. (1948) *An Approach Toward a Rational Classification of Climate*, Geographical Review, vol.38, no.1.

Ih = Humidity Index, the percentage ratio of the total annual water surplus (WS) to the total annual water need (WN) i.e. the Potential Evapotranspiration (PE),

$$\text{i.e. } Ih = \frac{WS}{WN} \times 100 = \frac{WS}{PE} \times 100 \qquad (2)$$

and Ia = Aridity Index. This is percentage ratio of the total annual water deficit (WD) to the total annual water need (WN) or the PE.

$$\text{i.e. } Ia = \frac{WS}{WN} \times 100 = \frac{WD}{PE} \times 100 \qquad (3)$$

Table 5.3

Moisture Index (1948 procedure of Thornthwaite)

Station	Annual Water Need (PE), Cms	Annual Water Surplus (WS) Cms.	Index of Humidity % Ih=WS/WN x 100	Annual Water Deficit (WD), Cms.	Index of Aridity % Ia=WD/WN x 100	Moisture Index % Im = Ih – 0.6 Ia
Ranchi	130.40	52.1	39.95	34.01	26.08	39.95-(0.6x26.08) M.I. = 24.30%
Dhanbad	154.88	23.25	15.01	58.35	37.67	15.01-(0.6x37.67) M.I = -7.59%

In the table 5.3, for the computation of Moisture Index for two stations Ranchi and Dhanbad, the annual values of water surplus and water deficit have been obtained form the water balance presented earlier in this chapter.

The total annual water surplus is the summation of all the monthly water surpluses during the year and similarly the annual water deficit and annual water need (PE) are obtained by summing up the monthly values for all the months of the year (Table 5.1 and 5.2).

Limitations of this Study

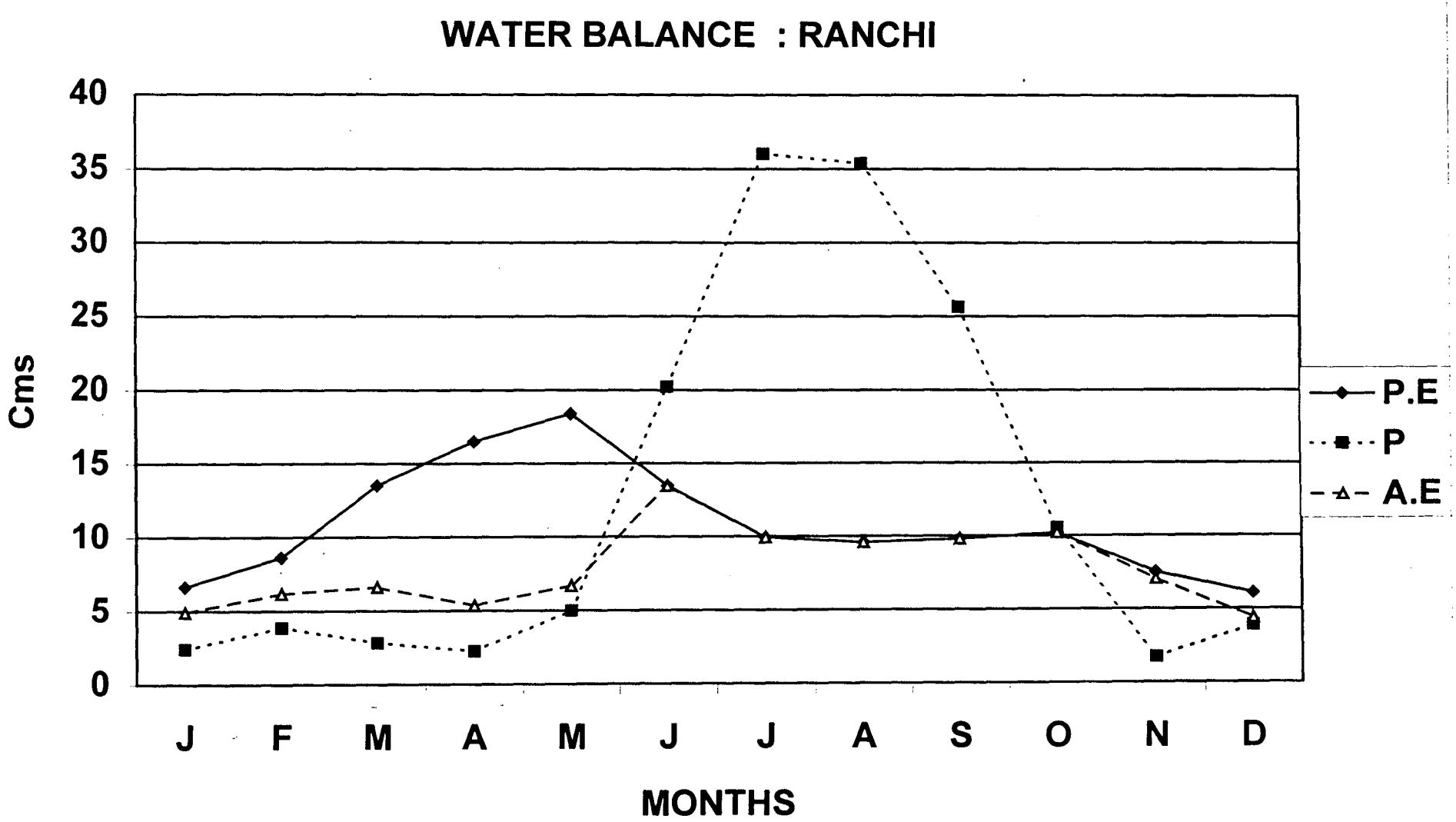
1) PE values used above are estimates on the basis of Thornthwaite's formula, which is criticised because of its empirical nature.

