"A Spatio-Temporal Analysis of the Land Use Pattern in Orissa; 1960-61 to 1980-81".

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DECLARATION

Certified that the dissertation entitled "A SPATIO-TEMPORAL ANALYSIS OF THE LAND USE PATTERN IN ORISSA ; 1960-61 TO 1980-81", submitted by SHRI GOPAL KRUSHNA DHALL in fulfilment of six credits out of the total requirement of thirty credits for the award of MASTER OF PHILOSOPHY (M.Phil) of the University, is, to the best of our knowledge, a bonafied work and may be placed before the examiners for evaluation

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C O N T E N T S

PREFACE

"A hungry world is never likely to be a peaceful world". This conclusion has stimulated researches on the problem of fighting the onslaught of hunger in the different branches of knowledge. It is not amazing that in geography, researches are also being carried out with this objective. The need for such research becomes all the more imperative in a region like ours where the agriculture is still in its babe. This, combined with the problem of the limited supply of land available for further expansion of agriculture poses a grave threat to the future of Mankind. It is in this context, that the land use studies aquire a special significance. Thus, the only solution to this problem is a proper evaluation of the existing land use patterns with their changes over time that will help in an attempt towards the optimum utilization of the available land resources.

The present study is only an exploratory work in this direction in one of the agriculturally most backward states -'Orissa'. The whole work consists of five units.

Chapter one of this work defines the nature of the Problem, objectives of the study and a brief introduction to the study region. Also elaborately discussed in this chapter are the data that have been utilized and methods followed to analyse the pattern of land utilization.

Second chapter deals with an analysis of the various factors that determine the extent and pattern of land utilization with reference to the study region.

Chapter three of this work elaborately analyses the 'Other than agricultural land uses', their pattern of distribution, growth and the forces causing this.

The'Agricultural land use patterns' are dealt with in the chapter four in terms of various characteristic features of agricultural land use and the forces that give rise to such features.

Finally, chapter five contains the concluding remarks and a brief discussion of the findings and inferences.

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CHAPTER - ONE

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

In regional geography there are two leading questions to be answered : to what uses is the area in question being put; and : what are its possibilities ? On these two questions the fundamental technique of regional analysis rests. (Sauer, 1921;3). If these primary objects are expressed in the study of rural areas, there will first be studies in the present utilization of land, when these are evaluated against a time frame it reveals the changes that had taken place in the land we pattern over time. The present study tries to explore and analyse these two aspects of land utilization. However, before delving deep into the analysis of these above mentioned aspects of land utilization, it makes sense to have a brief discussion as to what 'land use' does mean and what are the different characteristic features of land utilization? The term 'Land use' can be defined as the surface utilization of all developed and vacant land on a specific point, at a given time and space. It is the use actually made for any parcel of land. In fact, land use is mainly related to the optimum use of the limited land between the alternative major types of land uses. The concept of land use revolves around the man's accomplishments in conversion of land's major use to another general use. Thus, two major conceptual considerations are present in every land use analysis i.e.

A Compatibility Matrix of Competing Rural Activities

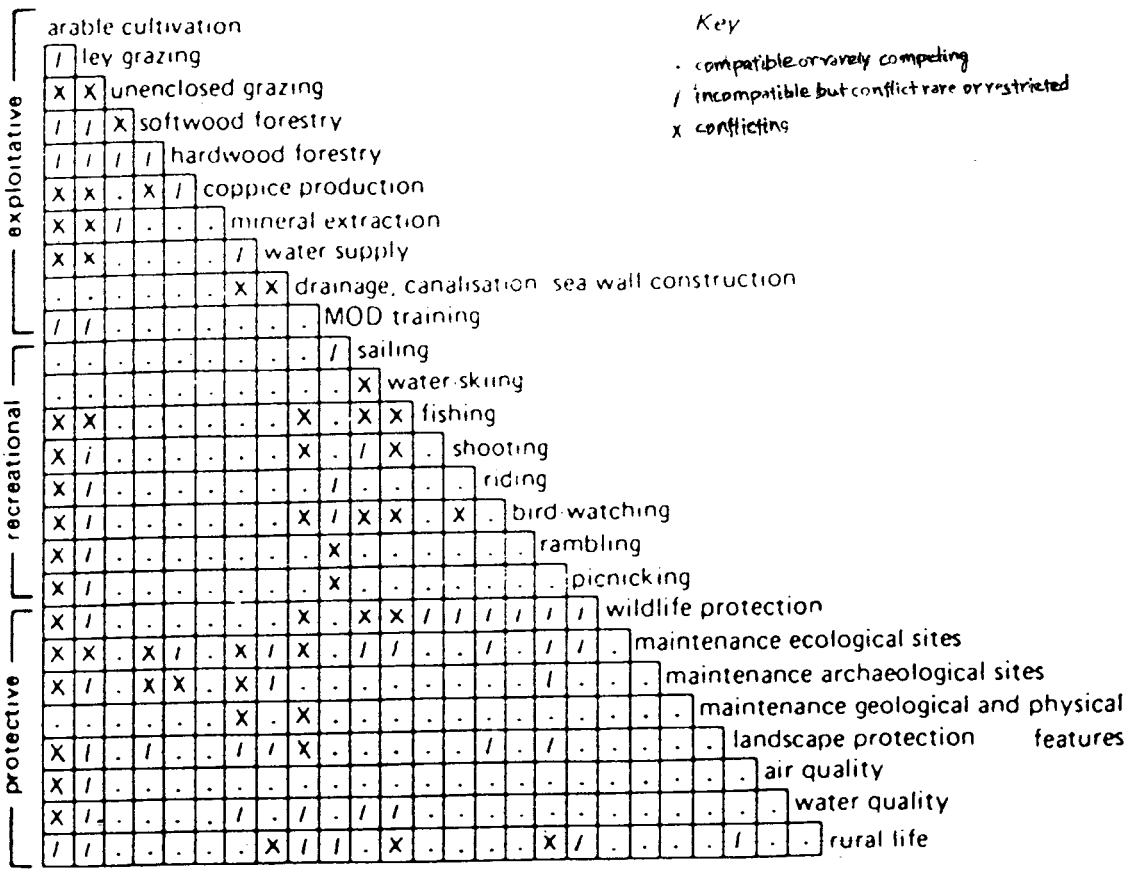

Fig. 1.1

Source : A.G. Champion (1983), p.39

a] Optimum use and

b] Alternate Use

These are the two basic concepts over which the whole body of land use analysis hoover around.

Optimum land use refers to the two characteristics of land use : type and intensity. 'Type' present no such problems of definition. No matter what land use classification scheme is being employed, researchers all use the term in the same way. 'Intensity', however, has been used with a variety of meanings. However, the usual meaning, and one which should be adhered to for the sake of confirmity is the ratio of inputs to land area. (Found, 1971; 12) The concept of optimum land use reflects as such the best and most favourable ecological relationships among land use components on the one hand and man on the other (Singh, 1977; 61).

Landuse is also related to the migration of land within alternate uses. In other words, 'Land Use" is also related to conversion of land from one major use to another general use (Nanavati, 1957; 2) As it is not normally possible to use land for two or more purposes at a time, there is always a competitive relationship between varrying economic activities related to land and usually the one with the highest degree of returns prevails over other competing ones. Fig.1. reflects such a compatibility matrix for the different and competing rural activities.

Again, land use changes to meet the variable demands of the land by the society in its new ways and conditions of life. The demand for the new uses of land may be inspired by a technological change or by a change in the size, composition and requirements of a community. Some changes are short lived, where as others represent a more constant demand (Jackson, 1963; 109) The growth of population and the resultant needs make the conflicts of land use more serious. In studying rural land use trends, it is therefore now necessary to look beyond the competition between land-using activities and the particularly well documented struggle between agriculture and urban development and recognize the existence of clashes between a range of interests within the rural environment (Champion, 1983; 21).

1.2 OBJECTIVE OF THE STUDY

The aim of the present work is to explore the pattern of land utilization and bringout the salient changes in the land use patterns of Orissa during the last 20 years i.e. between 1961 and 1981. During the post independence years, the increasing pressure of population on land, the impact of urbanisation and industrialisation, the introduction of scientific methods of cultivation and a gamut of other factors have brought about a sea of change in the general land use pattern of Orissa. As it has been stated earlier, the role of land use studies highlight the land use changes which have taken place due to socio-economic transformation and adminis-

trative set-up to suggest measures to increase production by proper uses of land. It also reveals the potentialities of the land, especially soils and suggests land utilization in proper way. Considering all these problems, the present study of Orissa has been selected because Orissa represents a Paradox - a land of poverty and stagnation in the midst of abundance of resources which have been left for most part untrapped. And what is important is that after four decades of independence the paradox is still there; compounded with the heart-breaking blows of successive phases of droughts, floods and cyclones.

1.3 SOURCES OF DATA

The present study is based on the secondary informations gathered from various governmental as well as non-governmental published sources. These are as follows :

1] The data concerning the pattern of land utilization has been collected from the 'Statistical Abstract of Orissa', 1961, 1973 and 1981 and the 'Indian agricultural statistics' of the year 1972-73.

2] Data regarding population of the state and its various characteristics e.g. literacy, rural urban ratio, Occupational structure, density etc. has been collected from the census of India, 1961 (vol.XII, part II A and B and part IX A) 1971 (Series -16, part II A and B and part IX) and 1981 (series-16, part IIA and Part III A & B).

3] The informations regarding climatic conditions and other physiographical characteristics were gathered from the 'Census Atlas of Orissa, 1971".

4] Information were also collected from other sources like'Economic Review of Orissa' and 'Economic situation of Orissa'.

5] Informations regarding fertilizer consumption were collected from the "Statistics on Fertilisers and Agriculture in Eastern India"while informations regarding the rivers were collected from the "Census Atlas of Orissa," 1971 as well as from "Floods in Orissa Rivers during 1955 and 1956, Final report", Government of Orissa.

6] Informations regarding the use of mechinery were gathered from the 'statistical abstract of Orissa', for the respective years.

7] Besides these, maps as well as informations were also collected from Published papers by various authors like Sinha (1958,1981) and Mahalik (1984).

1.4 METHODOLOGY

In the present study a number of methods were applied to analyse different aspects of land utilisation in Orissa during

1960-61 to 1980-81. Districts were taken as the basic units of study primarily because of the non-availability of data in Tahsil or Taluk levels for all the years. The following techniques were applied in the study to arrive at various conclusions.

1. Percentage of total area under different land use categories and area under different crops were arrived at by using the formula

$$\frac{X_1}{\Sigma X_{1----n}} \times 100$$

where X_1 - Area under a specific category of land use/crop

ΣX_{1----n} - Total Reported Area/Total cropped Area.

2. Growth rates were calculated to know the nature and intensity of change during two periods by using the formula

$$\frac{X_1 - X_0}{X_0} \times 100$$

where X_0 - the base year for which calculations were being made

X_1 - the figure of the next or succeeding year.

3. Physiological Density was derived by the following formula to illustrate the pressure of population on cultivated land.

$$PD = \frac{\text{Total Population}}{\text{Gross Cropped Area}}$$

where PD is the physiological density.

4. The intensity of cropping was calculated with the help of following formula :

$$I = \frac{\text{Gross Cropped Area}}{\text{Net Area Sown}} \times 100$$

where I is the intensity index.

5. Crop combination regions were identified by the help of Doi's method of Corp combination which reads as follows :

$$(\Sigma d^2)$$

6. Index of Mechanization was calculated by using M.N.Paul's formula which reads as follows :

$$I = \frac{S(P)}{S(Q)\ E\ (P) + S(P)\ E(Q)}\ Q_i + \frac{S(Q)}{S(Q)\ E(P) + S(P)\ E(Q)} P_i$$

where I - composite Index of Mechanization

Q_i - number of tractors per 1000 hectares of Net sown area

P_i - Number of irrigation mechinery per 1000 hectares of net sown area

E(Q) & E(P) - Mean of the series 'Qi' and 'Pi' respectively

S(Q) & S(P) - Standard deviations of the series 'Qi' and 'Pi' respectively.

1.5 AN OVERVIEW OF LITERATURE

The formulation of the techniques of land use studies may be said to have its origin to two papers published by professional geographers between 1919 and 1925. 1919 saw the publication of Carl O Saur's "Mapping the utilization of land" while in 1925 the Publication of Detailed Field Mapping of an agricultural area" by W.D. Jones and V.C. Finch. Thus, the era of systematic land use study began. Consequently more and more attention was diverted towards this field of study. In his 'Agricultural regions of Europe', Jonasson (1925) recognised 3 basic land use types e.g. the crops, the pasture and the forest. Similarly Baker (1927) recognised three land use classes e.g. crops, forests and live-stock in his article "Agricultural Regions of North America". Followed were Taylor's (1930) "Agricultural regions of Australia" and Valkenburg's (1931-36) "Agricultural Regionalisation of Asia" which was published in a series of articles between 1931-36. However, all these approaches were more or less normative and lacking a common quantitative flavour.

It was left to L.D. Stamp to attempt a more systematic, organised and quantitative approach in land use analysis. In the year 1930, he established an independent research organisation called, 'Land Utilisation Survey of Britain' with the main objective of preparing land use maps of Britain. He was able to prepare the land use maps before the war and it was only after

the war that the significance of such a study was realised. On the basis of these maps a voluminous book entitled, "The land of Britain : Its use and misuse" was published in the year 1962. Two other books e.g. 'Land for Tomorrow : The under developed world' and 'The land : Now and tomorrow' Published in the years 1951 and 1948 respectively. These three works encouraged and provided guidelines to geographers all over the world.

Similarly, J.L. Buck (1937) carried on the land utilisation surveying in China and the Maps and reports were published in the form of a book entitled, "Land utilization in China" The field work in this case did not spread over every single hectare of land as it did in the British Model of Stamp. Rather, it was confined to the Sample Surveying of Certain Selected districts (hesien) and the construction of a generalised picture of land use in China with the help of statistical data available. However, in the whole study no attempt was made to record the use of land on maps which is an important aspect of land use study.

In the USA, the government also encouraged the land utilization studies in the country. Although the programme of land utilization survey was launched in the year 1935, it was properly executed only after 1938. The organization undertook the studies of land utilization including map making and their analysis. Special attention was laid on farming types, land holding size in each landuse area, as well as areas to be recommanded for forestry

wildlife, recreation, settlements etc. Infact, the survey done in the U.S.A. were land capability surveys as their purpose was to record not only the use of the selected units of the land at one time, but also to indicate the best suited use of land. Much of the credit for such a study can be attributed to O.E. Baker (1973), who has depicted the trends in land use utilization and emphasized the need of land classification survey in his article entitled 'Land Utilization in the USA : Geographical aspects of the Problem). (Kumar,1986; 5)

Thus in the post war period,the study of land utilization has been undertaken in many countries either through independent research organizations or by universities. For example a second land utilization survey of Britain was taken up by Miss Coleman and Maggs in the year 1961. Similarly land utilization maps were prepared from about 10,000 air photographs (1:10,000 to 1:13,000) taken in 1949 under the direction of R.R. Rawson and K.R. Selay for Cyprus (Melamid, 1968; 112-113) The land use map of Italy were being published by Italian National Research Society (Kish, 1968; 270) As a result of the recommendations made by the commission on world land use survey of the International Geographical Union, the Italian deligation to the International geographical congress 1952 presented a map on the scale of 1:200,000 dealing with the land utilization in Tuscany. In Poland, under the direction of J. Kostrowiekai a new pattern of land use surveying

was developed basing upon the agricultural typology, agricultural regionalization and programmed agricultural development (Kostrowiekai, 1968) Thus today one can find excellent land use maps of Cyprus, Italy, Poland, Hong Kong and parts of Canada the U.S.A. and France.

In addition to this these were numerous micro analytical studies attempting an examination of the unique causes of patterns within specific areas. For example, Buchanan and Hurwitz (1951) tried to bringout the various factors affecting the agricultural potentialities of the various districts of Natal Province and found out that the dominating factor in the land use pattern appears to accessibility, largely to Durban. Similar works were also attempted by Baker (1921) Tavener (1937) Best and others (1962). However, broader attempts at generalization have been rare, partly because geographers have not regarded it as their function to provide broad generalizations and partly because other disciplines have been concerned with theories of land use to which geographers could refer when necessary (D.W. Harvey, 1966; 361).

HISTORY OF LAND USE STUDY IN INDIA

As far as the birth and progress of land utilization studies and surveys in India is concerned, it can be said that the Indian geographers got inspiration from L.D. Stamp during the 25th Session of the Indian Science Congress, 1938 which ignited the take off of

land utilization survey in India. Thus, it was in the year 1940 that professor S.P. Chatterjee tried to organize the land use survey of India. In his presidential address before the section of Geography and Geodesy in the Indian Science Congress Association of 1940 he pointed out the necessity of under taking a land use survey. It was followed up by a land utilization survey of 24 Praganas and Howrah districts of West Bengal by S.P. Chatterjee (1945 & 1952).

This was followed by a sample study of land utilization carried out by Karimi (1949-50) in Bihar. Similarly Lahiri (1950) made a study of land utilization in some villages near Jasidin. In Ranchi University, E. Ahmad (1984) analysed land use types in relation to physical elements and concluded that the slope of the land should be considered in preparing the development schemes of an Indian village. V.L.S. Prakasa Rao (1956) suggested land use classification on the lines of soil survey technique. He applied his idea to land use analysis of the Godavari region. Bharadwaj (1960) also dealt with land use in the low lands of the Beas River in the Bist-Jullunder Doab with particular reference to two villages - Mohalla and Aki Tunda.

The year 1960 saw the publication of Shafi's "Land Utilization in Eastern Uttar Pradesh," where he made a strong plea to carry out the land use survey combined with the survey of land capability. In one of his papers, Shafi also advocated for

a land use survey of Chinese sampling model where he preferred purposive sampling to other four types i.e. Randan, stratified, cluster and systematic (M. Shafi; 1966) Similarly he also view that the studies are recently shifting towards the application of quantitative techniques in the analysis of various land use components. (Shafi, 1966; 19) He also assessed the measurement of land resources interms of food production efficiency per unit area and its conversion into calories. In this way he studied land capability classification and measured the potentials of land after considering the effects of positive and negetive variables. (Shafi, 1969; 24).

There were also others like R.N.P. Sinha (1965) of Patna University who intensively studied the land use of canal irrigated area of Patna district. Tewari (1966) also attempted a land use survey of Jaunsar Bawar. Similarly Yadav (1965) had studied the broad regional variations in agricultural land use in Rajasthan. B.K. Roy (1968) made a sample study in land utilization of five village in Balia district and has also contributed a paper on measurement rural land use in Azamgarh, Middle Ganga Valley.

In Sagar University S.N. Mishra (1964) studied land use in Khadar and ravines of the lower middle Gomati Valley. Similarly K.Z. Amani (1968) brought out a paper on land utilization in village

Golagarhi.Das (1969) studied the land use of Kosi Basin in North Bihar while Singh (1970) calculated the land capability with potential productive unit and the standard nutrition unit. Indu Priya (1971) Prasad (1977) and Singh (1980) have studied the land use problem of different community development blocks of Bihar. Similarly Das (1973) attempted a study of land utilization in the sub Himalayan districts of West Bengal.

R.P. Singh (1975) published a paper on the land use and planning of Nagra. In 1977 Babban Singh attempted an analysis of theorising the different stages of land use development in his paper 'Land Use : Its efficiency, stage and optimum use; A study in formulating hypothesis and Models'. Similarly under the guidance of Dayal and Sharan (1972) Department of Geography, Patna University had surveyed 3 consucative community development Blocks i.e. Bihar Sharif, Noorsarai and Rahui in Nalanda district.

As far as the governmental initiatives in land use surveying in concened the government of India established a National Committee for the purpose under the guidance of S.P. Chatterjee. He surveyed 800 villages of West Bengal and brought out 11 land use sheets on the scale of 4 inches to mile.Prior to this, a scheme was drawn for preparing land use maps on scale 1:1,000,000 as a part of the National Atlas Organization. However,

by that time, no systematic land use survey had been initiated for entire country. The Government of Andhra Pradesh also conducted a pilot survey of east Godavari district. Similar studies have been made by the Government of Karnataka for the whole state (Govt. of Karnataka, Planning Department, 1975) The Government of Bombay also conducted a pilot land use survey for the Thana Taluka. Different Governmental agencies have also contributed to the knowledge of land use studies. The "Agricultural Atlas of India", the "National Atlas" and the "Census Atlases" of different states contain choropleth and dot maps relating of landuse and crops.

As regards of the studies on agricultural land utilization in India is concerned the 1960s stands out as a watershed in the diverse way of approaches by the Indian agricultural geographors. Prior to 1960s the works were based on commodities approach i.e. taking in to account a single or few crops and analysing it in the regional framework with reference to physical and socio-economic correlates. However, these studies failed to present a comprehensive scheme for agricultural regionalisation due to 3 basic factors e.g.

1] It did not include all crops covering a major portion of the gross cropped area

2] Crops were not visualised in their association with each other and

3] Studies were subjective due to the lack of proper quantitative methods.

However, in the early 1960s, the impact of quantitative techniques as introduced by Weaver (1954) in the crop combinational analysis followed as well as modified by others in the subsequent periods in the different parts of the world was realised by Indian Agricultural geographers. Slowly and steadily then, the introduction of quantitative techniques in agricultural land use analysis in India took place.

In 1963, Ganguly classified the croplands of Bhurki village of Banaras on the basis of areal strength of various crops.V.L.S.P. Rao (1954) discussed techniques of area analysis and classification of crop lands with reference to agricultural regions of lower Godavari basin area. Gosal and Ojha (1967) also analysed agricultural land use in Punjab by taking individual crops separately and by visualising changes in area under different crops between 1951-61. A similar study was also conducted by Tripathy and Agarwal (1968) using Doi's method of crop combinational analysis. G.K. Mishra (1971) stressed the need of having a new approach which he named as the "Land-climatic complex Approach" for tracing out the cropping pattern of a region. Similarly J. Singh (1971) also evaluated the impact of seasonality for determining the agricultural land use and cropping pattern in the Hissar district of Haryana.

By the end of 1960s, Crop combinational analysis as formulated by Weaver and further modified by Doi as well as the techniques formulated by Nelson and Bhatia analyse agricultural land use pattern were well accepted by the Indian geographers. There were also new formulations to arrive at the crop combination regions with least complexity as the formula adopted by Rafiullah (1956) which, although suffers from the defects of huge calculations is quite suitable for delineating sharply the primary crop combinations. Similarly, deviating from Weaver's idea of crop combination, N.P. Ayyar (1968) had tried to simplify such investigation through another formula known as maximum distance method. Also, there were the methods of difference and summation and lower limit method of Athawale (1966) and standard deviation method by Betal (1976) formulated for crop combinational analysis. All these developments signify the complete acceptance of quantitative techniques as a method to analyse the cropping pattern and to reach a comprehensive agricultural regionalisation.