2) In the above two examples field capacity of the stations is assumed as 250 mm for both Ranchi and Dhanbad and there may be minor variations in soil and nature of vegetation and crops.

Interpretation

Chotanagpur region is in a tropical location and in such areas though thermal regime of climate also determine the type and growth

FIGURE 5.1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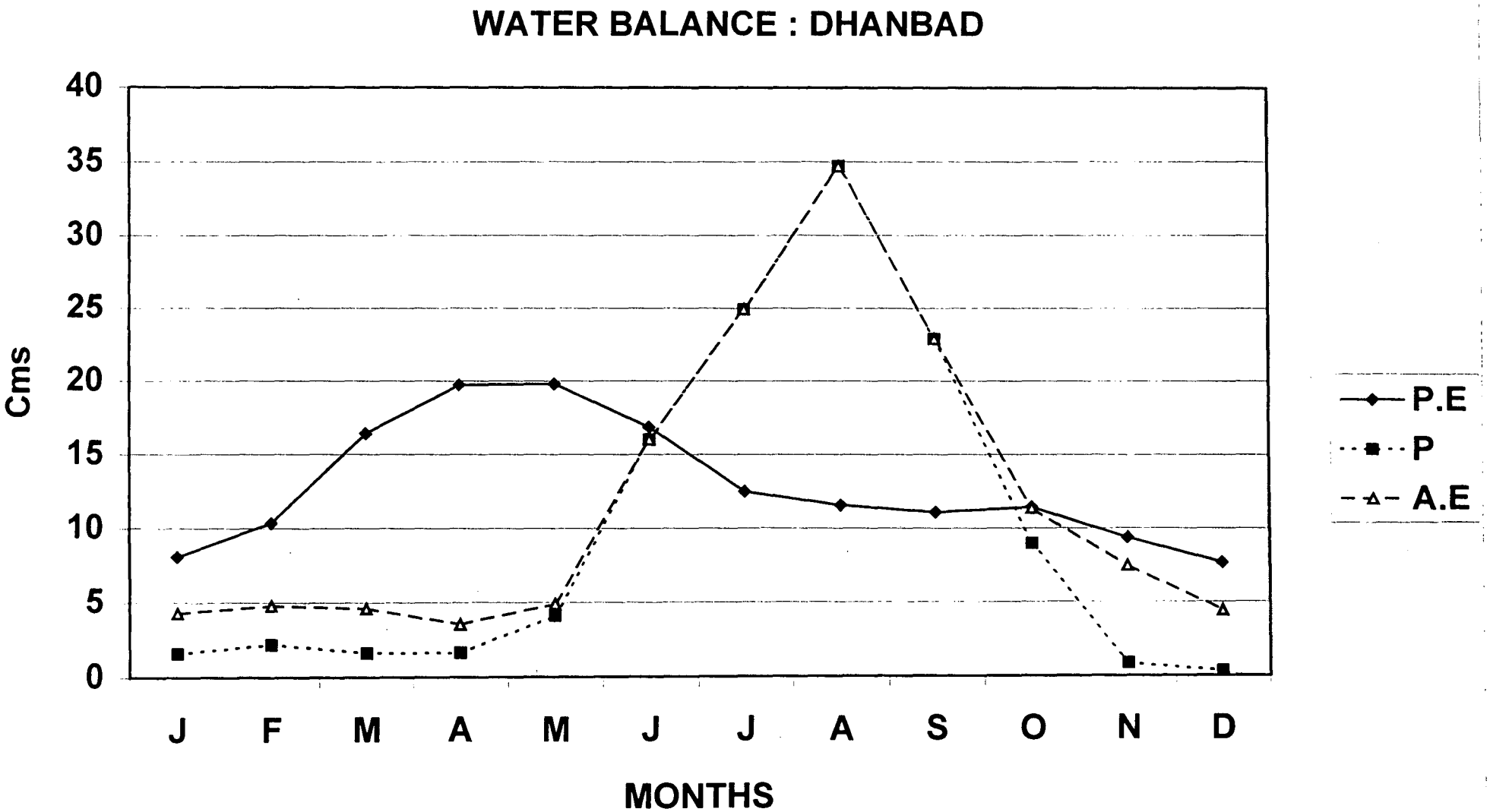
of vegetation but it is true when there is adequate amount of water moisture available. Ist relief is such that the quantity of rainfall has only minor variations (though not vary significant) for different stations. Hence one station is chosen which is having a higher location geographically (i.e Ranchi) and the other is (relatively has lower benchmark). The results of the above water balancing and computation of Moisture index shows that Dhanbad is drier than Ranchi and is deficient in moisture for most of the year (9 months form October to June) and its moisture index is also negative (i.e. -7.59%).