As regards the use of such techniques by Indian agricultural geographers Doi's method was used by Nityanand (1972) while working out the crop combination regions of Rajasthan. While analysing the changing character of agricultural land use in the littoral tract of deltaic West Bengal Chattopadhya and Bagchi (1984) also used the same method. Similarly N. Mohammad

and K.Z. Amani (1970) used Doi's method while analysing the crop combination regions in Trans-Ghaghara Plain. K.N. Singh and B. Singh (1970) also used Doi's method to arrive at the crop combinational regions of Shahganj Tahsil.

B. Mandal (1969) analysed the crop combination regions of North Bihar using Weaver's method. V.B. Tripathi (1965) and S.P. Garg (1968) while analysing the land use of Lower Ganga-Yamuna Doab and Saharanpur district respectively of Uttar Pradesh also used Weaver's formula. Others who had used Weaver's technique of Crop-combinational analysis include M. Hussain (1972) and S.C. Amatya (1973).

While analysing the crop combination, B.N. Sinha(1968) had taken the help of both Weaver's and Nelson's method. Similarly Das (1984) arrived at the crop combinational regions of Assam using Nelson's Method.

However, there are still many who did not deviate from the conventional approach. Sharma (1972) realised the importance of terrain and climate in determining the agricultural regions. However, he adopted crop combination analysis as basis for delineating the subregions of Macro-Morpho-Agricultural regions. Dixit (1973) presented a scheme of agricultural regionalization of Maharastra on the basis of similarity of cropping pattern. Similarly Shafi (1984) elaborately dealt with the cropping patterns

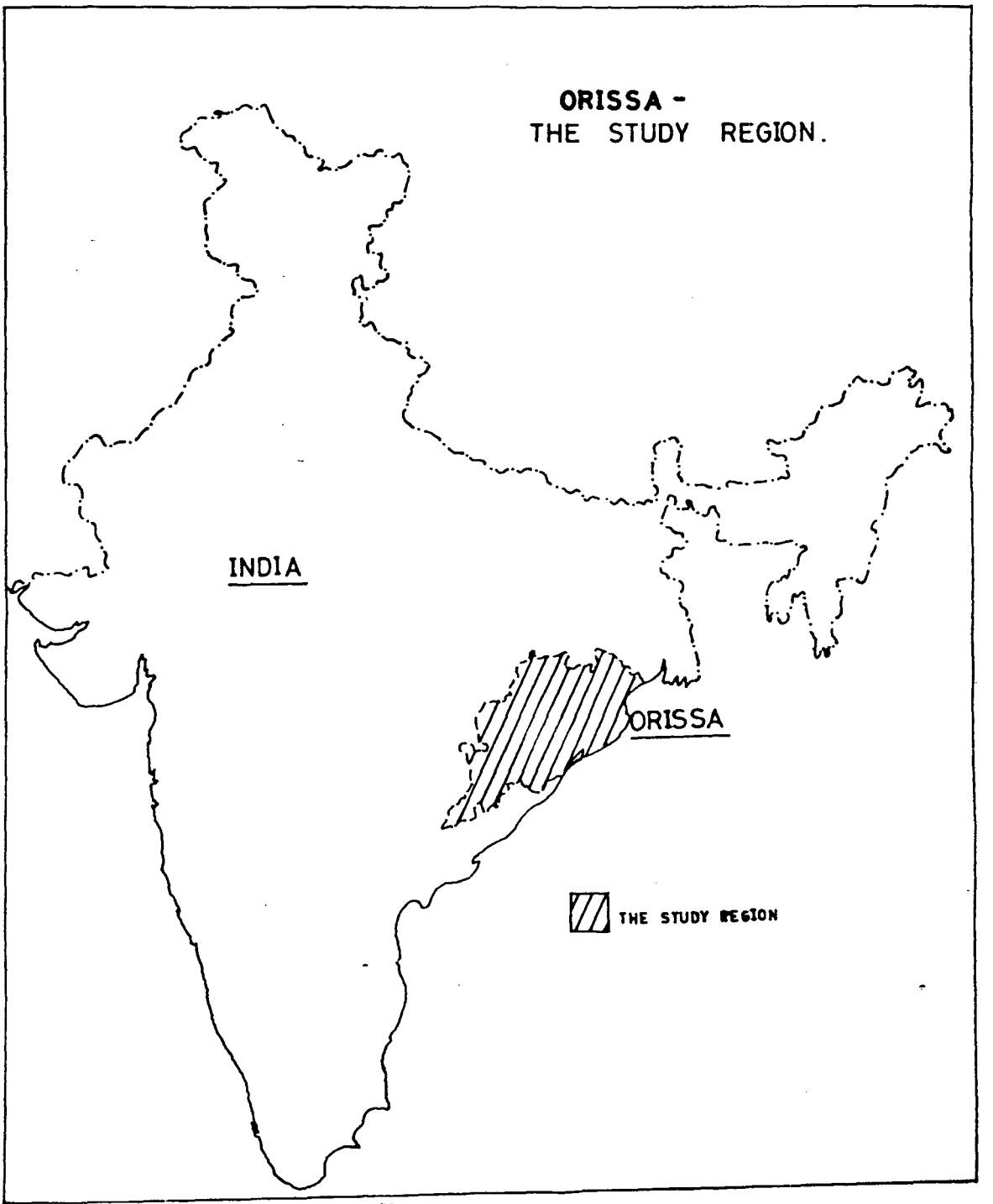

Fig. 1.2

and crop combination regions of Uttar Pradesh and the changes between 1966-67 and 1975-76 taking districts as units of study. Giriappa and Vivekanand (1984) studied the cropping pattern between 1950-51 and 1978-79 on the statelevel but only a few important crops are taken into account. Similarly M.V. Reddy and N.B.K. Reddy (1988) studied the land use orientation in the Chittor district of Andhra Pradesh using Kostrowicki's scheme of land use orientation.

The overview of the existing literature thus indicates that studies on the land utilization in general and agricultural land utilisation in particular have been initiated and well progressed at different levels of study in India. But, most of such studies are micro-regional in character being confined to particular regions of the country. Plenty of works are available on Punjab, Haryana, Uttarpradesh, West Bengal and Bihar where as such works are very few in number for a state with a predominantly agricultural population and economy like Orissa. The present study is therefore supposed to be of much importance as a contributory study to the economic geography of the state.

1.6 The Study Region

"Orissa" - the area under study lies in the east coast of Indian sub-continent. Extending from 17°48' north to 22°34' north latitude and 81°24' east to 87°29' east longitude it has an area

Based upon Survey of India Map with the permission of the Surveyor General of India. The Territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appopriate base line.

Fig.1.3

of about 155752 square kms. Flanked by the Bay of Bengal in the east and the states of Andhra Pradesh in South, Madhya Pradesh in West, Bihar in North and West Bengal in the North-East (Fig.1.2) the state of Orissa comprised of thirteen districts. The largest is Koraput with an area of about 27020 km^2 and the smallest being Balasore with an area of about 6470 km^2 (Fig. 1.3).

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Chapter - TWO

FACTORS OF LAND USE

2.1 *Introduction*

For human existence within certain biotic, ecological and economic conditions, the uitization of land assumes prime importance, which, inturn, is dependent upon a set of forces characterized by the physical, social economic as well as the cultural milieux of the region concerned. Social and natural scientists, especially geographers have a long tradition of examining the direct relationship between the natural environment and man's use of land. The dominant conclusion of this research tradition is that, variations in landuse, particularly on largescale, can be explained to a considerable degree by variations in land quality (including climate). Some researchers have even given the impression that this ecological relationship is so important and overwhelming that the role of man as a decision maker can largely be disregarded. But, actually, the existence of such a strong relationship could be regarded as putting the focus on man as a decision-maker who is very sensitive to variations in the land resource base and who displays a strong rationality by reacting sensibly to them. (Found, 1971;22).

Thus, two theoretical models, explaining the land use decision of man can be traced in every land utilization study. These include -

a] the economic decision making model;and

b] the behavioural decision making model.

The Economic decision making model suggests that, land use patterns can only be understood by understanding the relevent processes of decision making of the 'homo-economicus' seeking to optimize his net income in a purely competitive system. The following is a diagram illustrating the forces which influence land use decisions of man - the 'homo-economicus' in a greatly simplified fashion.

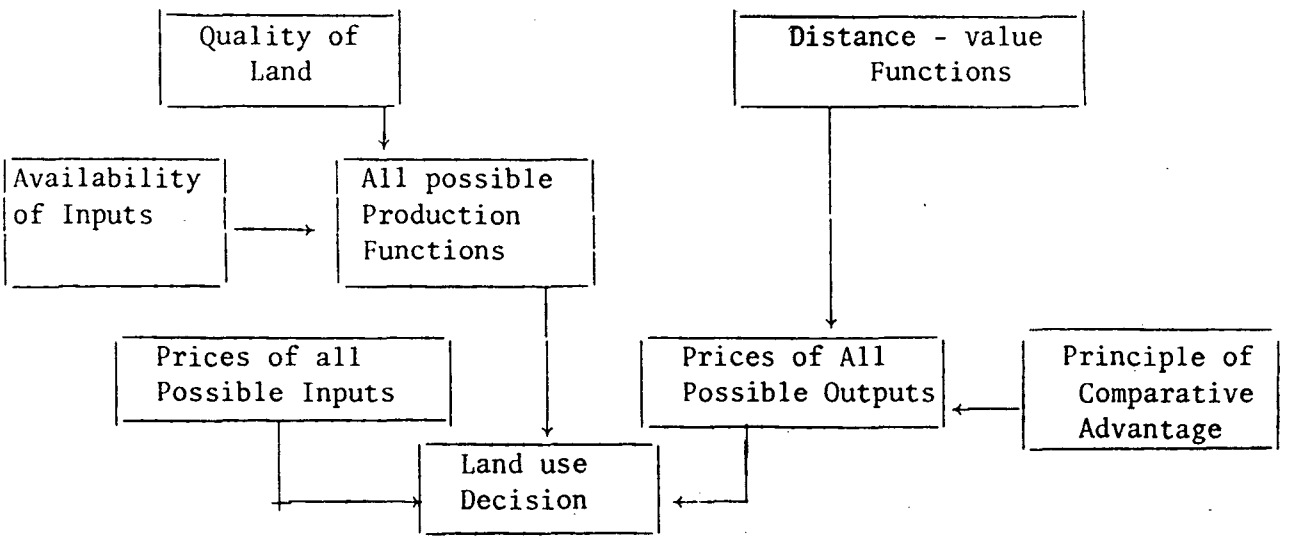

Fig. 2.1 : Decision framework for economic man at a particular location operating under pure competition.(Greatly Simplified) (Found, 1971; 165)

However, in the above model no attempt has been made to indicate two way relationships among the variables or to present much of the complexity of the framework. Infact, it presents one extreme - the decision framework for man possessing perfect information and capabilities. Thus, in explaining real life land

use variations, economic decision models are valid only if we can assume that real man behave according to the assumptions on which the models are based (Found, 1971; 167).

However, human behaviour is a complex factor and it depends upon the degree of modernisation, dietary habits, willingness to innovate and a gamut of other factors. Thus,any model neglecting this aspect of human behaviour lacks in the complete explanation of a particular phenomena. Again,individual behaviour, within normal limits of variation, is strongly related to the behaviour of the group, so that one can define regional 'personalities' or 'capabilities'. Land use decisions depend, in part, on the decision environment within which an individual operates. It is thus useful to call the information which is available to the decision maker as the 'decision environment', and the complete set of information assumed in most traditional models as the 'extended or real environment. (Simon; 1956).

The decision environment can be very different from the real environment if the individual has had insufficient time, ability, motivation or communication to learn about the world which sorrounds him. The decision environment also vary spatially, which is one of the reasons for spatial variations in land use. However, part of the explanation is that, real environment also vary spatially. These variations in the decision environment can also be related to other factors like availability of information and the extent to which decision makrers seek, learn and use it.

An important part of decision environment is thus, the collection of images of reality which relate to land use. Hence, as the preceeding discussion brings out, much of the literature concerned with the spatial variations in land use which relate to information and learning is concerned with (a) Cultural and sociological characteristics of the decision makers and (b) Mechanisms by which informaton about new innovations spreads. The following diagram is a highly abstracted model of the individual's general decision making frame work, with a number of interlinking variables such as communication, omitted for the sake of simplicity.

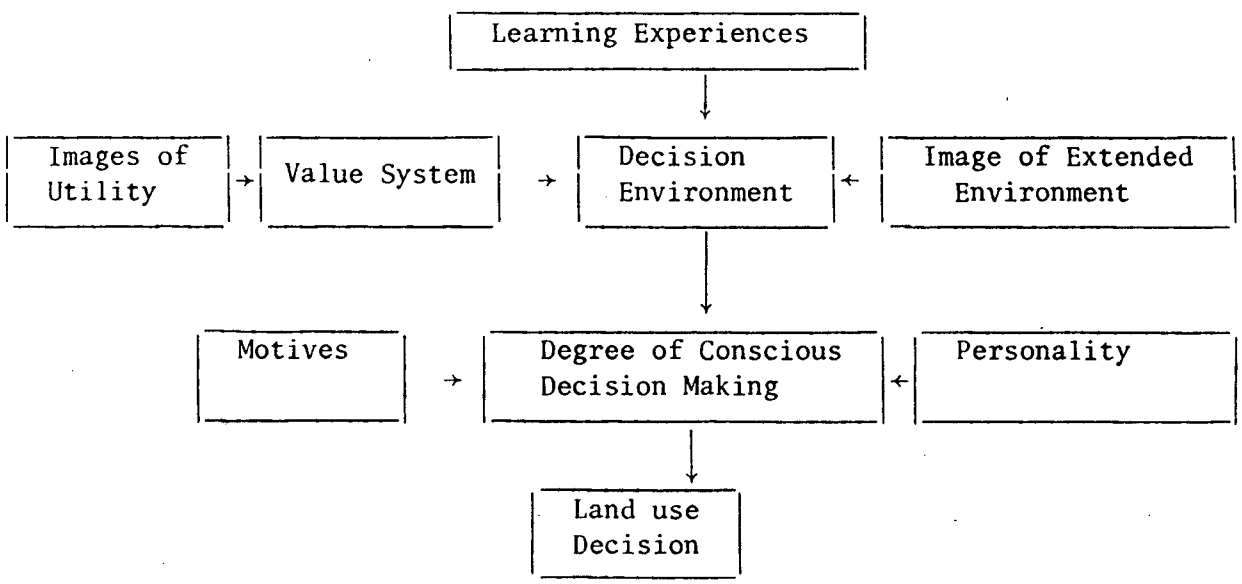

Fig. 2.2 : Simplified view of an individual's general decision making framework. (Found, 1971; 166).

Togather, traditional economic and behavioural concepts cover the complete range of a continuum of human decision making possibilities. However, it is doubtful if one could understand

any land use situation well without drawing on concepts of both economic and behavioural traditions. (Found, 1971; 166).

In the light of the preceeding discussion, it can thus safely be concluded that, before we embark upon the analysis of the pattern of land utilization in Orissa over the years, it makes sense to have a brief discussion on the factors of land use as they are distributed in Orissa spatially as well as temporaly. The whole range of factors affecting the land use pattern of a region can be discussed under the following heads :

2.2 *Physical Factors :*

The physical factors or conditions determine in large degree, the pattern of land utilization in a region; and, these factors become more important as the population increases, the knowledge and practice of agriculture advances, transportation facilities are imporoved and the supply of capital and labour is increased and better distributed - in brief, as agriculture and forestry become more highly organized and commercialized. (Baker, 1921; 17). These factors e.g. geology, relief features, climate, soil and vegetation etc. limits the use capability of land.

i] Geology

The geology of a region directing its influence in the form of soil characteristics, ground water availability etc. moulds

After N. K. Mahalik (1984)

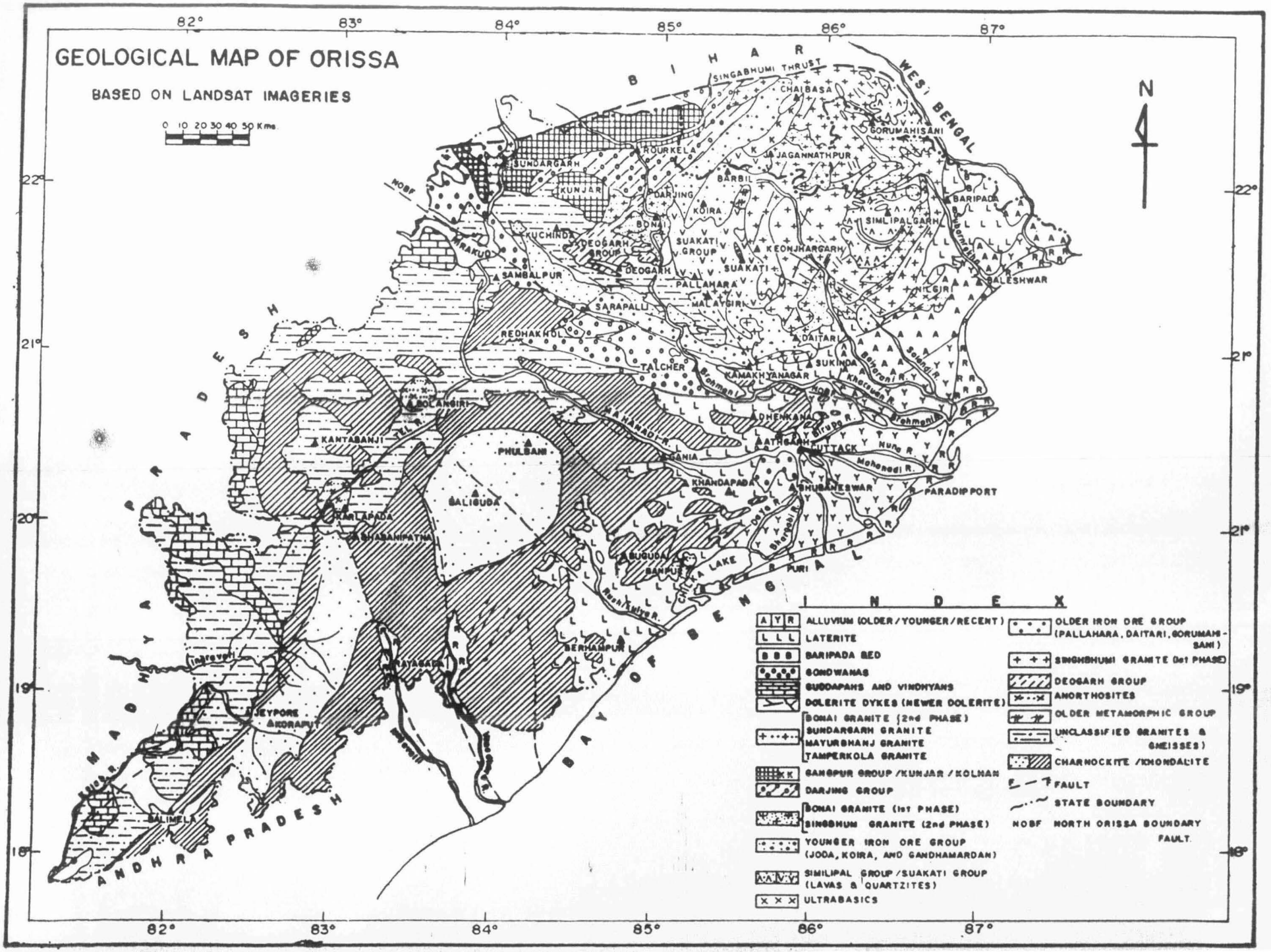

Fig 2.3

the pattern of land utilization accordingly.

Geologically, Orissa presents a complex lithological unit with rocks ranging from Archaean Period to the most recently laid alluviums occurring in association with each other. The North Orissa Boundary Fault (NOBF) as exposed by the land-sat imageries (Fig. 2.3) devides the state into two distinct geological units. It itself is a remarkable transverse trough partly floored by Gondawanas (including the famous Permo-Carboniferous glacial boulder bed at Talcher) (Spate etc, 1972 ;722). Towards the South of NOBF, occurrences of Archaean unclassified granites and gneisses can be marked covering the Western Parts of the districts of Koraput, Kalahandi and virtually the entire Bolangir district as well as parts of Sambalpur with interspersed out crops of Cuddapahs and Vindhyans. Khondalites occur towards the east of these formations with patches of Charnockites occurring as either circular or interbeded discordant bodies within them as one in Phulbani. These formations dominate the eastern parts of Koraput, Kalahandi, almost the entire Phulbani and Western Ganjam as well as parts of Puri, Cuttack and Sambalpur districts.

Coming to the land bounded by the Singhbhumi Thrust (See Fig. 2.3) in the north and the NOBF in the South, the major rock systems include the Singhbhumi granites occurring widely in the districts of Keonjhar and Mayurbhanj. The Bonai granites

occurring in the type region of Bonai and the iron ore bearing rocks of Pallahara, Daitary and Gorumahisani region are the other important rock systems along with the volcano - sedimentaries of Similipal Plateau and a spectrum of serveral other unclassified meta - sedimentaries and granite intrusives. (Mahalik, 1984; 3).

In the coastal plains, the alluvial deposites predominate in the districts of Balasore, Cuttack and Puri with older alluvium occurring in the upper deltaic plains away from the coast and recent alluvium in the lower deltaic plain close to the coast. Laterites can be identified in the Rushikulya plains in Ganjam and the mountainous tracts of Puri and Cuttack.

ii] Relief :

Perhaps the influence of environment on land use is more pronounced where topographical diversity is well marked. This includes rapid changes in land-forms, slope, degree of roughness of relief, changes in aspect and variation in altitude; all of which also controls the climate to a great extent which is one of the dominant factors in shaping the land use pattern of a region (Bose, 1969; 52).