Ranchi on the other hand is Wetter than Dhanbad. Where only a season of seven months (i.e. from November to May) has no water surplus and rest of the months (i.e from June to October) there is ample water surplus which and moisture index for Ranchi is 24.30%.

Here according to Thornthwaite's classification the moisture regions and their limits are discussed. According to that Ranchi is of 'MOIST SUB-HUMID (C2) climatic type and Dhanbad is 'DRY SUB-HUMID' (C1).There are further classification in these categories which is according to dry spell and moist spell in dry and moist climatic types but here in this study which primarily is based on the resource base and economic aspects of Chotnagpur region so

FIGURE 5·2


WATER BALANCE : DHANBAD
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there is not much scope to go into any further details of climatic classification for Chotanagpur region. Here our purpose is to understand and explain the economic and environmental variations on spatial and temporal basis in the Chotanagpur region.

The purpose in this study is to point out that due to human actions such as deforestation on a large scale and human interference with environment may affect the existing climatic pattern in any region in general and Chotanagpur region in particular. If forests and other vegetation are wiped out, it will lead to soil erosion and other degradation which may influence the moisture retention capacity of the soil as there will be more surface- run off and ground water will be recharged at lesser rate. If it happens then we may find after a few decades or a century or so, that a new pocket of semi-arid or arid area emerges in our climatic map, and that will be this plateau region of Chotanagpur.