A close look at the relief map of Orissa (Fig. 2.4) brings out four distinct morphological units e.g. (a) The Eastern Deltaic Plains of the major rivers like Mahanandi Bramhani, Baitarani,

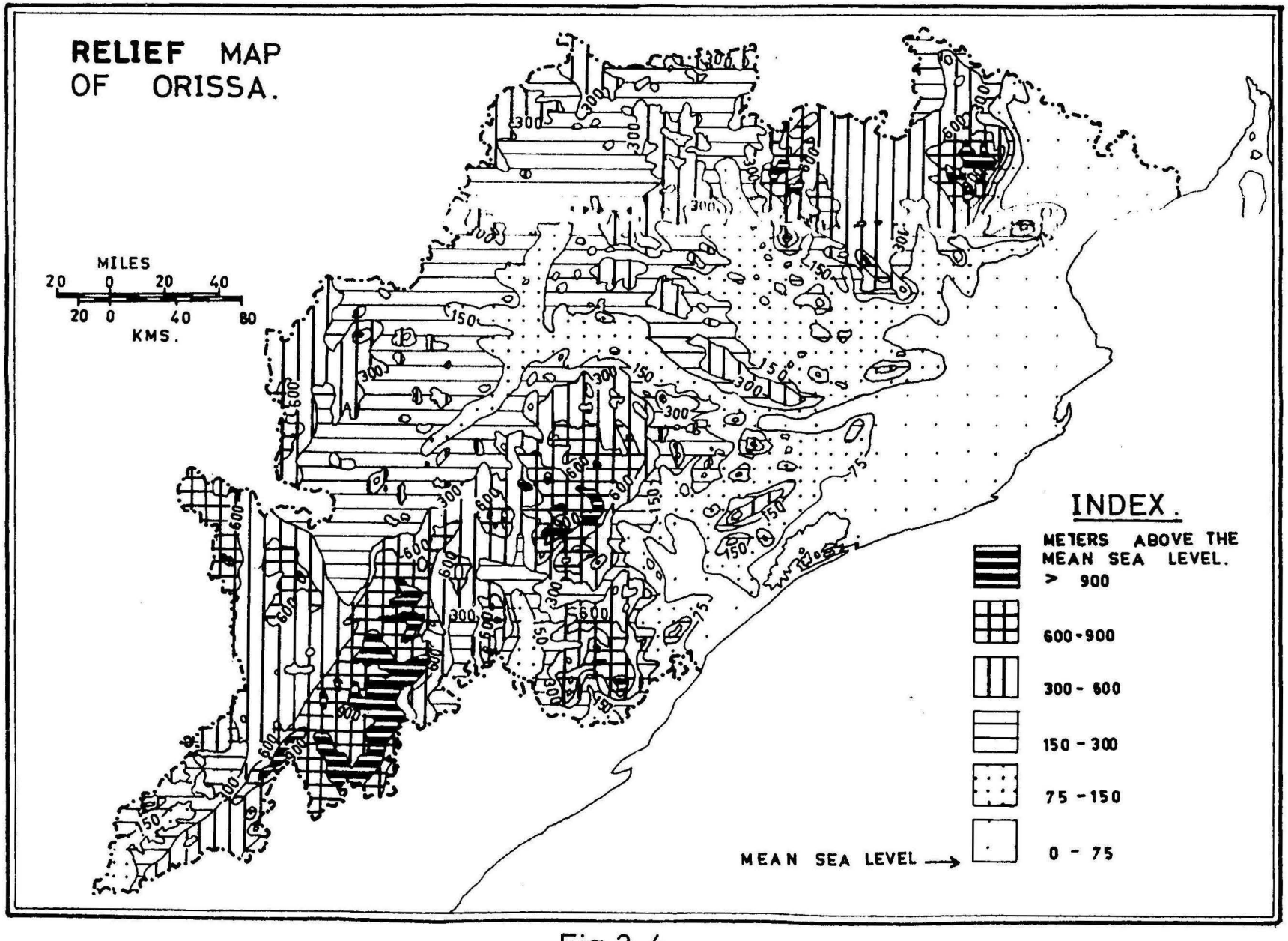
RELIEF MAP
OF ORISSA.
MILES
20 0 20 40
20 0 40 80
KMS.
INDEX.
METERS ABOVE THE MEAN SEA LEVEL.
> 900
600-900
300 - 600
150 - 300
75 - 150
0 - 75
MEAN SEA LEVEL

Fig.2.4

Subarnarekha etc. (b) The Erosional Uplands of West constituting the Mahanadi - Tel - Ong - Suktal basin (c) The Dissected Plateau-lands of the north and (d) The Eastern Ghat Mountainous regions of South and South-Central Orissa.

Three major rivers, the Baitarani, the Bramhani and the Mahanadi with contributions from rivers like Subarnarekha, Burhabalanga and Rushikulya and numerous other minor streams combine to form a great alluvial salient, 125 miles across the base from Balasore to Lake Chilka with a general breadth of 50 miles. (Sinha; 1961). The plain is narrower in both the ends and broadest in the center and is the most fertile and populous tract of the state. Roughly bounded by the 75 meter contour, the elevation within this tract increases from east to west and Sinha (1961) has rightly classified it further into (i) the Submontane tract with old alluvium towards the West (ii) the Salt tract adjoining the coastal areas and (iii) the rich arable part inbetween.

The erosional plains of the Mahanadi river basin lie between the Dissected Plateaus in the North and the South-South-Central hilly region of the Eastern Ghats. It includes the Ib, Suktel, and Tel river basins of the middle Mahanadi and the Sabari river basins. The Mahanadi-Tel basin is quite extensive covering about two-thirds of Sambalpur and Bolangir districts and one-third of Kalahandi. The average elevation of this region varies between

150 and 300 meters. They reveal all the pecularities of Peninsular table lands with an almost flat surface and isolated hills rising abruptly from the plains.

The dissected plateaus in the north is an undulating upland frequently intersected by hill ranges and has a general slope from North to South. Covering the districts of Mayurbhanj, Keonjhar, Sundargarh and the Pallahara sub-division of Dhenkanal district, it is considered to be the continuation of the Chhotanagpur Plateau of Bihar. The rivers - Bramhani and Baitarani, dissect it into three blocks. The eastern block consists of heavily forested hills of Mayurbhanj and forms the watershed of the Subarnarekha - Burhabalanga in the east and the Baitarani river systems in the west. The central block is again a well forested hilly region occupying most parts of Keonjhar and Sundargarh districts as also parts of Dhenkanal and acts as a watershed to the Bramhani and the Baitarani river systems. The Western block merges with the erosional plains of the Mahanadi basin.

The Mountainous region towards the South and South-Central Orissa represents the last lap of the Eastern Ghats. Stretching for about 155 miles in a north-east to South-West direction. This covers most parts of Koraput, Kalahandi, Phulbani and Ganjam districts. Most parts of this region have an elevation of over 900 meters acting as a watershed to the two set of rivers, one set flowing directly to the Bay of Bengal e.g. the Rushikulya

Nagavali and Vamsadhara rivers and the other set feeding the Godavari and Mahanadi systems.(Singh, 1971; 757). These include Indravati, Tel and Savari rivers.

iii] Drainage :

The principal rivers have shaped the physiography as well as the character and density of the alluvium tracts of the coastal deltas. Thus, the role of rivers in shaping the land use pattern of Orissa should not be underestimated. All the rivers that have drained through the state are rainfed and seasonal in character,thus,with pronounced fluctuations in the water flow. The major rivers of the state are the Mahanadi (533 miles), Indravati (329 miles), Subarnarekha (296 miles), Kolab (280 miles) Bramhani (438 miles), and Baitarani (215 miles). Besides, there are also a number of minor rivers like Machkund (184 miles), Burhabalanga (112 miles), Rushikulya (94 miles) etc.

The Mahanadi is the largest river of the state and indeed is one of the most active depositing streams in the sub-continent with an annual discharge that is extremely irregular - the maximum record near its mouth is as large as that of the Ganges during peak periods (Table 2.1). The rivers Baitarani, Bramhani and Mahanadi as they emerge in the plains, subdevide themselves into numerous branches eventually to be reunited and flowing into the Bay of Bengal through six major estuaries. The following table will provide a comparative picture of these three important

rivers.

TABLE - 2.1

THREE MAJOR RIVERS OF ORISSA: A COMPARATIVE ANALYSIS

Characteristics	Rivers		
	Mahanandi	Bramhani	Baitarani
1] Length (Miles)	533	438	215
2] Drainage Basin(sq.miles)	51000	14000	4000
3] Deltaic Area(sq.miles)	2940	854	659
4] Water Discharge(cusecs)			
i. Maximum	1571000	643290	500000
ii. Miaimum	200	130	74

(Source : Appendix - VI, Interim Report, Orissa Flood Advisory Committee, 1938-39)

iv] Climate :

Climate is one of the most dominant determinant of land use pattern extending its influence through the moisture and temperature conditions. The climatic conditions determine the type of soil a region has starting from the desert type soil to the heavily leached soils of rainy tropics and equatorial areas. The climatic factors influence in particular the development of general system of farming,dairying, cattle ranching, cotton growing etc. The climatic factors also affect the use of the land indirectly

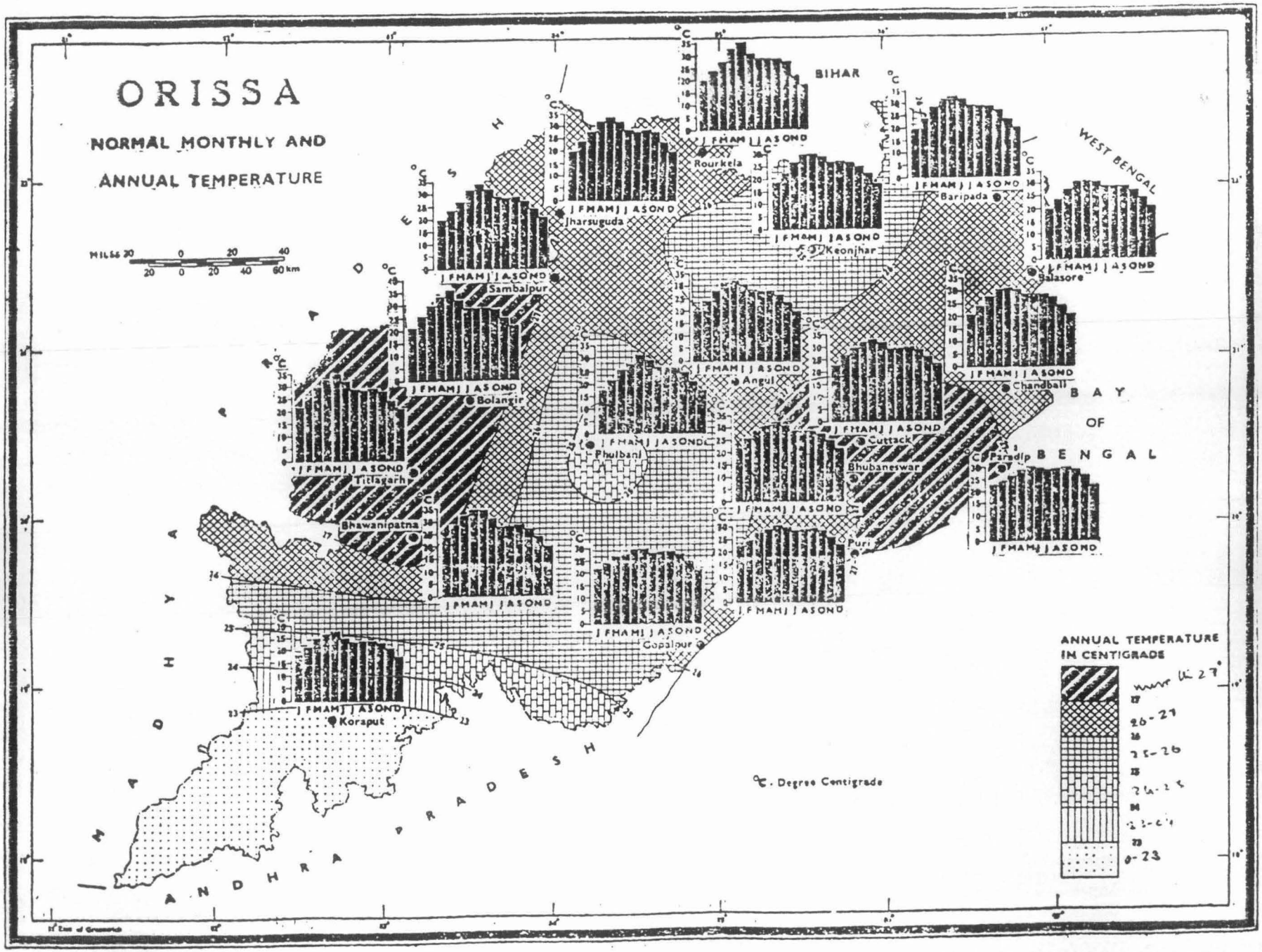

FIG. 2.5
SOURCE : CENSUS ATLAS OF ORISSA, 1971.

because of their influence upon the comfort and health of the people (Baker, 1921; 17).

Orissa enjoys a Tropical Monsoon type of climate with characteristically high temperature in most part of the year (Fig. 2.5) with medium to high rainfall. Basing on these two characteristics three main seasons can be identified, e.g.

a] Hot dry summer (March to Mid June)

b] Rainy or Season of South West Monsoons (Mid June to Mid Sept).

c] Cool dry winter (Mid September to February)

The transition from one season to another is not abrupt rather it is a gradual one prompting further local classifications.(Sinha, 1971; 21).

With the advent of summer, the mean Maximum temperature of the state rises upto 38.3°C in April and May from its original position of 32.8°C. The temperature begins to rise early in March and reaches its maxima around the end of May or early June (see Fig. 2.5). There is a steady increase of temperature from east to west as you move from the coastal areas to the inland districts. Thus, Sambalpur being located 180 miles inland has the mean maximum temperature of 42°C as compared to that of Puri with 32°C (Census of India, Part-I-A, 1961; 19). Almost the whole of Orissa except the coastal and the middle mountainous regions has a mean annual temperature of 21.4°C to 26.6°C.

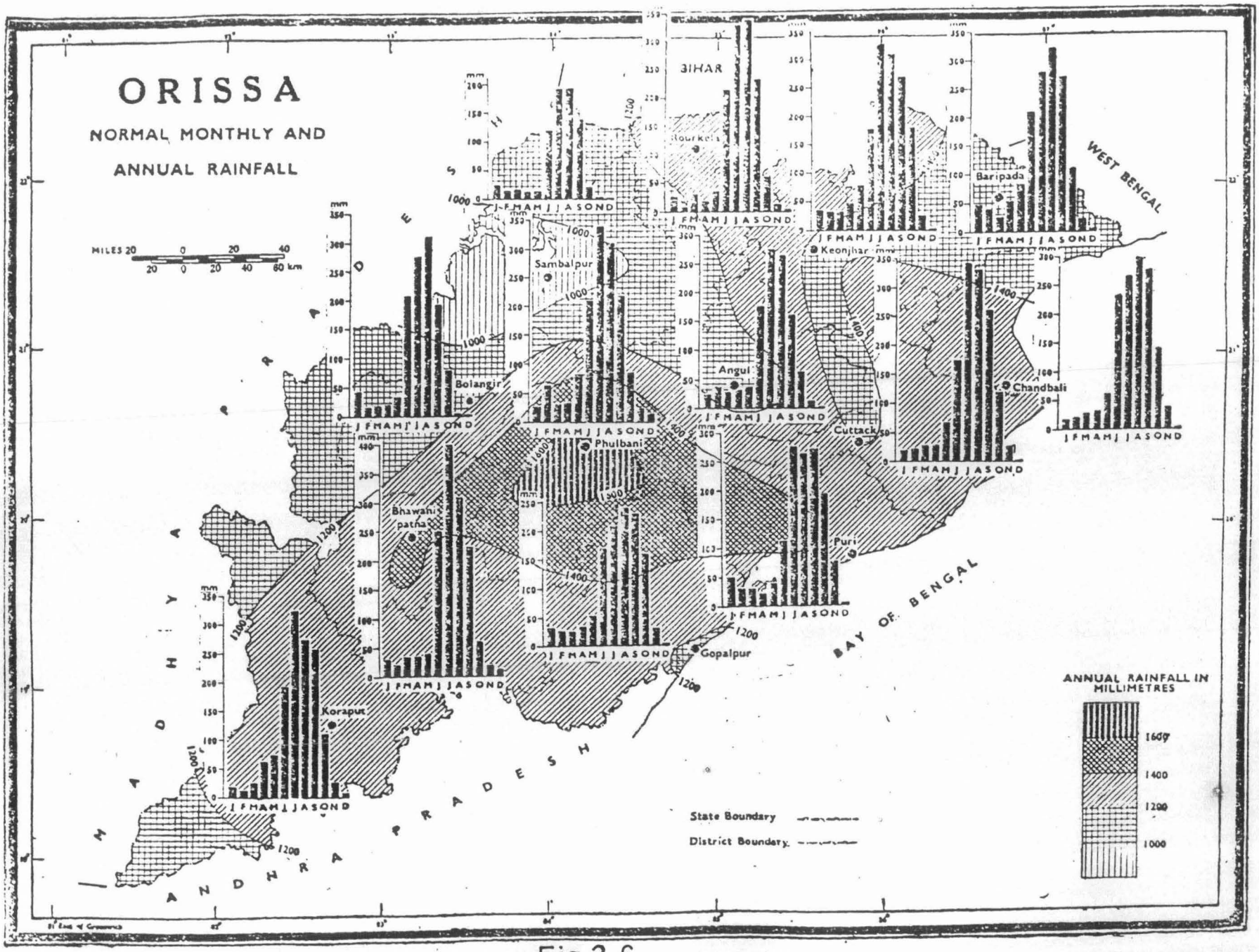

Fig.2.6

SOURCE: CENSUS ATLAS OF ORISSA 1971

The South-West Monsoon generally hits the state during the second week of June. During this period, the state receives about 75 to 90 per cent of the total rainfall. Cyclones during late monsoons move along Bramhani - Burhabalanga interfluve and bring heavy rain to the upper reaches of the drainage channels in the districts of Sundargarh, Mayurbhanj and Keonjhar. The average annual rainfall of the state is about 55 to 60 inches of which about 77 per cent is received during mid-June and September. July and August are the wettest months (see Fig. 2.6) with as much as 50 per cent of the total annual precipitation received during this period.Spatial variations in the pattern of rainfall can be marked from Fig. 2.6 with highest annual rainfall occurring in the Central Mountainous districts of Phulbani and parts of Ganjam, Puri and Kalahandi. The rainfall is moderate in the coastal districts of Cuttack, Puri, Ganjam as well as Southern Balasore and parts of Koraput, Dhenkanal, Keonjhar Sundargarh and Kalahandi. The areas with lowest rainfall are the western parts of the state covering parts of Sambalpur, Bolangir, Kalahandi and Koraput as well as parts of Balsore, Mayurbhanj and Dhenkanal districts.

As the rains become more sparse by the end of September dry sunny weather sets in with cirrocumulus and floating cirrus and Nimbus cloud formations indicating a change to cool autumnal season which in turn gives way to the cool dry winter. The mean minimum temperature comes down during the winter months to 22.8°C

which further falls upto 15°C in December which is the coldest month. The winter gives dry crisp weather with a few squalls of North-East Monsoon particularly over the Eastern Ghats Section. It gradually merges into the hot summer of the March thus completing a full cycle.

v] Soil :

Soil is the basic determinant of land use in any region. The plain deltaic regions with their characteristic fertile alluvial soil which is conductive to holding water encourages more intensive land utilization, while the plateau and hilly areas with their sandy and coarse soils are rarely intensively utilized unless other factors force such an use. Again, with reference to soils, whether the margin of utilization of land for crops rises or falls will depend largely on the price of farm products and the cost of ameliorating the adverse physical conditions particularly the cost of fertilizers.

The types of soil occurring in Orissa re discussed below:

a] Alluvial Soils

These are met with in the deltaic plains of the major rivers of the state. Most parts of Balasore, Cuttack and Puri districts have alluvial soil with large content of clay. The Rushikulya delta is also rich in alluvium, but as such, Ganjam district is not really deltaic; its core is the Rushikulya valley

with fertile black loams and clays and red hill-foot soils (Spate, 1972 ; 730). Again, the nature and age of the alluvial soils vary from saline soils clozer to the coast with a higher PH value to the old alluviums inland. Similarly, the texture also vary from the sandy loam type in Balasore to stiff clay type in the rest of the zone.

b] Laterite Soils

Laterite soils characterize a long stretch of land extending from the South-West corner of Koraput to the Northern part of Balasore somewhat following the Eastern Ghats. The width of the belt varies between 30-60 kms or more. About 50 per cent of the area of Bolangir and 15 per cent of Sambalpur are covered with this type of soil (Singh, 1971; 759). These are poor in plant nutrients due to heavy leaching. These are further subdevided into high or low level laterites depending upon the altitude of their occurrence.

c] Red Soil

These are met with in the Central table-land comprising the Mahanadi - Tel basin as well as in the northern parts of the disssected plateau-lands of Sundargarh, Sambalpur, Mayurbhanj and Keonjhar. These are distinguished from the laterites by a higher percentage of silica and bases. These are poor in plant nutrients and rich in mineral particles like iron-ore, Maganese, Limestone and other minerals.

d] Black Earth

Otherwise known as Regur, these are found in small patches in the Angul-Athmalik subdivisions of Dhenkanal and the eastern part of Rairhakhol subdivison of Ganjam district. Patches of this soil can also be found in a very limited area around Sonepur of Bolangir and in the districts of Phulbani, Kalahandi and Koraput. It is clayey and rich in lime at some places. It has an alkaline nature with the PH value varying between 7.5 to 8.5.

e] Brown Soil

Brown earth occur in the Baliguda sub-division of Phulbani and have a lower fertile horizon and a leached away surface which helped the growth of forests but have retarded cultivation. A patch of this soil can also be marked in the Kalahandi Sadar sub-division where there are thick reserved forests.

f] Yellow Earth

This type of soils have developed in the valley regions of Sambalpur and towards the east of the river Ib. The soil is sticky and contains very little exchangable calcium and magnesium.

2.3 *Socio-Economic Factors*

Besides these physical factors, the land use pattern of region is also governed by a gamut of other social,economic and institutional factors. These include above all population and its

various characteristic features such as density, literacy, growth etc. Transport and communication, Technological advancement etc.

1] Population

Any modification of the physical or natural landscape and the emergence of the cultural landscapes have one aspect in common, i.e. they are the surface expressions of human behavioural pattern. Population of any area is closely related with its land use, for, it is for the purpose of man's economic betterment that an optimum land use is prescribed (Chaudhary, 1982; 61). Thus, an analysis of the various characteristics of the population of Orissa should preceede its land use study.

i] Growth of Population

The present day population of Orissa is the net resultant of a long process of settling from time immemorial. Table 2.2 illustrates the march of population from the long past to the present. Three distinct phases of population growth can be marked from the following table. A slow but steady growth from 1881 culminated in a remarkable increase during the decade 1901-1911 when the population almost doubled itself followed by a negative growth during 1911-1921. The next is a phase characterized by an increase of population but in a diminishing rate upto 1951 which marks the beginning of yet another phase of high population growth. Infact, during the last hundred years, the population of Orissa has grown in an

incredible rate making the present day population more than five times that of 1881.

TABLE - 2.2

GROWTH OF POPULATION IN ORISSA

YEAR	TOTAL POPULATION ('ooo,ooo)	DECENNIAL GROWTH RATE (%)
1881	5.1	-
1891	5.7	+ 11.8
1901	6.2	+ 8.8
1911	11.3	+ 82.3
1921	11.1	- 1.8
1931	12.4	+ 11.7
1941	13.7	+ 10.5
1951	14.6	+ 6.6
1961	17.5	+ 19.9
1971	21.9	+ 25.1
1981	26.3	+ 20.1

Again, the pattern of growth during the last two decades is not uniform everywhere. It can well be marked from Table-2.3 that during these years, the districts of Sundargarh, Koraput and Dhenkanal had experienced the highest rate of population growth exceeding 60 per cent; while the districts of Mayurbhanj, Bolangir and Kalahandi had experienced the lowest rate of growth (less than 40%). The rest of the districts had a growth rate between these two extremes.

TABLE - 2.3

PATTERN OF THE GROWTH OF POPULATION IN ORISSA, 1961-81

Districts/State	TOTAL POPULATION ('000,000)			GROWTH RATE (%)
	1960-61	1970-71	1980-81	1961-81
Balasore	1.4	1.8	2.2	57.1
Bolangir	1.1	1.3	1.5	36.3
Cuttack	3.0	3.8	4.6	53.3
Dhenkanal	1.0	1.3	1.6	60.0
Ganjam	1.9	2.3	2.7	42.1
Kalahandi	1.0	1.2	1.3	30.0
Keonjhar	0.7	0.9	1.1	57.1
Koraput	1.5	2.0	2.5	66.6
Mayurbhanj	1.2	1.4	1.6	33.3
Phulbani	0.5	0.6	0.7	40.0
Puri	1.9	2.3	2.9	52.6
Sambalpur	1.5	1.8	2.3	53.3
Sundargarh	0.7	1.1	1.3	85.7
ORISSA	17.5	21.9	26.3	50.3

ii] Density and Distribution

"The spatial variation in the distribution and density of population in Orissa are to be understood in the context of its (a) Physiographical diversities (b) Plural social organization and (c) Predominantly agricultural economy and overwhelmingly rural population". (Gopal Krishnan, 1968; 250).

It can be marked from the following Table 2.4 that, the coastal districts of Cuttack, Puri, Balasore and to a lesser extent Ganjam enjoys a higher degree of population concentration as compared to the other districts. In these areas the density of population is more than 200 persons per square km. during 1981. As compared to this there is a pronounced sparsity on the Eastern Ghats and Northern Plateau regions. Thus, as a matter of fact, the districts of Koraput, Kalahandi and Phulbani have the lowest density of population (about 100 persons/sq.km.). However, the districts of Dhenkanal, Keonjhar, Mayurbhanj, Sundargarh, Sambalpur and Bolangir with their rich mineral reserves (NCAER, 1962; 54) and fertile river valleys managed to support a moderate population concentration.

TABLE - 2.4

DENSITY OF POPULATION IN ORISSA, 1961-81

DISTRICTS/STATE	PERSONS PER SQ.KM.			VARIATION IN PER CENT
	1960-61	1970-71	1980-81	1961-81
Balasore	218	286	357	63.8
Bolangir	121	142	164	35.5
Cuttack	281	341	415	47.7
Dhenkanal	94	120	146	55.3
Ganjam	153	183	213	39.2
Kalahandi	77	98	114	48.0
Keonjhar	89	116	134	50.6
Koraput	58	76	92	58.6
Mayurbhanj	116	138	152	31.0
Phulbani	46	56	65	41.3
Puri	178	230	287	61.2
Sambalpur	86	105	130	51.2
Sundargarh	77	107	138	79.2
ORISSA	113	141	169	49.6

Another feature can be well marked from the above table. During the past twenty years, the districts of Sundargarh, Puri and Balasore have experienced maximum population concentration with a more than 60 per cent variation in the density over its 1961 value. Moderate variation in the density has taken place in the districts of Koraput, Dhenkanal, Sambalpur and Keonjhar (between 50 to 60 per cent) while the remaining districts experienced a very low rate of growth in density that is less than 50 per cent.

iii] Literacy

The level of literacy that an area has acheived, is of paramount significance while studying its land use, since, the level of general awareness among people as governed by their status and level of educational attainment, in turn, governs their behavioural as well as perceptual decision making processes and preferences. The literacy pattern in Orissa is only a reflection of its diverse social organizational landscape. A look at the Table 2.5 will bring out the fact that the districts of Kalahandi, Koraput, Bolangir,Mayurbhanj and Phulbani had the lowest literacy rate (15 to 30%) in the state while, the coastal districts of Puri and Cuttack had a very high literacy rate (more than 45%) closely followed by Balasore (42.06%) during 1980-81. A glance at the Table 2.6 will show that except for the districts of Keonjhar and Sundargarh all the remaining four districts e.g. Kalahandi, Koraput,

Mayurbhanj and Phulbani having a higher proportion of tribal population rank among the least literate districts while Puri, Cuttack and Balasore with their small percentage of tribal population rank among the most literate districts. The hilly and forested sections of Orissa have been inhabited by aboriginal races (Imperial Gazetter of India, 1908; 254) who were always hostile to infilteration from outside (Hunter etc, 1956; 53). Thus, the interior of Orissa suffered isolation to a great extent from the mainstream of the historical life of India; while, the coastal plain has acted as a matchland between the Aryan North and Dravidian South (Banerji, 1930).

TABLE - 2.5

PATTERN OF LITERACY IN ORISSA, 1961-81

DISTRICTS/STATE	PERCENTAGE OF LITERATE POPULATION TO THE TOTAL POPULATION			PERCENT OF GROWTH
	1960-61	1970-71	1980-81	1961-81
Balasore	29.49	33.71	42.06	42.62
Bolangir	14.59	19.92	25.63	75.67
Cuttack	29.82	36.43	45.43	52.35
Dhenkanal	23.45	27.76	36.88	57.27
Ganjam	21.32	24.42	31.31	46.86
Kalahandi	11.51	13.85	19.42	68.72
Keonjhar	17.66	21.25	30-22	71.12
Koraput	8.14	10.58	16.13	98.16
Mayurbhanj	14.18	18.05	25.71	81.31
Phulbani	17.19	19.79	27.08	53.08
Puri	29.49	35.34	45.50	54.29
Sambalpur	22.93	27.12	33.83	47.54
Sundargarh	19.71	26.47	36.17	83.51
ORISSA	21.66	26.18	34.23	58.03

TABLE - 2.6

DISTRIBUTION OF ST. POPULATION IN ORISSA DURING 1981

DISTRICTS	PERCENTAGE OF ST. POPULATION TO TOTAL POPULATION	DISTRICTS	PERCENTAGE OF ST POPULATION TO TOTAL POPULATION
Balasore	6.84	Koraput	55.22
Bolangir	19.22	Mayurbhanj	57.67
Cuttack	3.13	Phulbani	38.94
Dhenkanal	12.26	Puri	3.45
Ganjam	9.48	Sambalpur	27.20
Kalahandi	31.28	Sundargarh	51.26
Keonjhar	44.82		
ORISSA	22.43		

The pattern of growth of the literacy suggests that, during the last two decades, highest growth has been experienced in those districts where the percentage of literacy was extremely low, i.e. Koraput, Sundargarh, Mayurbhanj, Bolangir and Keonjhar while the lowest rate of growth in literacy was experienced in the districts of Balasore and Cuttack.

iv] Rural-Urban Ratio

Urbanization as reflected in the percentage of total population living in Urban areas, is one of the most dominant factors of land use. The rural-urban ratio as reflected by the per cent of urban population in Table 2.7, clearly spells out the dominance of rural population which constitute as much as 90 per cent of the total population of the state. However, there is another interesting facet of it. The urban population has grown

in a remarkable pace equalling 87.3 per cent during the last twenty years. The districts of Sundargarh, Sambalpur, Puri and Ganjam had the highest proportion of urban population during 1980-81 while the districts of Phulbani, Mayurbhanj and Kalahandi had the lowest. But, interestingly, these were the districts along with Koraput, Keonjhar, Puri, Sambalpur and Bolangir which had the highest growth rate during these two decades. In fact, all these districts have almost doubled or more than doubled their urban population while the districts of Cuttack and Balasore were lagging behind.

TABLE : 2.7

PATTERN OF GROWTH AND DISTRIBUTION OF URBAN POPULATION IN ORISSA

DISTRICTS/STATES	PERCENT OF URBAN POPULATION TO THE TOTAL POPULATION			PERCENT OF GROWTH
	1960-61	1970-71	1980-81	1961-1981
Balasore	6.5	5.5	8.3	27.7
Bolangir	4.6	6.9	9.1	97.8
Cuttack	6.8	8.0	10.3	51.5
Dhenkanal	4.6	4.0	7.8	69.6
Ganjam	8.3	11.3	14.3	72.3
Kalahandi	2.8	4.9	6.0	114.3
Keonjhar	4.3	7.0	8.9	107.0
Koraput	5.1	8.2	11.3	121.6
Mayurbhanj	2.4	2.8	5.7	137.5
Phulbani	1.2	3.1	5.3	341.7
Puri	7.2	9.8	14.8	105.6
Sambalpur	7.6	12.0	15.5	103.9
Sundargarh	17.6	21.2	30.6	73.9
ORISSA	6.3	8.4	11.8	87.3

v] Occupational Structure

The occupational structure of the people of an area determine its pattern of land utilization. Thus, the rural land use pattern is far different from that of the urban areas. As much as 75 per cent of the total population of Orissa are engaged in agriculture. A glance at the Table 2.8 suggests that Orissa as a whole has experienced an increase in the percentage of agricultural workers (cultivators plus agricultural labourors) during the decade 1961-71,with almost all the districts except Keonjhar and Sundargarh reflecting the trend. The growth rate was highest for Cuttack (15.35 per cent),while,the growth rate of all other districts except Keonjhar and Sundargarh (which experienced a negetive growth) vary between 0 to 10 per cent.

However the following decade 1971-81 witnessed a reverse trend with almost all the districts except Ganjam, Kalahandi and Koraput, experiencing a negative growth, the highest slump being in the districts of Cuttack, Puri, Sundargarh and Dhenkanal. As regards distribution during 1980-81,highest proportion of agricultural workers were found in the districts of Kalahandi, Phulbani, Koraput, Bolangir and Mayurbhanj with more-than 80 per cent of their total main workers engaged in agriculture. The districts with lowest proportion of agricultural worker were Sundargarh and Puri with less than 65 per cent of their total main workers engaged in agricultural activities.

The pattern was more or less similar during 1961 and 1971.

TABLE - 2.8

PROPORTION OF AGRICULTURAL WORKERS TO TOTAL MAIN WORKERS IN ORISSA

DISTRICTS/STATE	PERCENTAGE OF AGRICULTURAL WORKERS TO TOTAL MAIN WORKERS			PERCENT OF GROWTH	
	1960-61	1970-71	1980-81	1961-71	1971-81
Balasore	79.6	84.5	79.1	6.16	- 6.39
Bolangir	78.1	82.9	81.8	6.15	- 1.33
Cuttack	64.5	74.4	68.4	15.35	- 8.06
Dhenkanal	73.2	78.5	73.1	7.24	- 6.88
Ganjam	68.0	73.5	74.6	8.09	1.50
Kalahandi	79.9	85.7	86.3	7.26	0.70
Keonjhar	81.0	75.3	73.2	- 7.04	- 2.79
Koraput	79.0	82.4	82.5	4.30	0.12
Mayurbhanj	83.5	83.6	80.5	0.12	- 3.71
Phulbani	77.5	84.1	82.6	8.52	- 1.78
Puri	68.4	72.2	64.5	5.60	-10.66
Sambalpur	73.3	75.6	73.1	3.14	- 3.31
Sundargarh	67.7	60.0	55.8	-11.37	- 7.00
ORISSA	73.8	77.5	74.7	5.01	- 3.61

vi] Physiological Density

The pressure of population on agricultural land as expressed interms of the physiological density determines to a great extent under what use that piece of land will be put into. The physiological density has been calculated by the following formula -

$$PD = \frac{\text{TOTAL POPULATION}}{\text{TOTAL CROPPED AREA}}$$

where PD is the physiological density of an areal unit.

A close look at the Table 2.9 illustrating the physiological density of the state will unravel the pressure of population on agricultural land. The physiological density was highest with more than 500 persons per sq. km. of agricultural land in the districts of Balasore, Cuttack, Ganjam and Puri while it was lowest (less than 300 persons per sq. km) in the districts of Kalahandi and Koraput during 1980-81. The trend of variations in the last two decades suggests that in a span of 20 years the districts of Sundargarh, Sambalpur and Balsore have experienced the highest degree of growth (more than 60 per cent) while the districts of Kalahandi, Ganjam and Phulbani had the lowest growth rate (less than 20 per cent)

TABLE : 2.9

PHYSIOLOGICAL DENSITY OF POPULATION IN ORISSA, 1961-81

DISTRICTS/STATE	PERSONS PER SQ. KM OF AGRICULTURAL LAND			PERCENT OF GROWTH
	1960-61	1970-71	1980-81	1961-81
Balasore	322	441	516	60.2
Bolangir	236	327	349	47.9
Cuttack	461	541	664	44.0
Dhenkanal	272	324	396	45.6
Ganjam	485	516	534	10.10
Kalahandi	250	265	263	5.2
Keonjhar	289	396	389	34.6
Koraput	188	284	287	52.6
Mayurbhanj	305	362	378	23.9
Phulbani	262	339	310	18.3
Puri	433	500	612	41.3
Sambalpur	212	324	366	72.6
Sundargarh	267	440	488	82.8
ORISSA	303	390	430	41.9

After Sinha (1971)

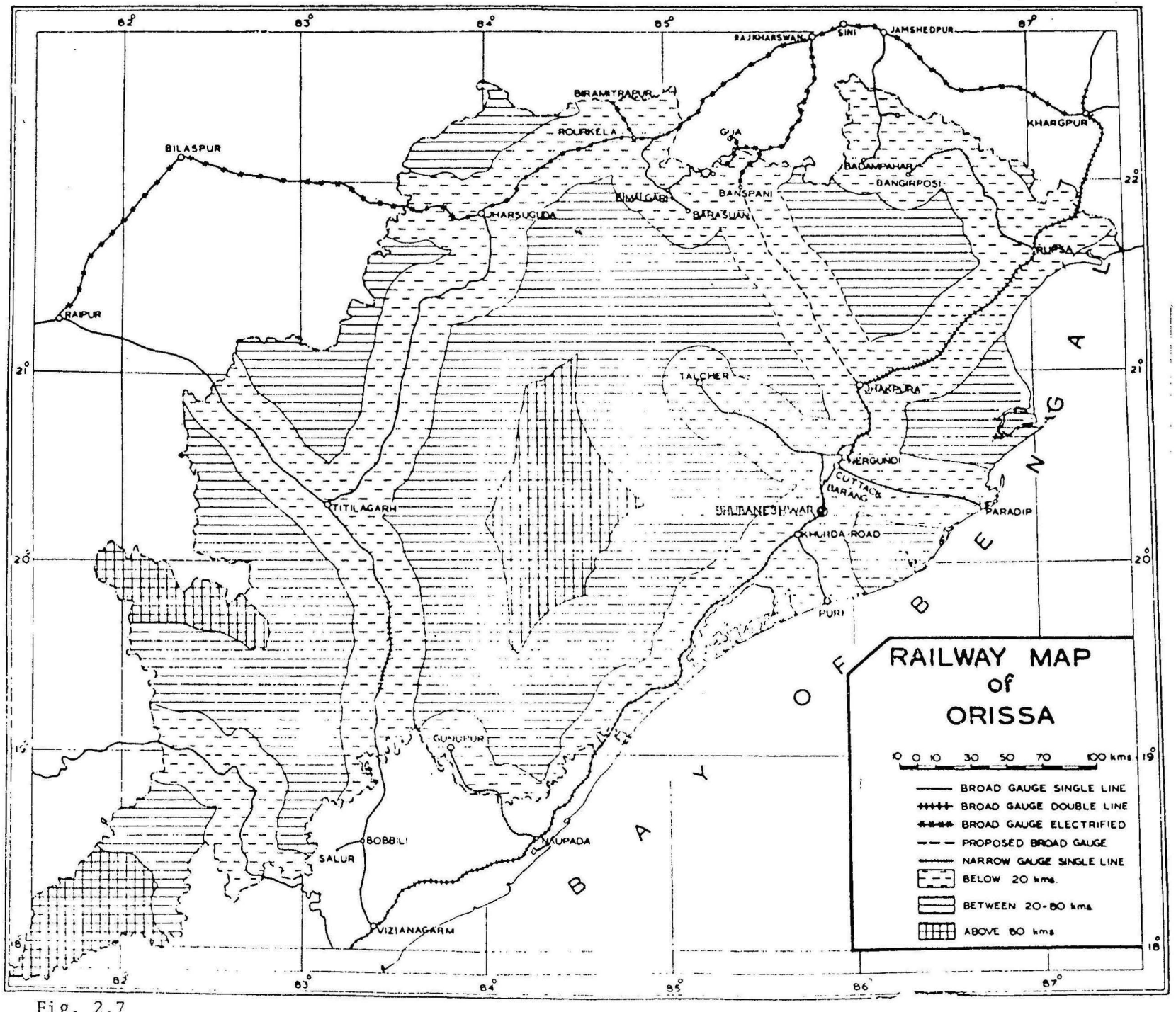

Fig. 2.7

Based upon Survey of India Map with the permission of the Surveyor General of India.

The Territorial Waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

vii] Transport

Accessibility is one of the dominant factors in the land use pattern of a region. Transport networks form the life line of a region through which it receives all its necessary ingradients and radiates back and distributes the products of labour. In an agricultural region the transport network acts as a main vehicle for the new innovations and informations which accordingly give the existing land use pattern a new look.

Orissa is one of the least developed states in matter of railways. The existing railway lines pass through the fringes of the state leaving the central area untouched (Fig. 2.7). The state had only 13 kms. of railway line per 1000 sq. kms of area as against the all India level of 18.4 kms. The railway network is increasing gradually from its total route length of 1710.36 km during 1965-66 to 1948 kms during 1980.81.

The defficiency in railway transport could have been compensated by an adequate network of roads. But the existing roads in the state are equally inadequate. The surfaced road length in Orissa is very much below the road length of other states. Orissa has only 9.5 kms of surfaced road in every 100 sq. km. of area as compared to the all India figure of 19 kms per 100 sq. km. Similarly in regards road length per lakh population, Orissa was third from below with 56.3 km of road length as compared to the All India figure of 96.3 km.

A picture of the pattern of road transport in Orissa has been given in the Table 2.10 for the year 1980-81. It can be seen that, the total road length per 1000 sq. km of area is lowest in the Koraput district with only 68 kms of road. The accessibility as reflected by the road length per 1000 sq. km is also poor in the districts of Kalahandi, Sambalpur, Phulbani, Sundargarh and Bolangir districts with less than 110 km of road per 1000 sq.km. The districts with most developed road transport system are Puri, Cuttack and Ganjam. Balasore and Mayurbhanj have a medium road network while the remaining districts have a figure close to the state average of 116 km per 1000 sq. km.

TABLE - 2.10

DISTRIBUTION OF ROAD TRANSPORT NETWORK IN ORISSA, 1980-81

DISTRICT/STATE	TOTAL ROAD LENGTH (Km)	ROAD LENGTH(km) per 1000 sq.km.	ROAD LENGTH(km) per lakh persons
Balasore	913	141	40.50
Bolangir	956	108	65.5
Cuttack	1998	183	43.2
Dhenkanal	1345	123	85.0
Ganjam	1900	156	71.2
Kalahandi	1156	100	86.3
Keonjhar	915	110	82.1
Koraput	1957	72	78.8
Mayurbhanj	1433	138	90.6
Phulbani	1115	101	155.4
Puri	1524	460	52.2
Sambalpur	1745	100	76.5
Sundargarh	1029	105	76.9
ORISSA	17986	116	68.2

viii] Irrigation

Since irrigation is one of the primary determinants of agricultural land utilization, it will be prudent on our part to have a general overview of the existing pattern of irrigated lands and their growth over time in Orissa. An ever increasing density of population could only have been mentained by bringing new lands under cultivation; but it would not be practically possible to have a continuous horizontal expansion of the agricultural land (i.e. an increase in the net sown area). Thus as Sharma (1978) viewed, it seems better to determine the vertical extension (intensity) of agricultural land by evaluating the extent of irrigated land, land cropped more than once and cropping intensity of the land.

Orissa is one of the least developed states in terms of the provision of irrigation. With only 19.25 per cent of its total cropped area being irrigated, the expectations of a more stable and rewarding agriculture still remains a distant proposition. Table 2.11 presents a general picture of the extent and distribution of irrigated lands in Orissa during 1960-61 and 1980-81. (see also Figure 4.3b).

TABLE - 2.11

AREA UNDER IRRIGATION IN ORISSA,1961-81

DISTRICTS/STATE	PERCENT OF TOTAL CROPPED AREA IRRIGATED		
	1960-61	1972-73	1980-81
Balasore	8.24	17.78	18.28
Bolangir	11.46	21.55	18.83
Cuttack	18.99	32.64	29.26
Dhenkanal	31.57	11.06	10.09
Ganjam	45.31	24.54	31.87
Kalahandi	12.54	3.25	6.83
Keonjhar	5.72	4.71	8.77
Koraput	4.86	4.95	4.35
Mayurbhanj	9.04	7.42	9.81
Phulbani	5.43	15.27	10.84
Puri	22.46	23.95	38.38
Sambalpur	29.54	33.22	28.50
Sundargarh	2.54	5.04	8.30
ORISSA	16.95	18.17	19.25

It can be marked from the above table that, the irrigation is most developed in the districts of Puri, Ganjam, Sambalpur and Cuttack with more than 25 per cent of their total cropped area under irrigation during 1980-81. Infact, these were the only districts having a higher percentage of total cropped area under irrigation than the state's average figure of 19.25 per cent. The districts of Koraput, Kalahandi, Sundargarh, Keonjhar and Mayurbhanj had the lowest area under irrigation during this period. The pattern of distribution was also similar during 1960-61 and 1972-73. It can also be marked that there has been an increase in the total irrigated area during the last twenty years, as it has jumped from its 1960-61 figure of 16.95 per cent to 19.25 per cent during 1980-81. However, the growth itself is a very marginal

one amounting only to 13.57 per cent in twenty years.