Table 5.1

Water Balance Computation for Ranchi

Field Capacity Assumed = 250 mm

	N=12												(All values are in mm)
Wet	ΣΔ = Positive	(P-PE) Positive = +748					(P-PE) Negative = -588.3			Net = + 159.3			
	N=1	[ΣΔ for 5 months, June to Oct.					[ΣΔ for 7 months, Nov. to May]						
Item	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct.	Nov.	Dec	Annual
1. PE	66.5	86.3	135.3	165	184.6	134.9	99.3	95.8	97.9	101.9	75.1	60.8	1304
2. P	24.1	38.7	28.3	22.6	49.9	202.3	360.3	353.8	256.2	105.2	17.4	3.9	1462.7
3. Δ = (P=PE)	-42.4	-47.6	-107	-142.2	-134.7	67.4	261	258	158.3	3.3	-57.7	-56.9	159.3
4. APWL	-157	-204.6	-311.6	-454	-588.7						-57.7	-114.6	
5. St	132	109	71	40	23	90.4	250	250	250	250	197	157	
6. Δ St	-25	-23	-38	-31	-17	67.4	159.6	0	0	0	-53	-40	
7. AE	49.1	61.7	66.3	53.6	66.9	134.9	99.3	95.8	97.9	101.9	70.4	43.9	941.7
8. WD	17.4	24.6	69	111.4	117.4	0	0	0	0	0	4.7	16.9	340.1
9. WS	0	0	0	0	0	0	101.4	258	158.3	3.3	0	0	521
10. SR= (WS/2)							50.7	129	79.15	1.65			260.5
11. GWR= (WS/2)							50.7	129	79.15	1.65			260.5

Where PE = Potential Evapotranspiration; P = Precipitation;
Δ = (P-PE); APWL = Accumulated Potential Water Loss;
St = Soil Moisture Storage; Δ St = Change in Soil Moisture Storage;
AE= Actual Evapotranspiration; WD = Water Deficiency;
WS = Water Surplus; SR =Surface Run-off (Assumed to be ½ of WS)
GWR = Ground Water Recharge (Assumed to be ½ of WS)

Table 5.2

Water Balance Computation for Dhanbad

Field Capacity assumed = 250 mm

Dry	N=12 ΣΔ = N=1	Positive (P-PE) Positive = +473.5 [ΣΔ for 3 months, July to Sep.]					(P-PE) Negative = -824.5 Net = -351 [ΣΔ for 7 months, Oct to June]					(All values are in mm)	
Item	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct.	Nov.	Dec	Annual
1. PE	80.9	103.6	164.1	197.2	198	168.5	125	115.5	110.9	114.2	93.7	76.7	1548.8
2. P	15.8	21.8	16.0	16.2	41	160.2	249.1	347	228.8	89.6	8.6	3.2	1197.3
3. Δ = (P=PE)	-65.1	-81.8	-148.1	-181	-157	-8.3	124.1	231.5	117.9	-24.6	-85.1	-73.5	-351
4. APWL	-248.3	-330.1	-478.2	-659.2	-816.2	-824.5				-24.6	-109.7	-183.2	
5. St	92	66	36	17	9	9	133.1	250	250	226	160	119	
6. Δ St	-27	-26	-30	-19	-8	0	124.1	116.9	0	-24	-66	-41	
7. AE	42.8	47.8	46	35.2	49	160.2	249.1	347	228.8	113.6	74.6	44.2	1438.3
8. WD	38.1	55.8	118.1	162	149	8.3	0	0	0	0.6	19.1	32.5	583.5
9. WS	0	0	0	0	0	0	0	114.6	117.9	0	0	0	232.5
10. SR= (-WS/2)								57.3	58.95				116.25
GR= (WS/2)								57.3	58.9				116.25

Notation same as in Table 5.1.

Chapter VI

CONCLUSION

Chotangapur region is a tribal region where there are vast economic disparities between tribals residing in rural areas and mainly non-tribals in the urban areas. Tribal areas are known for the tradition based primitive economy and social institutions, which together bear heavily on their less dynamic socio-economic life. Economic activities in tribal areas are not profit motivated to attain individual material benefit unlike those of advanced areas. In Chotanagpur tribal also social and cultural compulsions guide every individual and collective economic activity and agricultural pursuit is no exception to it. In t he rural areas tribals engage in subsistence forming and sedentary cultivation unlike many other tribal areas of India where shifting cultivation is practised.

The major bottleneck in the economic development of this area is inadequate infrastructure like roads, railways, power and communication. Somehow there has been lack of political will by the Central government as well as the state government to develop this region in accordance with its resource potential. This might be caused by various lobbies of rested interests. Many programmes are launched here but they did not succeed desirably due to major

lacuna of bureaucracy, faulty programme formulation, inadequacy of banking facilities in the remote tribal areas, Malpractices and corruption in the government offices at grassroots level. Also there has been lack of project approach as well as proper monitoring, absence of both forward and backward linkages and mainly the hostile socio-political and economic institutional set-up of the state of Bihar.