One of the primary resons for such a low per cent of irrigated area is that the major irrigation systems in the state are multipurpose projects which are dependent on Monsoon. In the years of scarce rainfall, the available water gets preference for power generation over irrigation. Thus, the support for rabi irrigation from such projects is limited. During 1980-81 thus, only 28.94 per cent of the total irrigated area had rabi irrigation facilities. Besides, most of the minor irrigation projects being rainfed are not helpful for rabi cultivation. The only source of perennial water supply is lift irrigation. But it also suffers from two limitations e.g. (1) slow pace of electrification and (2) lack of detailed assessment of ground water potential of the state. Thus, the only solution is the construction of large storage tanks reservoirs for storing water and a proper assessment of the ground-water potential of the State.

ix] Mechanization

Technology plays an important role in shaping the land use pattern of a region. It is obvious that a region with Primitive Modes of Production will have a comparatively poor and different land use pattern than a region with highly developed technologies. The modernization and mechanization of agriculture has been arrived at in this chapter by M.N. Paul's formula which

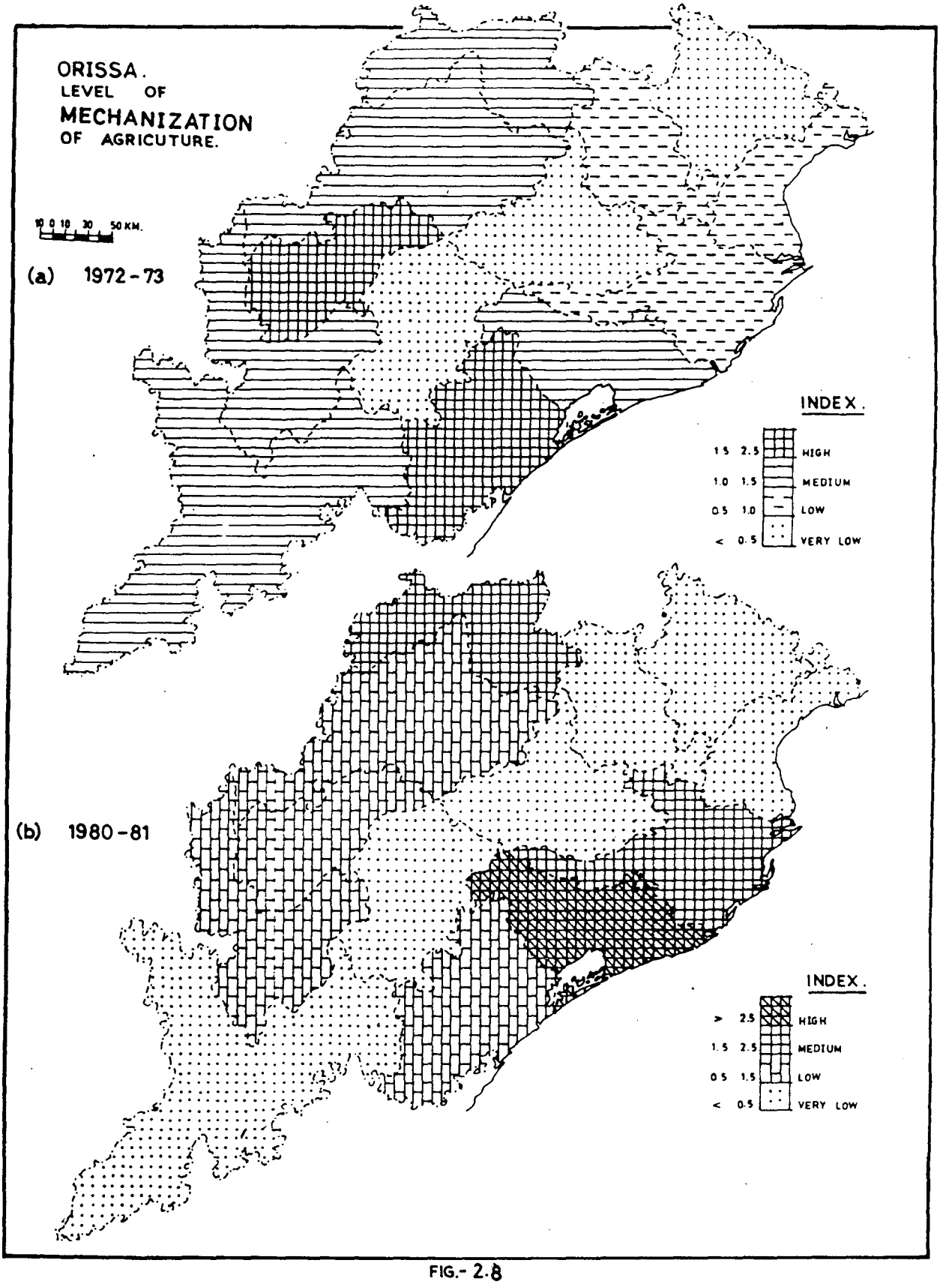
ORISSA.
LEVEL OF
MECHANIZATION
OF AGRICUTURE.
0 10 30 50 KM.
(a) 1972-73
INDEX.
1.5 2.5 HIGH
1.0 1.5 MEDIUM
0.5 1.0 LOW
< 0.5 VERY LOW
(b) 1980-81
INDEX.
> 2.5 HIGH
1.5 2.5 MEDIUM
0.5 1.5 LOW
< 0.5 VERY LOW

FIG.- 2.8

reads as follows :

$$I = \frac{S(P)}{S(Q)\ E(P) + S(P\ E(Q)} \quad Qi + \frac{S(Q)}{S\ (Q)\ E(P) + S(P)\ E(Q)} \quad Pi$$

where I = Composite Index of Mechanization

Qi = Number of tractors per 1000 hectares of Net Sown Area

Pi = Number of Irrigation Mechinery per 1000 hectares of Net Sown Area

E(Q) & E(P) - Mean of the Series 'Qi' and 'Pi' respectively

S(Q) & S(P) - Standard deviations of the series 'Qi' and 'Pi' respectively.

(The formula has been adopted from, "A Geo-Economic Evolution for Micro level Planning" edited by M.N. Qureshi and A. Mathur, 1983; 111).

The level of Mechanization as shown in Fig. 2.8 spells out the fact that during 1972-73 the highly mechanized distircts were Bolangir and Ganjam with an index value of more than 1.5. The districts with moderate mechanization were Kalahandi, Koraput, Puri, Sambalpur and Sundargarh while, the level of mechanization was low for Balasore, Keonjhar and Cuttack districts. The districts of Dhenkanal,Mayurbhanj and Phulbani had the lowest mechanization in the state.

However, 1980-81 provides a completely different picture altogather. During this period, Puri was very highly mechanized followed by Sundargarh and Cuttack, while, the level of mechanization was low for the districts of Bolangir, Ganjam, Kalhandi and Sambalpur. The level of mechanization was very low for the districts of Balasore, Dhenkanal, Keonjhar and Mayurbhanj. Such a reversal can be attributed to the fall in the number of tractors per hectare of net sown area. Infact, during 1973-81 not only the net sown area has increased but there is also a decline in the number of tractors in the state. Thus, the districts of Bolangir, Dhenkanal, Mayurbhanj and Phulbani had practically no tractors during 1980-81 while other districts except Puri had a reduction in the number of tractors. Similarly only the districts of Cuttack, Kalahandi, Keonjhar, Koraput, Puri, Sambalpur and Sundargarh increased their number of electric pumps and pumps for tubewell during 1973-81 while the remaining districts experienced a decline.

x] Fertilizer Consumption

Fertilizer consumption being one of the indicators of advancement in agriculturealso plays a significant role in determining the agricultural land use pattern of a region. The pattern of fertilizer consumption as reflected by Table 2.12 shows that the highest consumption of fertilizer during 1980-81

was associated with the districts of Sambalpur (24.4 kg per ha) followed by Ganjam, cuttack and Puri while the lowest fertilizer consuming district was Kalahandi (0.6 kg per ha) The rest of the districts except Bolangir (9.7 kg per ha) had a fertilizer consumption ratio that was far below the state average.

TABLE - 2.12

PATTERN OF FERTILIZER CONSUMPTION IN ORISSA, 1973-81

DISTRICTS/STATE	CONSUMPTION OF FERTILIZER PER UNIT OF GROSS CROPPED AREA (Kg per hectare)	
	1972-73	1980-81
Balasore	4.6	8.8
Bolangir	5.2	9.7
Cuttack	14.9	13.7
Dhenkanal	1.8	3.8
Ganjam	14.6	15.1
Kalahandi	0.9	0.6
Keonjhar	1.8	3.1
Koraput	2.8	3.5
Mayurbhanj	2.3	3.5
Phulbani	1.6	3.1
Puri	5.8	11.3
Sambalpur	25.1	24.4
Sundargarh	2.1	7.6
ORISSA	8.00	9.3

The pattern of fertilizer consumption during 1972-73 also brings out a similar sorry picture like during 1980-81. The low consumption of fertilizer can be attributed to (a) the lack of assured water supply (b) reluctance of farmers to take risk in the high price input farming and (c) Inadequate institutional help for investment in agriculture. Also, there

is the impact of the natural calamities which can not be overruled.

Besides all these abvoe discussed factors these are many more other factors like the inadequate marketing facilities, the land reforms, income of the people, the social structure of the people etc. which also determine the extent and pattern of land utilization. And even in these respects, Orissa remained still back-ward.

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CHAPTER - THREE

PATTERN OF LAND UTILIZATION : (1) OTHER THAN AGRICULTURAL LAND USES

3.1 *INTRODUCTION*

"One of the main areas of work on rural land use remains the identification and measurement of the land use patterns themselves and of their changes over time" (Clock, 1980 ;28) Any such attempt towards theabove mentioned objectives must therefore be preceeded by a sound land use classification scheme. However, land use classification is not an end is itself but a means of obtaining better land use. In the present study the land use classification scheme as adopted by the Directorate of Economics and Statistics (DES), India,has been utilised. According to this scheme the total area available for land utilization purposes as reported by the village papers is comprised of the following five broad land use categories, e.g. (a) Forests, (b) Land not available for cultivation which is further sub classified into : (i) Land Put to Non-Agricultural uses and (ii) Barren and uncultivable lands (c)Other uncultivated lands excluding fallow lands which is comprised of (i) permanent pastures and other grazing lands (ii) Land under miscellaneous tree crops not included in net sown area and (iii) cultivable wastes, (d) Fallow lands which includes (i) other than current fallow lands and (ii) current fallow lands and finally (e) Net sown area.

In the present study, for a betterment in the description and analysis of the land use patterns the above mentioned five land use categories are discussed under two broad heads e.g. (a) Land under other than agricultural uses and (b) Land under agricultural uses. Land under other than agricultural uses covers all the existing lands which are not presently under cultivation. It includes forests, land not available for cultivation, other uncultivated lands excluding fallow lands as well as fallow lands and has been discussed in the present chapter. Land under agricultural uses on the other hand deals with the characteristic features of the area presently under cultivation i.e. net sown area in its various forms e.g. gross cropped area, area sown more than once etc. which has been discussed in the following chapter (Chapter - Four).

3.2 GENERAL PICTURE

In general, forests and net sown area are the two dominant land use categories in Orissa sharing among them more than 60 per cent of the total area of the state. As it can be marked from the Table - 3.1, all through from 1960-61 to 1980-81 these two categories have monopolised the top two slots in terms of percentage of the total area under them, there is a lot of interclass variations in the ranks of the other land use categories.

TABLE - 3.1

PATTERN OF LAND UTILIZATION IN ORISSA;1961-81

YEAR	PERCENTAGE OF TOTAL REPORTED AREA UNDER -				
	FORESTS	LAND NOT AVAILABLE FOR CULTIVATION	OTHER UNCULTIVATED LANDS EXCLUDING FALLOW LANDS	FALLOW LANDS	NET AREA SOWN
1960-61	22.95	16.36	16.39	7.06	37.24
1972-73	39.18	5.66	10.40	8.58	36.18
1980-81	42.73	5.77	7.93	4.12	39.45

As it can be observed from the above table, the extent of land not available for cultivation as well as other uncultivated lands excluding fallow lands is declining over the years while the area under forests is increasing. The trend of growth in the extent of fallow lands and net sown area is an irregular one but one feature can be marked out, that when there is a decrease in the net sown area there is an increase in the fallow lands and vice-versa. The subsequent analysis will provide a clear picture of the trend of growth and distribution of the different land use categories in Orissa over the years.

3.3 *LAND UNDER OTHER THAN AGRICULTURAL USES*

a] Forests : These include all actually forested areas classified or administered as forests under any legal enactment dealing with forests, whether state or private owned (Govt. of India, DES; 1957: vi) As the definition suggests, any increase or decrease

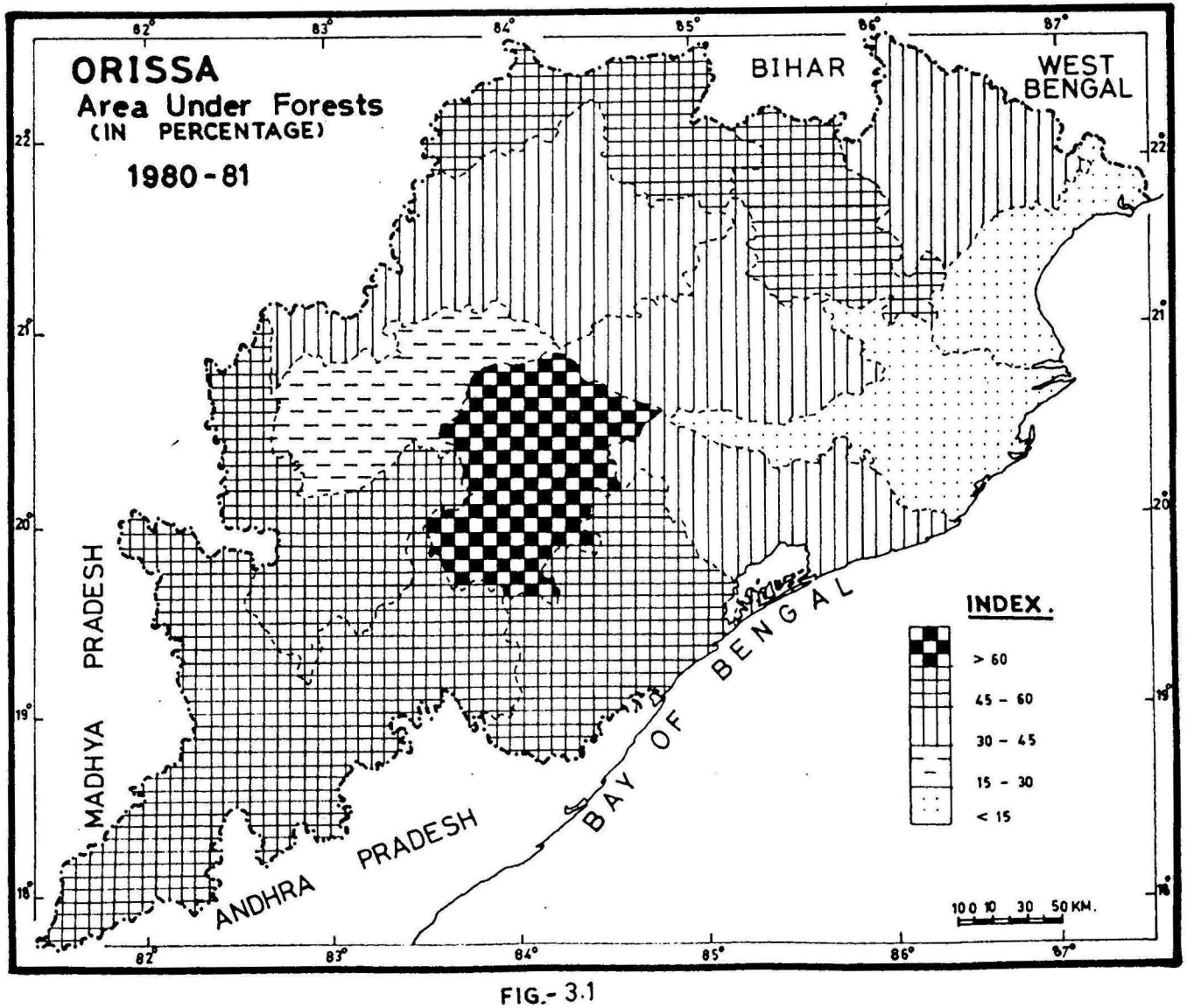
ORISSA
Area Under Forests
(IN PERCENTAGE)
1980-81
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
> 60
45 - 60
30 - 45
15 - 30
< 15
100 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 3.1

in the area under forests is only a governmental exercise of declaring more and more lands as forests or eliminating lands from forests category and including them else where.

As Sinha (1958; 13) has pointed out, the forest resources of Orissa exceed the optimum requirements of the state, but their maldistribution is a serious problem. A look at the Figure-3.1 brings out this fact clearly. The coastal districts of Cuttack, and Balasore have the lowest percentage of area under forests where as the districts of Koraput, Sundargarh and Phulbani have the highests proportion of land under forests in the state during 1980-81. Infact, the whole of Balasore excepting the Nilgiri subdivision is practically devoid of any forest cover and the case is no way better in the Sadar, Jajpur and Kendrapara subdivisions of Cuttack and Sadar sub-division of the Puri district. (Sinha ; 1958 :17) Table-3.2. Provides an allround view of the pattern of growth and distribution of forests in Orissa.

TABLE - 3.2

DISTRIBUTION & GROWTH OF FORESTS IN ORISSA, 1961-81

DISTRICTS/ STATE	PERCENTAGE OF TOTAL AREA UNDER FORESTS			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
1.	2.	3.	4.	5.	6.
Balasore	6.03	5.10	6.18	-15.38	21.21
Bolangir	18.46	19.14	24.12	3.68	26.04
Cuttack	11.94	8.81	12.86	-26.15	45.83
Dhenkanal	30.95	46.61	41.58	50.59	-10.81
Ganjam	17.33	45.74	46.64	166.99	1.97
Kalahandi	33.92	27.98	45.51	-26.86	62.65
Keonjhar	20.94	45.97	48.98	119.54	6.54
Koraput	19.30	54.77	51.81	200.20	-5.41
Mayurbhanj	21.63	38.65	45.00	78.67	16.42
Phulbani	44.57	75.09	75.09	68.50	0
Puri	29.54	27.82	32.79	- 5.83	17.87

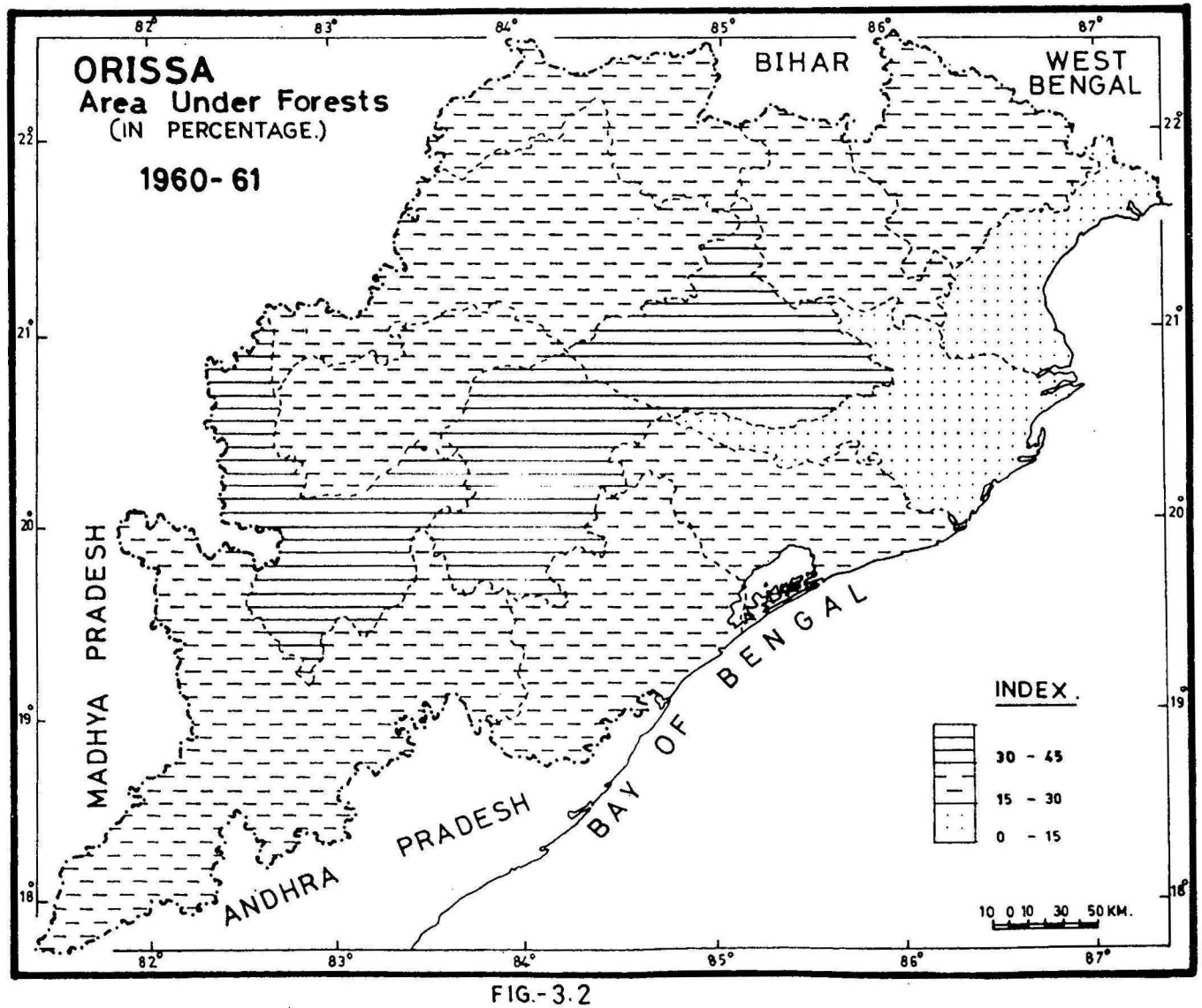
ORISSA
Area Under Forests
(IN PERCENTAGE.)
1960-61
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
30 - 45
15 - 30
0 - 15
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.2

contd...

1	2	3	4	5	6
Sambalpur	16.98	30.30	40.08	78.45	32.26
Sundargarh	25.94	49.54	56.08	90.94	13.20
ORISSA	22.95	39.18	42.73	70.72	9.07

An analysis of the Table - 3.2 brings out the following salient features of the pattern of distribution and growth of forests in Orissa.

1] Firstly, during 1960-61 most of the forests were concentrated in the districts of Phulbani, Kalahandi and Dhenkanal with more than 30 per cent of their area under forests (Fig. 3.2). The next 12 years witnessed the concerted drive by the government to increase the forested area and by 1972-73 Six districts e.g. Phulbani, Koraput, Sundargarh, Dhenkanal, Keonjhar and Ganjam had more than 45 per cent of their total area under forests. Infact, Phulbani had as much as 75.09 per cent of its total area under forests during 1972-73.

2] Almost all the districts except Balasore, Puri, Kalahandi and Cuttack experienced a positive growth in the area under forests during 1960-61 and 1972-73. The growth rate was highest for Koraput (200.20%) followed by Ganjam (166.99%) and Keonjhar (119.54%). All these districts had more than

doubled their forested area. Bolangir (3.68%) had the lowest positive growth, while the growth rate for Dhenkanal, Phulbani, Sambalpur, Mayurbhanj and Sundargarh districts was between 50 to 91 per cent.

3] The highest negetive growth in the area under forests was marked in the district of Kalahandi (-26.86%) while the degree of reduction in the total forested area for the districts of Cuttack, Balasore and Puri was -26.15, -15.38 and -5.83 per cent respectively.

4] During 1961-73 the state, however, as a whole experienced a high positive growth (70.72%) whereby its total forested area increased from 3566 thousand hectares during 1960-61 to 6088 thousand hectares in 1972-73.

5] The period between 1973-73 and 1980-81 witnessed a very low positive growth in the area under forests amounting only to 9.07 per cent for the whole of the state. Thus by 1980-81 the state had 42.73 per cent of its total area under forests as compared to 39.18 per cent during 1972-73.

6] As shown in the Fig. 3.1, during 1980-81 six districts e.g. Phulbani, Sundargarh, Koraput, Keonjhar, Ganjam and Mayurbhanj had 45 per cent or more of their total area under forests. Infact, as it can be marked from the Table-3.2 Phulbani, Sundargarh and Koraput districts had

more than 50 per cent of their total area under forests during 1980-81. The districts with lowest percentage of forested area were Balasore and Cuttack followed by Bolangir. The rest of the districts had between 30 to 45 per cent of their total area under forests during the said period.

7] As regards the growth of forests during 1972-73 and 1980-81 only Dhenkanal and Koraput districts experienced a reduction in their area under forests while Phulbani experienced no growth at all.

8] The growth rate was positive inthe remaining districts with Kalahandi experiencing the highest growth (62.65%) followed by Cuttack, Sambalpur, Bolangir and Balasore with a growth rate between 20 to 50 per cent. Ganjam with a growth rate of 1.97 per cent had the lowest positive growth while the growth rate for the other districts was between 5.20 per cent and for the state as a whole it was only 9.07 per cent.

b] *Land Put to Non-Agricultural Uses* : This comprises of a number of different types of land which is not available for cultivation under the existing circumstances. It includes all lands occupied by rural and urban dwellings, farm establishments, threshing ground, railways and roads factory and public buildings,

places of worship,rural market places and water bodies e.g. rivers, canals, Ponds etc. "In course of time this type of land is bound to increase in extent in view of the growth of population in village and the gradual expansion of cultural land-scape" (Ahmed, 1965 ; 84). As Chaudhary (1982; 67) remarked, this will also follow from mining, industrialization and the growth of irrigation. Yet, another situation may lead to the decrease of this type of land. Inspite of the physical limitations, minor and medium irrigation works are growing. Thus, electrification and assured irrigation will result in intensified and extended agricultural activities and agricultural use of land (Kumar, 1986; 76). Again, governmental policies also play a great role in the growth of such types of lands. Thus, areas which were treated as non-cultivable may be utilised for the purpose other than as indicated in the cultivable category (Roy, 1973 ; 17).

An analysis of the pattern of growth and distribution of land put to non-agricultural uses during 1960-61 and 1980-81 reflects certain interesting features as can be marked from the Table - 3.3.

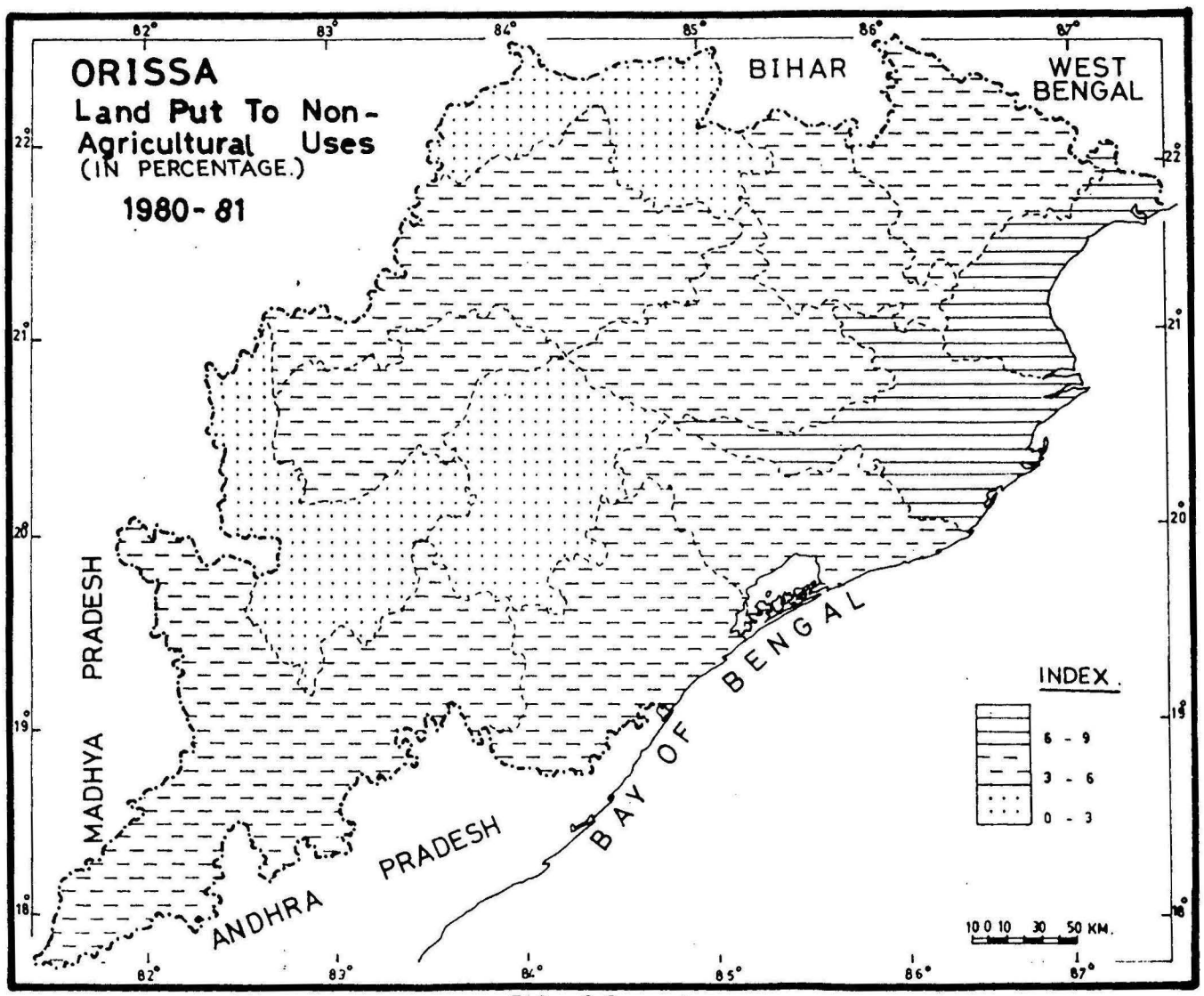
ORISSA
Land Put To Non-Agricultural Uses
(IN PERCENTAGE.)
1980-81
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
6 - 9
3 - 6
0 - 3
100 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG. -3.3

TABLE - 3.3

PATTERN OF DISTRIBUTION & GROWTH OF LANDS PUT TO NON-AGRICULTURAL USES, 1961-81

DISTRICTS/ STATE	PERCENT OF TOTAL AREA PUT TO NON-AGRICULTURAL USES			PERCENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	7.26	6.96	7.10	- 4.26	2.22
Bolangir	2.04	3.51	3.96	72.22	12.90
Cuttack	7.71	8.72	8.82	13.10	1.05
Dhenkanal	5.13	2.93	3.94	-42.86	34.38
Ganjam	5.49	4.67	4.75	-14.93	1.75
Kalahandi	4.36	2.50	2.76	-49.12	10.34
Keonjhar	10.95	2.89	3.00	-73.63	4.17
Koraput	9.83	1.89	3.48	-79.68	84.31
Mayurbhanj	5.10	3.37	3.56	-33.96	5.71
Phulbani	5.25	1.18	1.36	-77.59	15.38
Puri	5.93	5.55	5.64	- 6.45	1.72
Sambalpur	9.38	2.57	3.71	-72.56	44.44
Sundargarh	13.99	2.55	2.76	-81.75	8.00
ORISSA	7.39	3.47	4.07	-52.84	17.04

An analysis of the Table - 3.3 as well as Fig.3.3 and 3.4 brings out the following characteristic features of the growth and distribution of lands put to non-agricultural uses in Orissa during the last two decades.

i] Firstly, it can be marked from the Fig.3.4 and Table 3.3 that, during 1960-61 highest proportion of land put to non-agricultural uses was found in the Sundargarh district (13.99%) followed by Keonjhar (10.95%) Koraput (9.83%) and Sambalpur (9.38%) while, the districts having lowest concentration of this type of land use was Bolangir (2.04%),

followed by Kalahandi (4.36%). Cuttack and Balasore had 7.71 and 7.26 per cent of their total land put to non-agricultural uses, while, the rest of the districts had between 5 to 6 per cent of their total land devoted towards this sort of uses.

ii] It can also be inferred from the Table 3.3 that, the state as a whole experienced a sharp reduction in the share of land put to non-agricultural uses during 1960-61 and 1972-73. The state had a negetive growth rate equalling - 52.84 per cent. Except for the districts of Bolangir and Cuttack (which are the only districts which had increased their area under non-agricultural uses) all the remaining districts experienced a negetive growth in their land put to non-agricultural uses. This was most glaring in case of Sundargarh, Koraput, Phulbani, Keonjhar and Sambalpur all of which had a growth rate of more than -70 per cent (see Table- 3.3). In contrast, the lowest negetive growth (less than -15%) can be marked in the districts of Balasore, Puri and Ganjam. The growth rate for the remaining districts vary between these two extremes.

iii] As regards the distribution of this type of land use during 1972-73, highest concentration was in the districts of Cuttack and Balasore with more than 6 per cent of their total area under this category followed by Puri (5.55%) and

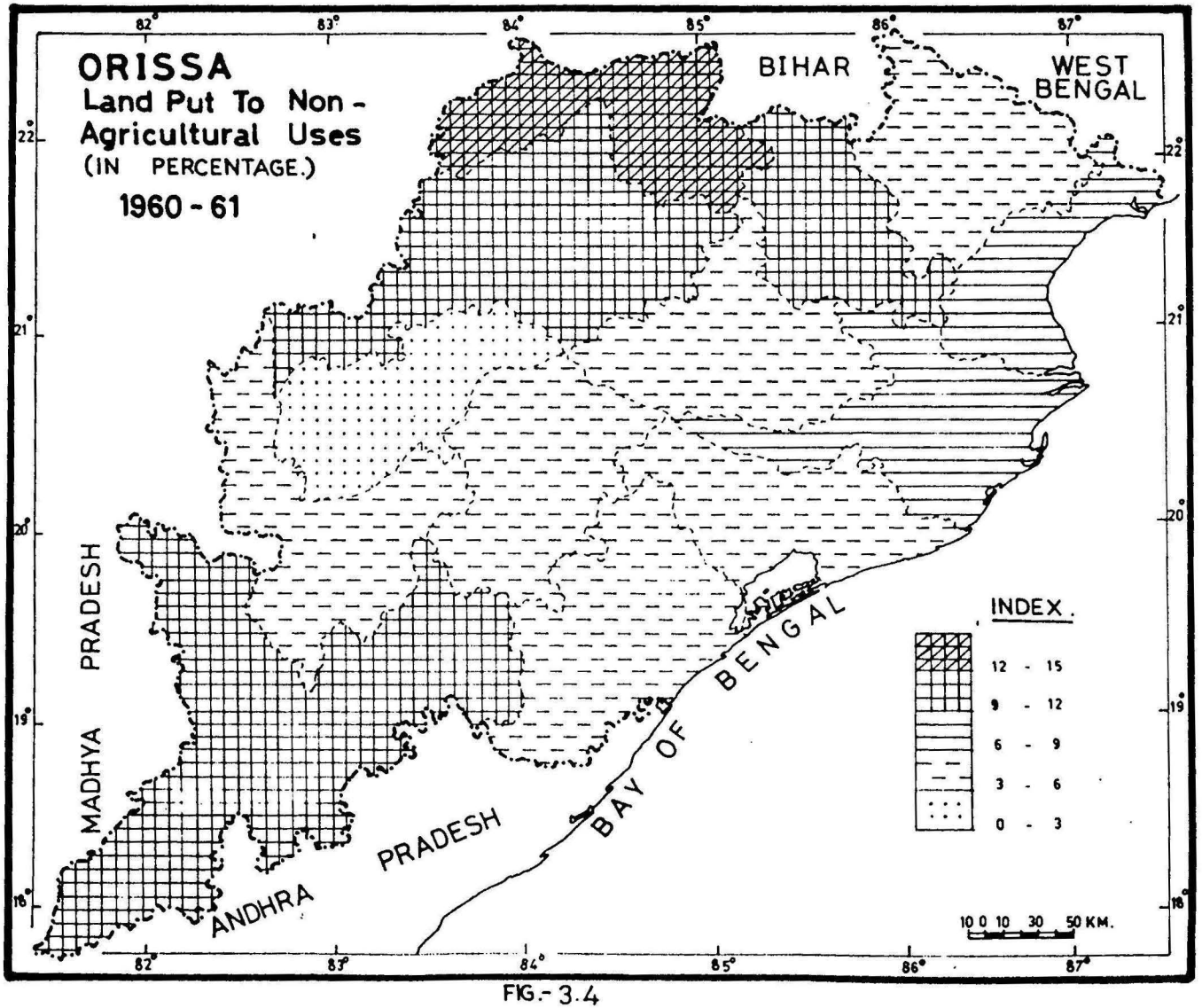
ORISSA
Land Put To Non - Agricultural Uses
(IN PERCENTAGE.)
1960 - 61
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
12 - 15
9 - 12
6 - 9
3 - 6
0 - 3
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 3.4

Ganjam (4.67%). The lowest concentration was in the districts of Phulbani (1.18%) and Koraput (1.89%). The concentration was also low in the districts of Kalahandi, Sundargarh, Sambalpur, Keonjhar and Denkanal all of which had between 2 to 3 per cent of their total land under non-agricultural uses.

iv] The picture provided by Fig. 3.3 as well as Table - 3.3 is a more or less similar pattern of distribution during 1980-81 with the districts of Cuttack and Balasore having the highest proportion of land put to non-agricultural uses (6 to 9%) while, Phulbani, Kalahandi and Sundargarh had the lowest (1 to 3%). The remaining districts had a share between 3 to 6 per cent.

v] As regards the growth, the whole state experienced a positive growth, hence an expansion of the land put to non-agricultural uses during 1973-81. The growth rate was highest for Koraput (84.31%) followed by Sambalpur (44.44%) and Dhenkanal (34.38%). The districts having lowest rate of growth were Cuttack (1.05%), Puri (1.72%), Ganjam (1.75%) and Balasore (2.22%).

A review of the above mentioned changes will bring into light some interesting characteristic features.

1] Firstly there was a sharp decline in the area under non-agricultural uses during 1961 and 1973 in the Mountainous and high land districts with their comparatively sparse populatic while the decline if any was very low for the coastal districts of Balasore, Cuttack, Puri and Ganjam with their high population density.

2] The general picture of distribution during 1972-73 and 1980-81 shows that these coastal districts had the highest proportion of land under non-agricultural uses while the mountainous districts of Phulbani, and Koraput had the lowest followed by the highland districts.

3] Again the growth rate during 1973-81 was lowest for the coastal districts as compared to that of other districts.

Thus as it is often treated as an index of the development of an area (Kumar, 1986; 75), it can be roughly concluded that the coastal districts are more economically developed than others while the districts of Phulbani, Kalahandi and Sundargarh are least developed while the rest of the districts are quickly catching up.

c] *Barren and Uncultivable Lands* : These include all barren lands as well as lands which can not be brought under cultivation except at a high cost. It is thus, a Mixture of lands put to non-agricultural but productive uses and lands which are

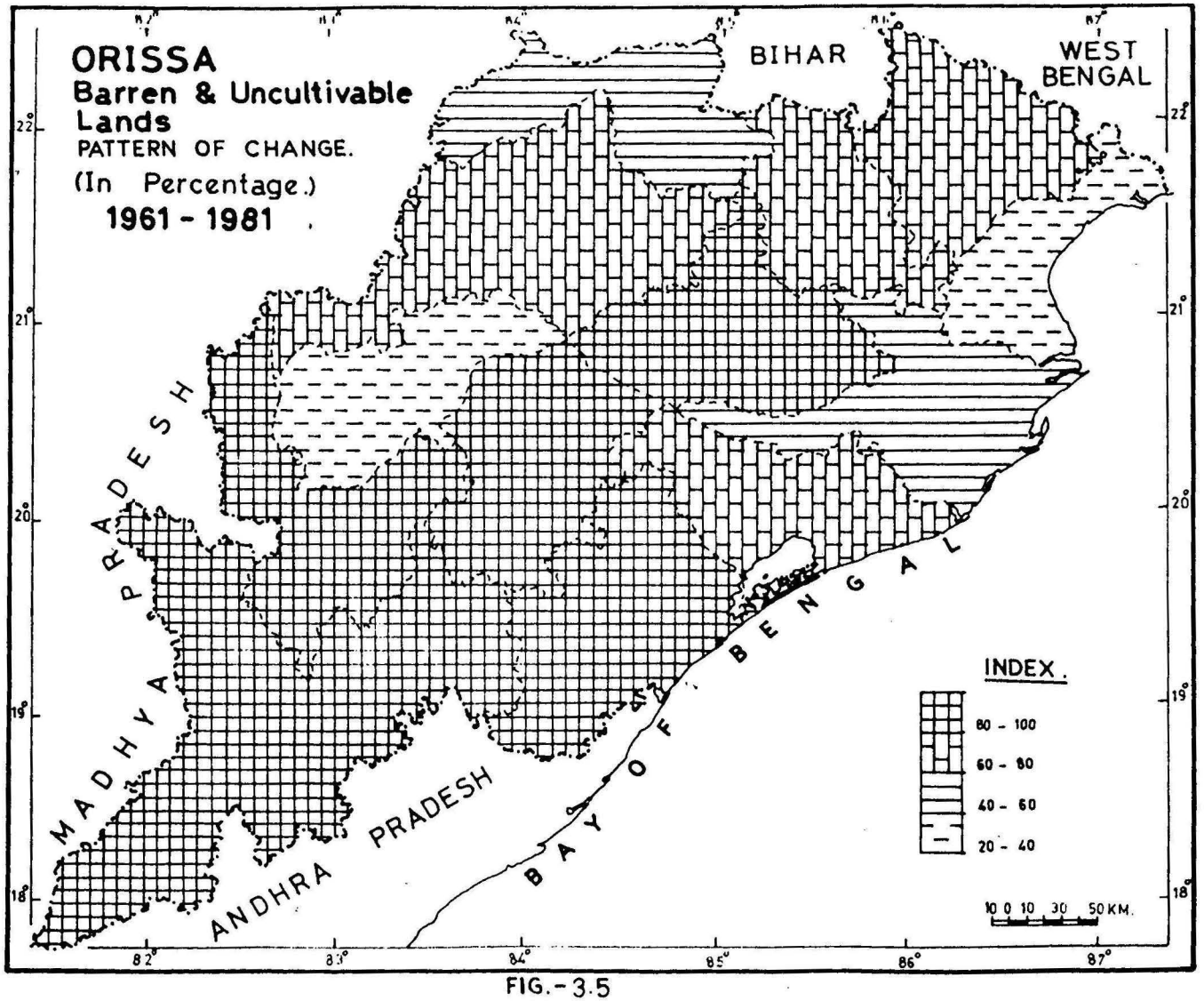
ORISSA
Barren & Uncultivable Lands
PATTERN OF CHANGE.
(In Percentage.)
1961 - 1981
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
80 - 100
60 - 80
40 - 60
20 - 40
10 0 10 30 50 KM.
22°
21°
20°
19°
18°
82°
83°
84°
85°
86°
87°

FIG.- 3.5

uncultivable and those of little value. Thus, the conversion of such type of lands is limited only to non-arable uses like forests and land put to non-agricultural uses and land under miscellaneous tree crops, at best.

As it can be marked from Fig. 3.5 during 1960-61 and 1980-81 lot of changes have taken place inthe area under this category of land use. Maximum change had taken place in the districts of Phulbani, Ganjam, Koraput, Dhenkanal and Kalahandi followed by Sambalpur, Mayurbhanj and Keonjhar. In contrast, the change was minimum for the districts of Balasore and Bolangir followed by Cuttack and Sambalpur. Remaining districts had a moderate rate of growth. The picture becomes more distinct while comparing the growth and distribution of barren and uncultivable lands in Orissa during the last twenty years as illustrated in Table 3.4.

TABLE - 3.4

PATTERN OF DISTRIBUTION AND GROWTH OF BARREN AND UNCULTIVABLE LANDS IN ORISSA, 1961-81

DISTRICTS/ STATE	PERCENTAGE OF TOTAL AREA BARREN & UNCULTIVABLE			PERCENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	2.94	3.86	3.71	31.58	- 4.00
Bolangir	5.55	4.64	3.40	-16.33	-26.83
Cuttack	1.65	0.92	0.92	-44.44	0
Dhenkanal	10.07	1.37	1.37	-86.36	0
Ganjam	14.18	1.07	0.41	-92.49	-61.54
Kalahandi	3.52	2.12	0.26	-39.13	-89.29
Keonjhar	6.02	2.17	2.17	-64.00	0
Koraput	15.00	2.74	1.67	-80.68	-39.19
Mayurbhanj	13.75	3.37	3.37	-75.52	0
Phulbani	10.96	0.18	0.18	-98.35	0
Puri	6.02	2.01	2.01	-66.67	0
Sambalpur	11.61	2.75	2.69	-76.35	- 2.08
Sundargarh	1.94	1.02	1.02	-47.37	0
ORISSA	6.99	2.19	1.71	-75.66	-22.06

As analysis of Table 3.4 bring out the following facts regarding the pattern of growth and distribution of barren and uncultivable lands in Orissa.

1] The state is experiencing a reduction in the barren and uncultivable lands, with the rate of conversion into other uses being more prominent during 1961-73 as compared to that during 1973-81.

2] The districts experiencing highest rate of conversion were Phulbani, Ganjam, Dhenkanal, Koraput, Sambalpur and Mayurbhanj during 1961-73 and Kalahandi and Ganjam during 1973-81.

3] During 1973-81 most of the districts had no change in their area of barren and uncultivable lands, while the only districts that had experienced a positive growth in this category of land use within the last twenty years was Balasore during 1961-73.

4] These were wide range of variations in the concentration of barren and uncultivable lands both in terms of space and time. During 1960-61 Koraput, Ganjam, Mayurbhanj, Sambalpur, Phulbani and Dhenkanal were the districts with highest percentage of barren and uncultivable lands (more than 10% of the total reported area). 1973-73 provides a quite different picture of distribution with

highest concentration occurring in the districts of Bolangir, Balasore and Mayurbhanj (between 3 to 5 per cent). The pattern of distribution remained more or less similar during 1980-81.

5] The lowest concentration of barren and uncultivable lands during 1960-61 was there in the districts of Cuttack, Sundargarh, Balasore and Kalahandi which had less than 5 per cent of their total area under such type of lands. However, large scale conversion during 1961-73 saw that by 1972-73, lowest degree of concentration occurred in the districts of Phulbani, Cuttack, Sundargarh, Ganjam and Dhenkanal (less than 1.5%). By 1980-81 there was further reduction in the extent of barren and uncultivable lands in the districts of Kalahandi, Ganjam and Koraput providing them with a slot in the category of districts with lowest concentration of barren and uncultivable lands along with Phulbani, Cuttack, Dhenkanal and Sundargarh. Infact, the state had only 1.71 per cent of its total area as barren and uncultivable during 1980-81 as compared to that of 8.99 per cent during 1960-61 showing the declining trend of growth of this category of land use.