Human interaction with the environment should be to a degree where dynamic ecological balance is maintained to the mutual advantage of mankind and nature. It is therefore essential to find and analyse ways of sustainable use and co-existence in harmony. The most vital issues of environment conservation are in the preservation of forests, soils and bio-diversity. These aspects of conservation are interrelated.

Forests cover, not only in Chotanagpur region but everywhere else have many faced ecological role to play which affects human life directly in a variety of ways. They thwart damages of cloud drifting, soil erosion, floods, wind erosion, and ground water evaporation.

Chotanagpur region has one of the lowest level of groundwater response development of the total replenishable ground water, (1.9%) according to ground water statistics (1996).

India has a forest area of 64.01 mha, which constitutes only 19.5% of the total land area Ravindranath, et al (1994)[1] as against 33% of national forest policy of 1998. A large part of these forests is degraded and productivity is very poor. Forest cover situation as assessed by remote sensing, however shows some increase in the area under close forests by almost 1% from 1981-83 to 1987-89 (GOI, 1994).[2] In Chotanagpur region there has been minor increase in the forest area from 29.21% in 1971 to 29.24% in 1991 according to Agricultural Statistics (1971 and 1991) which is only 0.03% better than forms period. This increase is however not very encouraging in the real sense because due to rapid urbanisation and mineral exploitation activities in Palamau, Dhanbad and Ranchi there is sharp decline in forest area and its not a very healthy trend as "Jharkhand or the 'land of forests' is rapidly converting into concrete jungles due to growing population and rural to urban migration is search of employment and there is also decline in land

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1 Ravindranath, N.H. and Hall, D.O. (1994) Indian Forest Conservation and Tropical Deforestation, Ambio, vol.23, 8, p.521.

2 Annual Report, 1993-94, MOEF (Ministry of Environment and Forest), Govt. of India, p.24.

use area for cultivation and overall in Chotanagpur the decline is net cropped area is from 30.27% in 1971 to 25.03% in 1991 of the total reporting area.

It has been estimated that about 157 million tons of firewood are required for fuel every year by the rural population, whereas production is only 58 million tons (GOI, 1993)[3]. The remaining demand is met by illegal cutting and encroachment of forest.

In Chotanagpur the outward expansion of urban areas and illegal felling of trees by nexus of forest officials and contractors are mainly responsible for the depletion rather than the tribal inhabitants. Mostly they only collect dry twigs of wood for fuel wood purposes and this is very insignificant in intensity. The increasing population density has created a pressure on the existing forest near town and cities and per capita forest area is also decreasing. It has disturbed the flora and fauna variety of these forests also, as their natural habitats are getting destroyed.

Though there are some trends in the area on an improvement in the quality of forest, there is still needs to have massive

[3] GOI (1993) Report of the Expert Group on estimation proportion and number of poor, Perspective planning division, Planning Commission, Government of India, New Delhi, July 1993.

reforestation programmes, provision of cheap fuel through alternative technologies such as solar power or bio-gas plants (In the areas where significant livestock population is there). More kerosene should be made available to save the forests from denotation though tribals harm very less to the forests. Here are some measures suggested to preserve the forests:

1) More aforestation, reforestation and regeneration activities to be carried out in the areas where mining activities has depleted forests. To replenish the forests.

2) To control over hacking and grazing.

3) To control rate of increase of population of human beings and livestock so as to reduce pressure on existing forests.

4) Availability of cheap and clean fuel to the rural poor to save the forests from denudation.

5) Last but not the least is involvement of tribal inhabitants of the region in conserving the forests and to check corruption in the forest departments.

The cultivators of Chotanagpur region mainly depend on a good rainfall for their crops. The hill streams remain almost dry except in the rainy season and do not offer much scope for

irrigation as the perennial rivers. There is need to develop watershed in the suitable areas and groundwater can be recharged through such processes. This will lead to increase and growth of vegetation as the soil moisture will increase. As the vegetation growth will take place, the surface-run-off will be reduced and will lead to further addition to groundwater. In the Chapter V of this study a detailed study has been carried out regarding the water balance and moisture index according to Thornthwaite's approach (1948). In the study findings are that Dhanbad which was relatively less forest cover has lesser rainfall and has a negative moisture index which means that area is suffering from water deficiency and if the population pressure increases then the groundwater may decline further and a situation of water scarcity may occur. Here groundwater recharge can be done through watershed management approach in which rain-water could be stored below the slopes of hills and undulating areas and the water which will go waste otherwise or will be evaporated or lost by surface-run-off, may be used to recharge the ground water and water table could be raised.