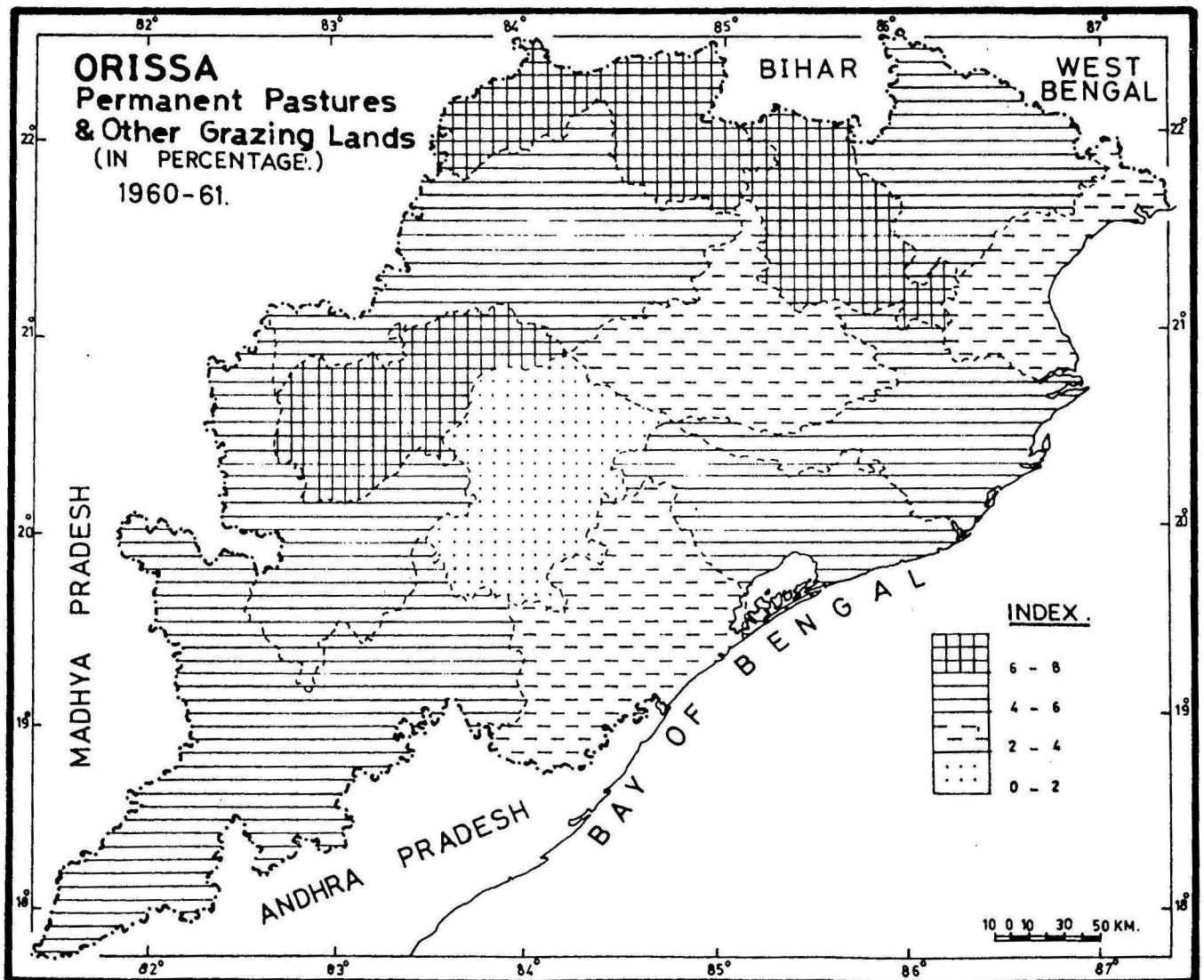
ORISSA
Permanent Pastures
& Other Grazing Lands
(IN PERCENTAGE.)
1960-61.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
6 - 8
4 - 6
2 - 4
0 - 2
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.6

d] Permanent Pastures and Other Grazing Lands : These include all grazing lands whether they are permanent pastures and meadows or else. Village common and grazing lands within forests are also included under this head. The pattern of the distribution and growth of permanent pastures and other grazing lands in Orissa exhibits large scale variations from place to place and time to time. A study of the Fig. 3.6 will bring out the fact that during 1960-61 the highest concentration of such type of lands were in the districts of Sundargarh, Keonjhar and Bolangir with more than 6 per cent of their total area under this category of lands, followed by Kalahandi, Cuttack, Mayurbhanj, Puri, Koraput and Sambalpur districts (4 to 6 per cent). Phulbani had the lowest proportion of area under this category having only 1.27 per cent of its total area under permanent pastures and other grazing lands as compared to the state's average of 4.74 per cent. Table 3.5 reflects the pattern of growth and distributiln of permanent pastures and other grazing lands in Orissa.

TABLE - 3.5

PATTERN OF DISTRIBUTION AND GROWTH OF PERMANENT PASTURES AND OTHER GRAZING LANDS IN ORISSA, 1961-81

DISTRICTS/ STATE	PER CENT OF TOTAL AREA UNDER PERMANENT PASTURES AND OTHER GRAZING LANDS			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
1	2	3	4	5	6
Balasore	3.55	4.79	4.01	34.78	-16.13
Bolangir	6.23	6.80	4.53	9.09	-33.33

contd..

1	2	3	4	5	6
Cuttack	5.23	5.33	3.49	1.75	-34.48
Dhenkanal	3.93	1.83	4.12	-53.49	125.00
Ganjam	3.85	2.29	3.11	-40.43	35.71
Kalahandi	5.90	5.09	3.51	-23.38	-30.51
Keonjhar	6.38	4.57	4.57	-28.30	0
Koraput	4.89	2.11	3.48	-54.40	64.91
Mayurbhanj	5.10	2.88	2.88	-43.40	0
Phulbani	1.27	0.36	0.36	-71.43	0
Puri	4.97	5.45	5.45	9.62	0
Sambalpur	4.17	3.38	4.00	-19.18	18.64
Sundargarh	6.64	4.29	3.98	-35.38	- 7.14
ORISSA	4.74	3.49	3.60	-26.32	3.13

As it is evident from the Table-3.5 the period between 1961-73 saw an overall depletion of the pasture and grazing lands of the state. However, there were districts which also increased their pasture lands. These included Balasore, Puri, Bolangir and Cuttack. The rest of the districts had experienced a reduction in their pasture and grazing lands with the highest rate of reduction being felt in Phulbani followed by Koraput and Dhenkanal. The negetive growth rate was also well above the state's growth rate (-26.32%) in the districts of Mayurbhanj, Ganjam, Sundargarh and Keonjhar. Districts having least negetive growth were Sambalpur and Kalahandi.

There was only a marginal increase in the Permanent Pastures and other grazing lands of the state during 1973-81. Though a number of districts like Keonjhar, Mayurbhanj, Phulbani and Puri experienced no growth at all during this period, there were districts which had a negetive growth (e.g. Balasore, Bolangir,

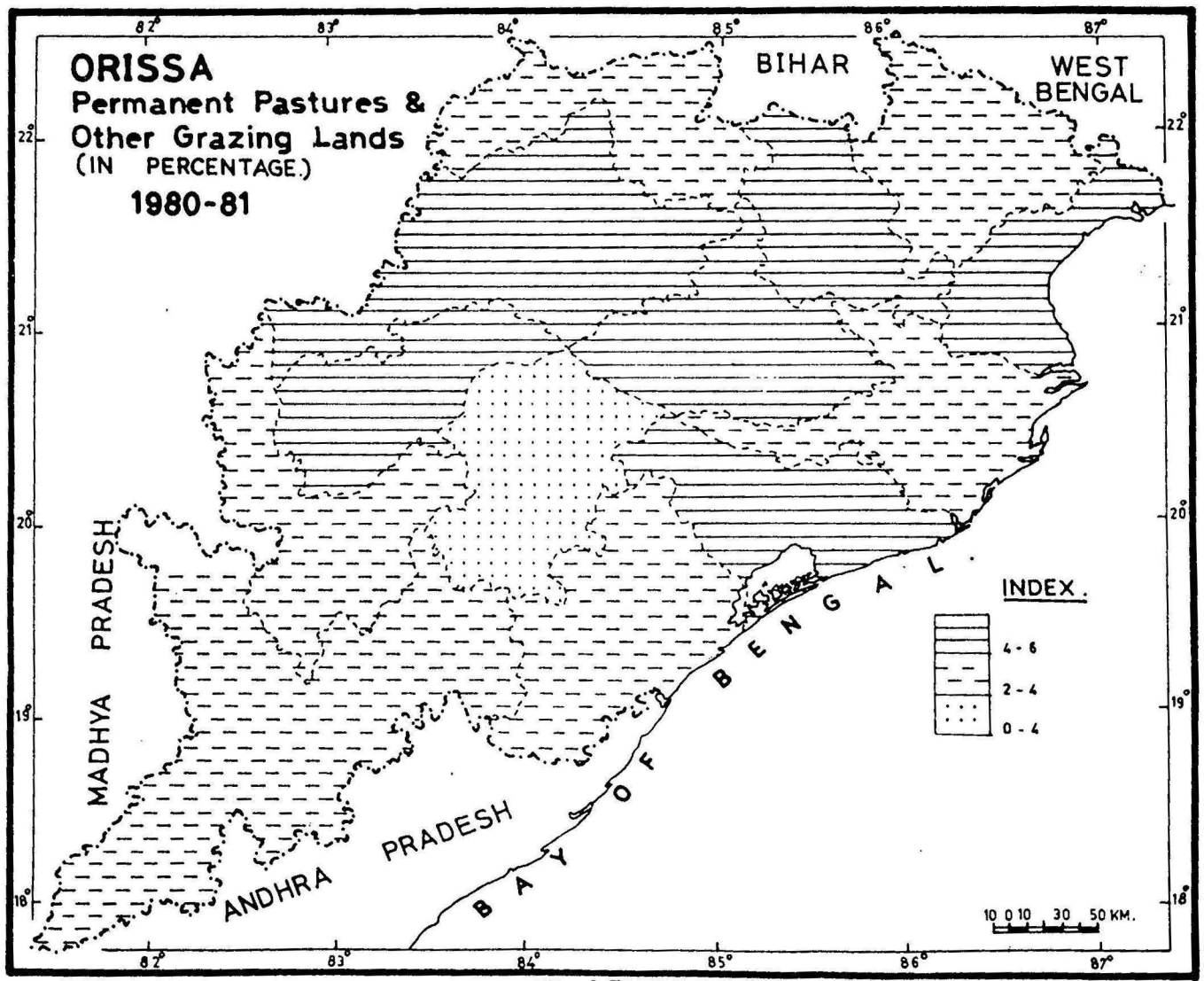
ORISSA
Permanent Pastures &
Other Grazing Lands
(IN PERCENTAGE.)
1980-81
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
4 - 6
2 - 4
0 - 4
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.7

Cuttack, Kalahandi and Sundargarh), or a positive growth like in the districts of Dhenkanal, Ganjam, Koraput and Sambalpur.

The pattern of distribution during 1980-81 was more or less similar to that of 1972-73 with minor variations. Thus, the highest percentage of pasture and grazing lands were found in the districts of Puri, Keonjhar, Bolangir, Dhenkanal and Balasore during 1980-81 (Fig. 3.7) as compared to those of Bolangir, Puri, Cuttack and Kalahandi during 1972-73. Similarly, the lowest concentration of this type of lands were found in the districts of Phulbani and Mayurbhanj both during 1972-73 and 1980-81 as well as in Dhenkanal, Koraput and Ganjam during 1972-73. Besides these, the other districts with a percentage of area under permanent pastures and other grazing lands lower than the state average were Sambalpur during 1972-73 and Cuttack, Ganjam, Kalahandi and Koraput during 1980-81.

e] *Land under Miscellaneous Tree Crops and Groves* :These include all cultivable land which is not included under 'net sown area', but is put to some agricultural use. Lands under casurina trees, thatching grasses, bamboo bushes and other grooves for fuel etc. which are not included under orchards are classified under this category. Though it has not occupied a greater proportion of the total area of the state (only 2.97 per cent during 1960-61 and 2.72 per cent during 1980-81), it exhibits perhaps the greatest fluctuations in terms of growth and distribution.

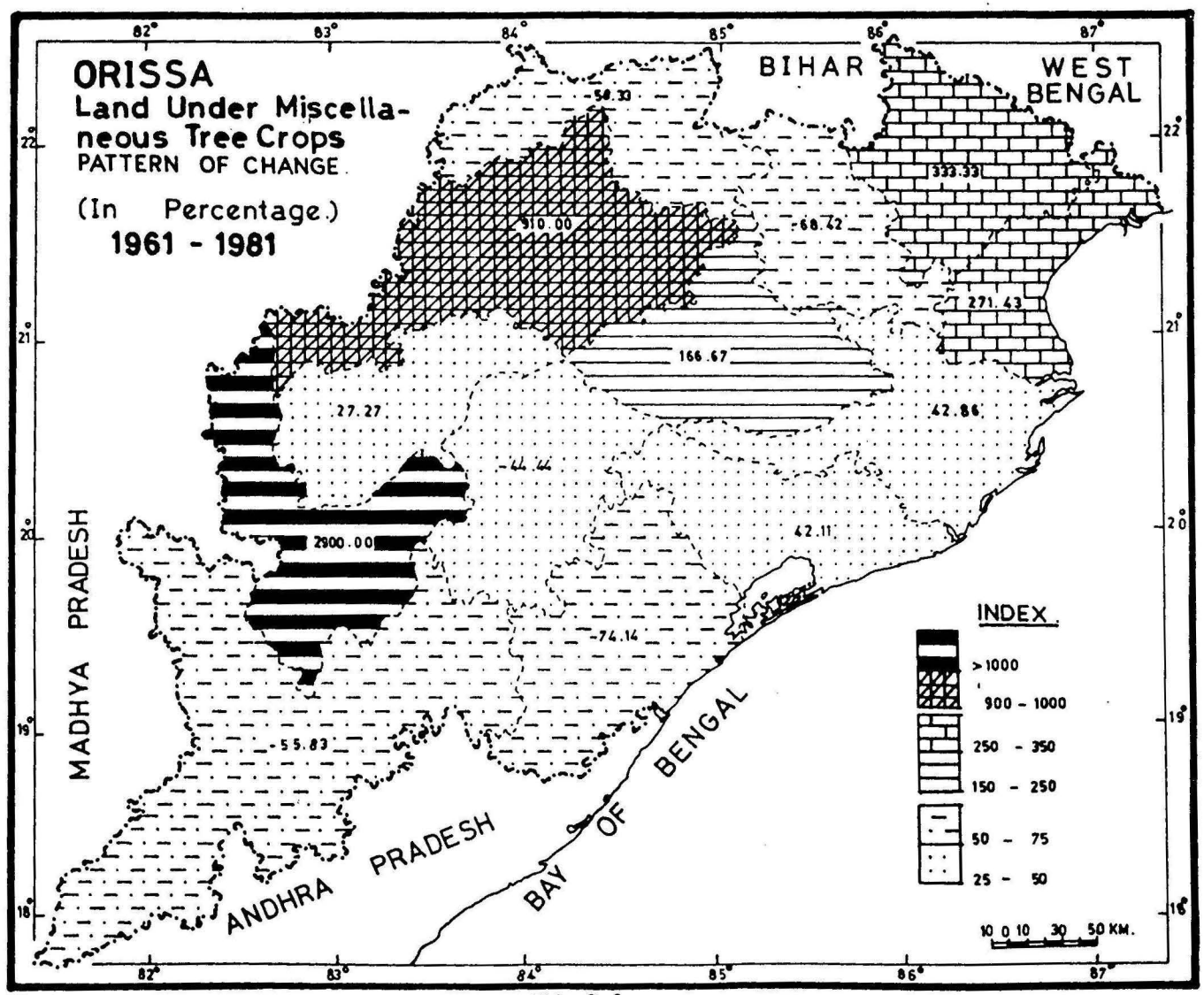
ORISSA
Land Under Miscellaneous Tree Crops
PATTERN OF CHANGE
(In Percentage)
1961 - 1981
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
58.30
910.00
68.42
333.33
271.43
166.67
27.27
42.86
44.44
2900.00
42.11
74.14
55.83
INDEX
>1000
900 - 1000
250 - 350
150 - 250
50 - 75
25 - 50
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.8

As it canbe marked from Fig. 3.8 there are the districts characterised by incredible amount of change like Kalahandi which has witnessed a growth of 2900 per cent during 1961-81 while there are also districts like Bolangir which has only a marginal rate of change as compared to this. Table 3.6 illustrates the picture more profoundly.

TABLE - 3.6

PATTERN OF DISTRBUTION AND GROWTH OF LAND UNDER MISCELLANEOUS TREE-CROPS AND GROVES IN ORISSA, 1961-81

DISTRICTS/ STATE	PERCENTAGE OF THE TOTAL AREA UNDER MISCELLANEOUS TREE-CROPS AND GROVES			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	1.08	3.09	4.02	185.71	30.00
Bolangir	1.23	1.93	1.59	54.55	-17.65
Cuttack	1.93	2.39	2.75	23.80	15.38
Dhenkanal	1.37	0.92	3.66	-33.33	300.00
Ganjam	9.51	1.64	2.46	-82.76	50.00
Kalahandi	0.08	15.89	2.59	18300.00	-83.70
Keonjhar	2.29	0.72	0.72	-68.42	0
Koraput	8.07	1.92	3.37	-74.76	75.00
Mayurbhanj	0.29	0.77	1.25	166.67	62.5
Phulbani	0.82	0.45	0.45	-44.44	0
Puri	1.82	2.29	2.58	26.32	12.5
Sambalpur	0.57	13.55	5.77	2270.00	-57.38
Sundargarh	2.45	1.02	1.02	58.33	0
ORISSA	2.97	3.98	2.72	34.27	-31.-6

An analysis of the Table 3.6 brings out the following facts :

1] In the state the miscellaneous tree crops occupy only a small per cent of area as compared to that of forests or net sown area.

2] The districts with highest concentration of land under miscellaneous tree crops and groves were Ganjam and Koraput during 1960-61, Kalahandi and Sambalpur during 1972-73 and Balasore, Sambalpur, Dhenkanal and Koraput during 1980-81. But one thing should be remembered, that, the share of miscellaneous tree crops and groves in the total land available increased during 1961-73 and then declined during 1973-81.

3] The districts having only a small proportion of their area under miscellaneous tree crops and groves during 1960-61 like Kalahandi and Sambalpur experienced the maximum increase in the area under miscellaneous tree crops during 1961-73. These were also the districts which experienced highest negetive growth during 1973-81. In contrast to this, the districts which had experienced a negetive growth during 1973-81, experienced a positive growth during 1971-81 like the districts of Dhenkanal, Ganjam and Koraput or no growth at all like Keonjhar and Phulbani districts.

4] The only districts that have experienced a positive growth throughout are Balasore, Cuttack, Mayurbhanj and Puri while Sundargarh had experienced a positive growth during 1961-73 but no growth at all during 1973-81.

An explanation to such a tendency may be the fact that the repeated onslaught of draughts during 1961-73 & 1973-81 may have resulted in the diversion of lands previously used for more lucrative/productive agricultural uses towards such type of minor productive uses, and the lands previously under this category may be completely diverted towards certain other type of land uses e.g. cultivable wastes etc. thus resulting in a decrease in the lands under this category. Another factor which should not be overlooked is the Governmental Planning and involvement in schemes like Social forestry as Orissa is one of the first order states having highest proportion of lands under this scheme.

6] *Cultivable Wastes:* Simply speaking, cultivable wastes are lands which have potentials for cultivation of crops at the time of need (Roy, 1973; 18). The term cultivable waste represents lands which are intermediate between barren lands on the one hand and fallows on the other. These include all lands available for cultivation whether not taken up for the purpose or abandoned after a few years of cultivation for one reason or the other. Such lands may be assessed or unassessed and may lie in isolated blocks or within cultivated holdings. This type of land include lands which are water logged, or which is marked by a slope too steep for ordinary cultivators or wastes that are neither pastures nor arables but which are level enough for cultivation after the provisions of water and fertilizers.

Infact, these are the lands once cultivated but uncultivated for five years or more in succession. The position of cultivable wastes in the mosaic of agricultural land scape is vital because this provides with an avenue for extension of agricultural in future (Prasad, 1976) As far as the reclaimation of cultivable wastes is concerned, it involves comparatively less cost over alluvial tracts than to those over mountainous regions.

The decrease in the area under cultivable wastes with time under normal circumstances, due to increasing pressure of population on agricultural land is a proven phenomena. Orissa is no exception to such a trend. An analysis of the pattern of growth of cultivable wastes as illustrated by Table 3.7 shows that the proportion of area under cultivable wastes has decreased drastically during the last two decades from its 1960-61 figures of 8.68 per cent to 1.60 per cent during 198-81 for the state as a whole.