Topography, drainage, weather and climate, soils and the land and water resources are the fundamental features and on these the nature, distribution, pattern, production and problems of cultivation/forming depends.

Initial increase in population always leads to increase in net cultivable area and till the beginning of 1960's in India increase in agricultural production was more the result of expansion of cropped area. This increase was by turning the grazing land and forest lands into, crop lands, bringing cultivable wastelands under the plough, shifting the cropping pattern in such a way as to divert land under fodder crops to other crops, and so on. This dynamism in land use may take another turn, the NSA may actually decline, with the relentless growth of population and growing urbanisation as is the case is Chotanagpur region where land is fast disappearing under concrete buildings and tar roads in cities like Ranchi, Bokaro, Jamshedpur, Dhanbad and here also good agricultural land is being destroyed to produce bricks.

In a hilly area like Chotanagpur, soil erosion by rain and river takes place and makes the land unsuitable for various uses. Cutting of trees for firewood, agricultural implements and timber, construction of loads, indiscriminate quarrying (limestone etc.) and other activities have all led to the opening of hill faces to heavy soil erosion. The need is to intensify the efforts and curb soil erosion, to retain and increase the productivity of agricultural land and to control the expansion of badlands. Measures could be adopted to control soil degradation, such as, regeneration of

wastelands, particularly CPR of communities, soil conservation technologies to be adopted. In Chotanagpur (as discussed in the introductory chapter) there are various kinds of metallic and non-metallic minerals, in abundance and their exploitation is also done as they are inevitable for the economic development of the country. They can also uplift the socio-economic conditions or status of the local people where they are found.

In Chotanagpur region there are a large number of small mines for various minerals under public and private sector. The damage to the environment on account of mining and quarrying is a matter of concern. Some are as follows:

1) The dust and gases pollute the environment. This comes while drilling, blasting, mine haulage etc.

2) Uranium mines are in Ghatsila in Singhbhum and there are cases of improper waste disposal . Streams and water bodies are prone to radiation. There have been reports of concern, miscarriages of women who live or work nearby the mines.

3) Mining also modified the water regime and sometimes groundwater or water table may go further down.

4) Soil erosion is most common and soil modifies with addition of dust and salt and large areas become barrier and the landform is alternated e.g. in Dhanbad.

5) Mot importantly mining of minerals has destroyed flora and fauna both, e.g. Dhanbad, Singhbhum.

I will conclude my study here but before that I would like to agree with what Lahiry (1997)[4] says, "The Government in exercise of its power under MMRD Act, has made comprehensive provisions under the Mineral conservation and development rules, 1988, for environmental protection. The lincesee licensee/lesser is duty bound under the Mineral Conservation and Development Rules to prepare and get approved a mining plan which inter-alia prescribes action to takes precautions regarding:

1) Removal and storage of the top soil, over burden waste and sub-grade material.

2) Reclamation and Rehabilitation of lands;

3) Precaution against ground vibrations and fly rocks.

4) Precaution against air pollution;

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[4] Lahiry, S.C.(1997) Mineral Development and Environment, Yojna, vol.41, no.8, August 1997,pp.88-92.

5) Precaution against polluting material water coursed around the mining areas;

6) Discharge of toxic fluids/failings;

7) Precaution against moist, and

8) Restoration of flora and fauna."

If the government diverts its concern for a while, from only harnessing the natural resources with the aim of maximisation of profit from this region and try to strictly follow the application of the existing rules with the assistance of bureaucratic machinery and also by involving people, then we can have a proper balance of economy with the environment in this region.

Use of many essential resources and generation of various kinds of pollution and degradation in the environment have already surpassed rates that are physically sustainable. The need is to have comprehensive revision of policies and practices that perpetuate growth in material consumption and worsen the environmental condition. An equilibrium between economy y and environment is still technically and economically possible.

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