TABLE - 3.7

PATTERN OF GROWTH AND DISTRIBUTION OF CULTIVABLE WASTES IN ORISSA, 1961-81

DISTRICTS/ STATE	PER CENT OF THE TOTAL AREA AS CULTIVABLE WASTES			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	3.25	3.86	3.09	19.05	-20.00
Bolangir	7.36	6.12	5.32	-16.92	-12.96
Cuttack	4.96	3.95	0.92	-20.37	-76.74
Dhenkanal	8.70	1.55	0.64	-82.11	-58.82
Ganjam	9.43	1.64	0.41	-82.61	-75.00
Kalahandi	11.64	3.20	0.43	-75.66	-86.49
Keonjhar	8.54	4.09	1.08	-52.11	-73.53
Koraput	9.04	1.26	1.11	-85.28	-11.76
Mayurbhanj	6.73	1.92	0.58	-71.43	-70.00
Phulbani	18.12	0.45	0.45	-96.50	0
Puri	6.68	5.83	3.06	-15.28	-47.54
Sambalpur	7.32	5.43	3.60	-25.78	-33.68
Sundargarh	7.66	1.02	1.02	-86.67	0
ORISSA	8.68	2.93	1.60	-66.27	-45.27

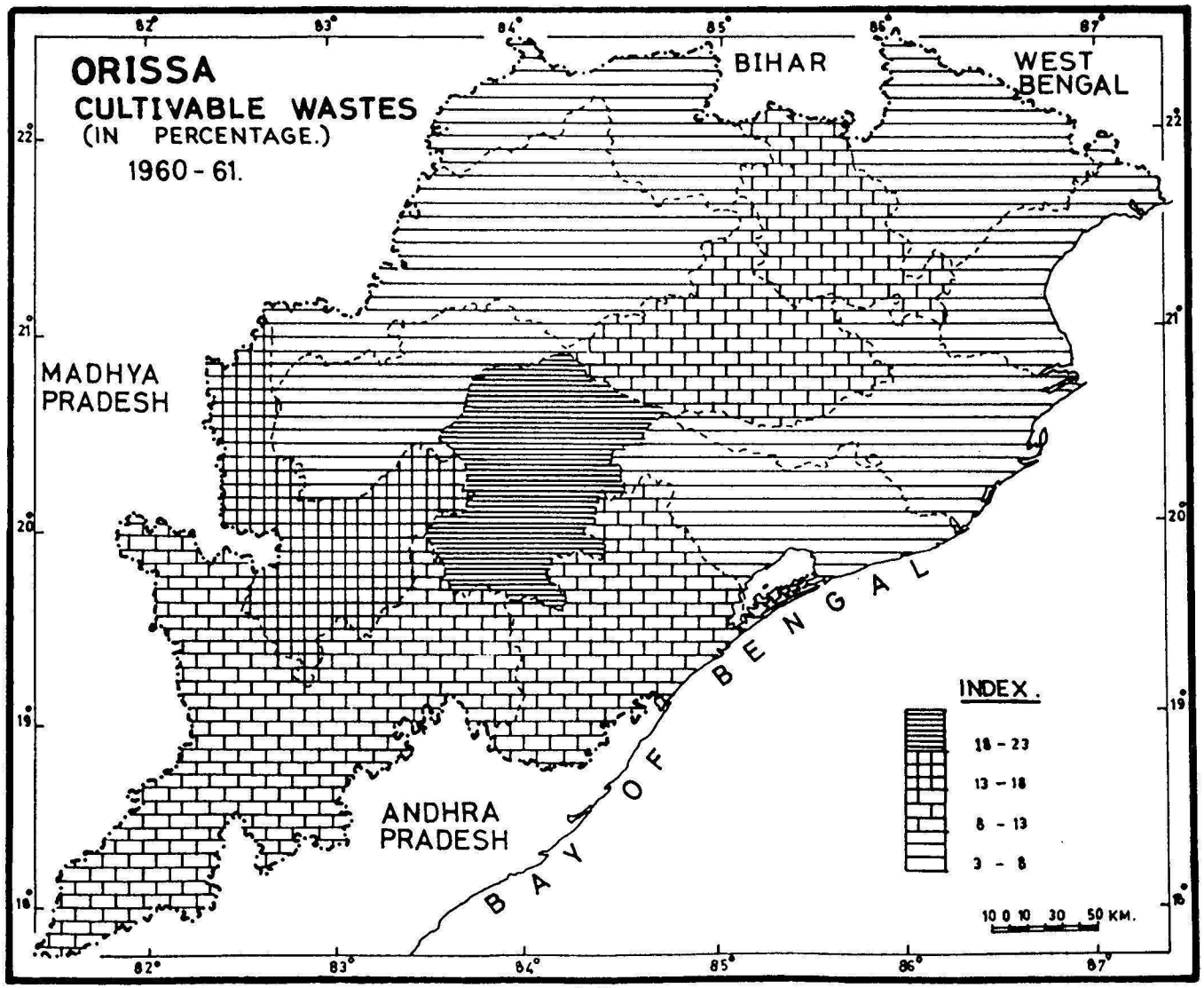
ORISSA
CULTIVABLE WASTES
(IN PERCENTAGE.)
1960 - 61.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
18 - 23
13 - 18
8 - 13
3 - 8
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.9

As reflected by Table 3.7 as well as Fig. 3.9 the cultivable wastes in Orissa exhibit an interesting pattern of distribution, during 1960-61. On the one hand there were the coastal districts of Balasore, Cuttack and Puri where lands which were capable of easier reclaimation had been convered into agricultural lands or fallows by local peasantory thus leaving alone only a small proportion of the total area as cultivable wastes, while on the other hand the districts of Phulbani, Kalahandi,Koraput, Ganjam, Dhenkanal and Keonjhar with their mountainous terrain topography and comparatively lower population density had much larger proportion of areas under cultivable wastes. The rest of the districts with their sub-dued plateaulands and medium population density had cultivable wastelands between these two extremes.

The fact that with an ever increasing population the extent of cultivable wastes will deminish has been aptly demonstrated by the declining share of cultivable wastes in the general land use pattern in Orissa. While during 1960-61 Orissa had 8.68 per cent of its total area as cultivable wastes this figure declined to 2.93 per cent during 1972-73 and further to 1.60 per cent during 1980-81.

The declining trend of the extent of cultivable wastes was more prominent in the districts of Phulbani, Sundargarh, Koraput, Ganjam, Dhenkanal and Kalahandi during 1961-73 (Table - 3.7) while it was highest for the districts of Kalahandi, Cuttack, Ganjam,

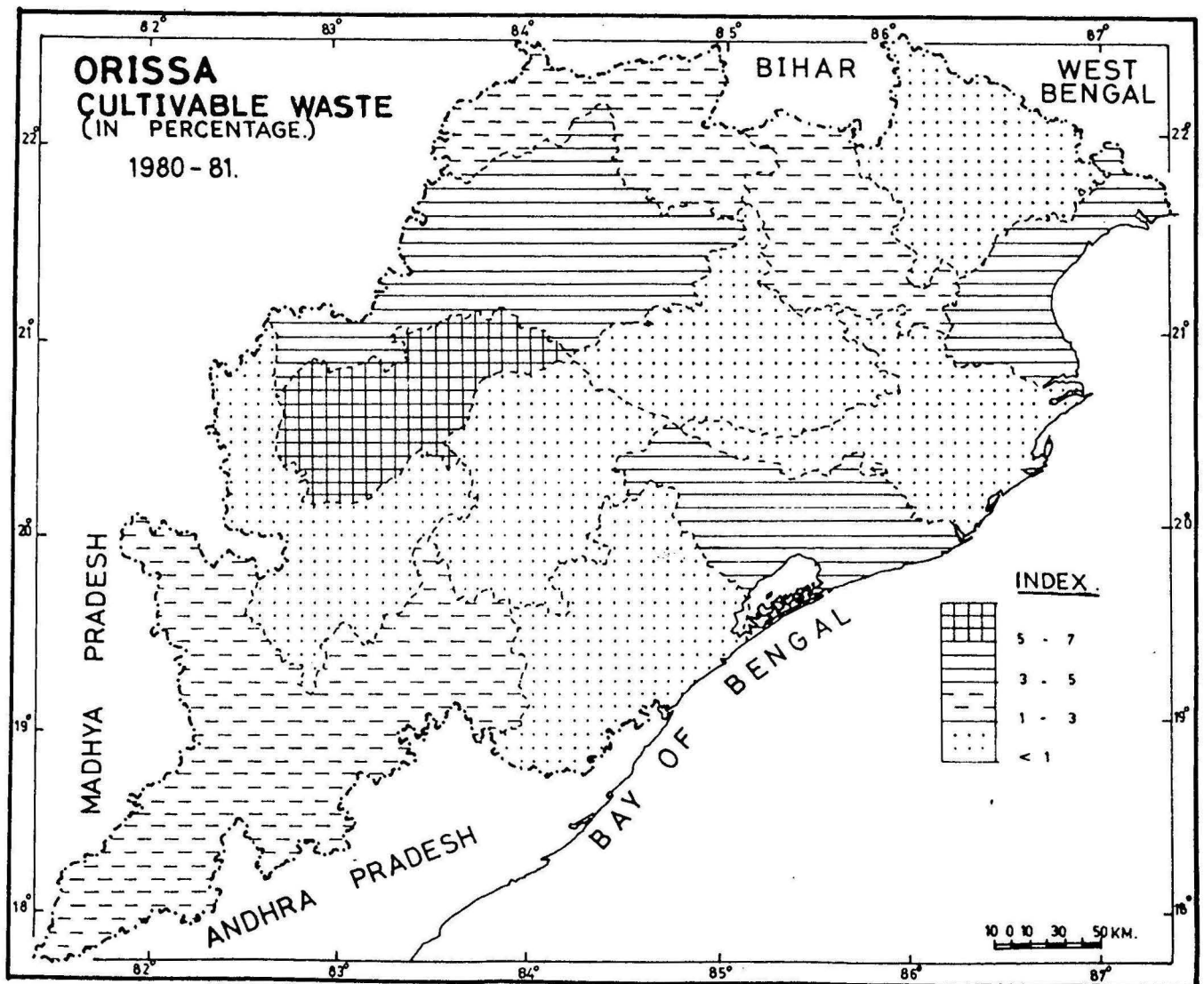
ORISSA
CULTIVABLE WASTE
(IN PERCENTAGE.)
1980 - 81.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
5 - 7
3 - 5
1 - 3
< 1
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 3.10

Keonjhar and Mayurbhanj during 1973-81.

Another important feature is that during 1980-81 there were as many as six districts having less than one per cent of their total area under cultivable wastes. The highest concentration of cultivable wastes were in Bolangir district followed by Sambalpur, Balasore and Puri (Fig. 3.10).

All this show the impact of the meancing population growth and technological advancement on the growth of cultivable wastes. Thus practically any piece of land that can be reclaimed has been reclaimed by the local peasentry for their uses.

g] *Fallow Lands* : Fallow lands cover all cropped areas thrown out of cultivation during the year in question or not cultivated temporarily for specific periods in order that they may recoup their fertility. The maximum period for which land left uncultivated is reckoned as fallow and varies according to local customs and rules in different areas e.g. from two years in Punjab to Ten years in Bombay. However in general the land is said to be fallow if it has not been cultivated for the last Five years. After this period if theland is still left uncultivated then it is included under the category of cultivable wastes.

The growth and extent of fallow lands depend upon climatic and other socio economic conditions. As there is a close relationship between fallow lands and net sown area there are frequent shift overs

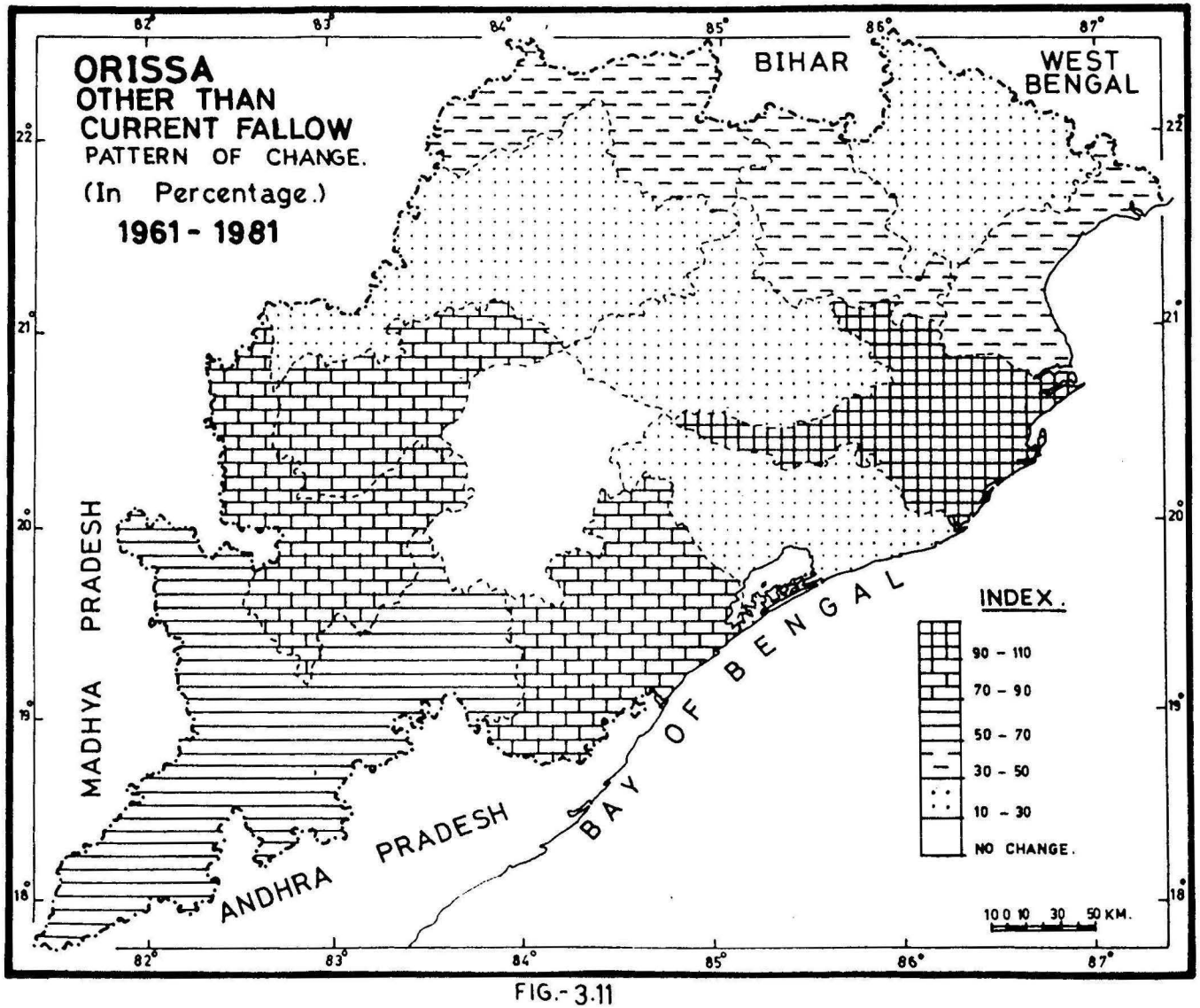
ORISSA
OTHER THAN
CURRENT FALLOW
PATTERN OF CHANGE.
(In Percentage.)
1961 - 1981
BIHAR
WEST
BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
90 - 110
70 - 90
50 - 70
30 - 50
10 - 30
NO CHANGE.
100 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 3.11

from one to another. A good and timely rainfall and favourable weather conditions help in increasing the area sown at the cost of fallow lands while a failure will spell the reverse. In general, however, with the development and gro-th of irrigation the extent of fallows will decrease, as it appears to be in agreement with a concerted drive for winning as much land permanently under the plough as possible yet, another factor that might cause the concentration of fallow lands at the cost of net area sown is urbanization and industrialization combined. (Chaudhary, 1982; 62). The fallow lands were further subdevided into the following two categories :

i] *Other than Current Fallow* : These include all lands which are temporarily out of cultivation for a period of not less than one year and not more than five years. The reason for keeping such lands fallow may be one of the following.

1] Poverty of Cultivator
2] Inadequate supply of water
3] Malarial climate
4] Silting of Canals and Rivers and
5] Unremunerative nature of farming

(Government of India, DES, 1957; 663).

As regards Orissa, it has only a small proportion of area under this category amounting only to less than two per cent throughout the stipulated time period of 1961-81. As it can be marked from the Fig. 3.11 the pattern of change in the other than current fallows during 1961-81 gives a very complex picture. Their

were districts like Cuttack with maximum change in the other than current fallows on the one hand while on the other, there were districts like Phulbani which had the same percentage of area during 1980-81 as during 1960-61 under this category. Table 3.8 will show this varried and complex picture of distribution and growth.

TABLE 3.8

OTHER THAN CURRENT FALLOW : PATTERN OF GROWTH AND DISTRIBUTION IN ORISSA, 1961-81

DISTRICTS/ STATE	PERCENTAGE OF AREA UNDER OTHER THAN CURRENT FALLOWS			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	2.16	1.86	1.23	-14.29	-33.33
Bolangir	2.15	3.96	3.96	84.21	0
Cuttack	0.92	0.37	1.84	-60.00	400.00
Dhenkanal	1.74	0.92	1.92	-47.37	110.00
Ganjam	1.64	0.82	0.41	-50.00	-50.00
Kalahandi	1.30	0.78	0.43	-47.06	-44.44
Keonjhar	1.81	0.96	1.20	-46.67	25.00
Koraput	0.47	1.67	0.74	275.00	-55.56
Mayurbhanj	1.25	2.31	0.96	84.62	-58.33
Phulbani	0.45	0.27	0.45	-40.00	66.67
Puri	0.76	0.57	0.96	-25.00	66.67
Sambalpur	0.97	2.63	1.14	170.59	-56.52
Sundargarh	1.43	3.07	2.04	114.28	-33.33
ORISSA	1.18	1.56	1.22	32.24	-21.90

As the above table shows, maximum concentration of other than current fallows were in the districts of Balasore and Bolangir while the districts with lowest concentration were Phulbani, Koraput, Puri and Cuttack during 1960-61. However, by 1972-73 as a consequence of the continuing drought conditions over the state,

the area under this category of lands went through a period of positive growth and during 1972-73 Bolangir and Sundargarh were the districts with highest proportion of area under other than current fallows followed by Sambalpur and Mayurbhanj. However, not all the districts experienced a positive growth as there may also be conversion of other than current fallows into other types of land uses especially in to net area sown and cultivable wastes. Thus the districts like Balasore, Cuttack, Dhenkanal, Ganjam, Kalahandi, Keonjhar, Phulbani and Puri experienced a decrease in their other than current fallow lands.

The period between 1972-73 and 1980-81 witnessed a further decline in the other than current fallow lands of the state. The districts with a negative growth were Balasore, Ganjam, Kalahandi, Koraput, Mayurbhanj, Sambalpur and Sundargarh. In other words roughly the districts except Balasore, Ganjam and Kalahandi with a positive growth during 1961-73 had a negetive growth during 1973-81 and districts with a negetive growth during 1961-73 experienced a positive growth during 1973-81. As regards the distribution, during 1980-81 only Bolangir had more than 3 per cent of its total area under other than current fallows followed by Sundargarh while there were as many as six districts with less than 1 per cent of their area under this category as compared to 7 districts during 1972-73 and 5 districts during 1960-61. The lowest concentrations during 1980-81 were confined to these districts of Ganjam, Kalahandi, Phulbani, Koraput, Puri

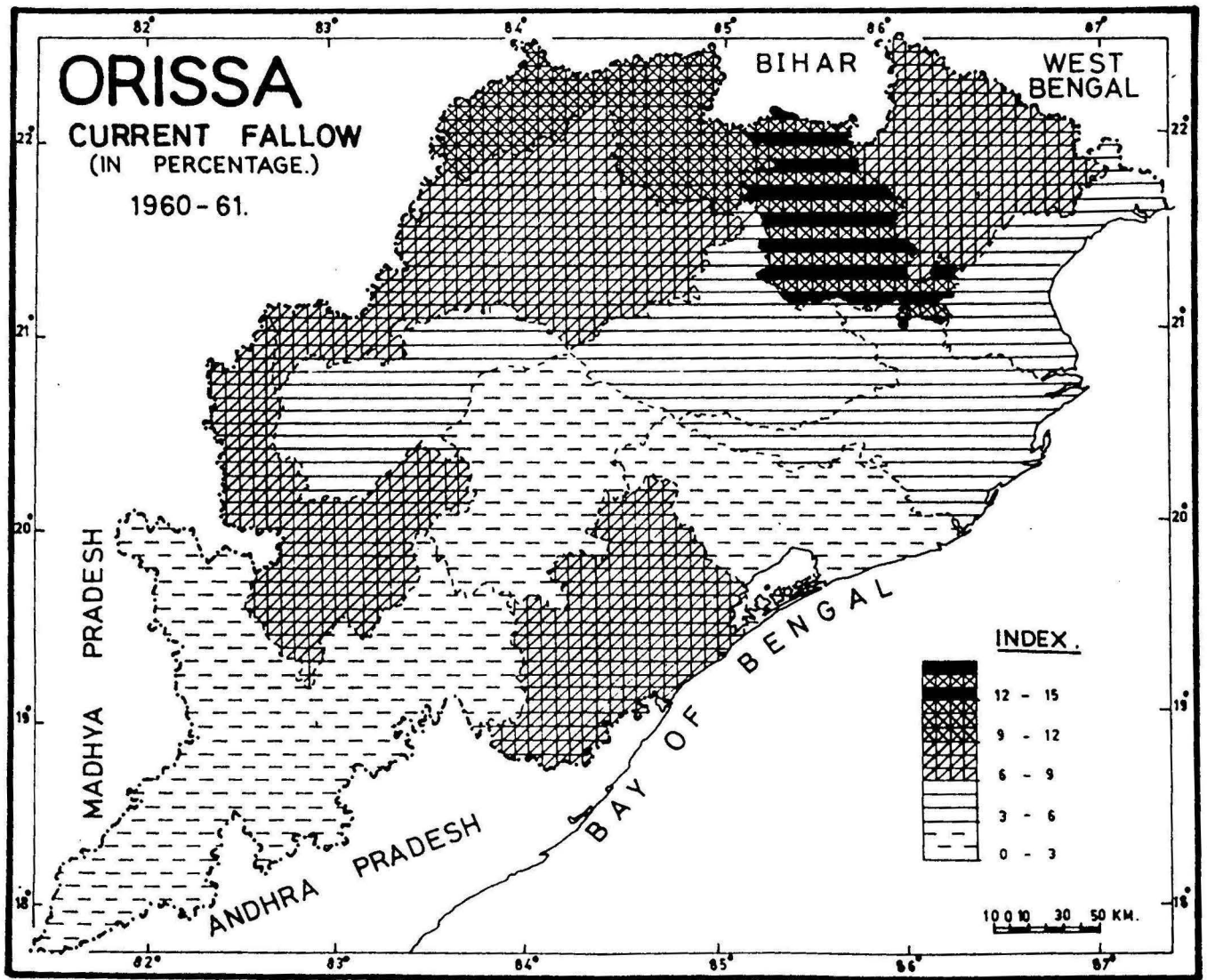
ORISSA
CURRENT FALLOW
(IN PERCENTAGE.)
1960 - 61.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
12 - 15
9 - 12
6 - 9
3 - 6
0 - 3
0 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-3.12

and Mayurbhanj, followed by Sambalpur, Keonjhar, and Balasore.

ii] *Current Fallow* : These include all cropped areas which are kept fallow during the current year i.e. census year. For example, if any seedling area is not cropped again during the same year it is treated as current fallow. Thus these are areas kept fallow for less than one year.

As Fig. 3.12 shows the highest concentration of current fallows during 1960-61 was confined to the Keonjhar district followed by Sundargarh while Koraput, Phulbani and Puri had the lowest percentage of their total area under current fallows. Table 3.9 also represents the same situation. It is worth noting that the coastal districts of Cuttack, Balasore and Puri had a very low percentage of their total land under current fallows, while the Mountainous districts of Koraput, Phulbani, Ganjam and Dhenkanal had also a lower proportion of current fallows .

TABLE - 3.9

PATTERN OF GROWTH AND DISTRIBUTION OF CURRENT FALLOWS IN ORISSA, 1961-81

DISTRICTS/ STATE	PERCENTAGE OF TOTAL AREA UNDER CURRENT FALLOWS			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	5.87	6.34	3.25	7.89	-48.78
Bolangir	5.77	10.19	5.77	76.47	-43.33
Cuttack	4.77	4.59	4.40	-3.83	-4.00
Dhenkanal	3.39	7.33	6.22	116.22	-15.00
Ganjam	7.13	5.74	0.86	-19.54	-85.71
Kalahandi	8.35	4.32	0.56	-54.13	-88.00
Keonjhar	12.27	9.63	3.85	-21.57	-60.00
Koraput	2.31	7.03	2.40	222.03	-65.79
Mayurbhanj	8.27	8.65	0.96	4.65	-74.44
Phulbani	0.81	5.49	0.45	566.67	-86.67
Puri	2.96	5.74	0.95	93.55	-66.67
Sambalpur	8.40	6.86	1.14	-18.37	-50.00
Sundargarh	10.93	11.24	2.04	2.80	-63.64
ORISSA	5.88	7.02	1.21	19.23	-58.57

A general phenomena that can be marked from Table 3.9 is that during 1961-73 there was an overall increase in the current fallow in Orissa. This can be attributed to the fact that during this period the state was reeling with the blows of severe droughts of 1965-66, 1966-67 and 1971-72 and cyclones of 1967 and 1968 (Government of Orissa, 1977; 111). The worst affected are the districts which have a very low percentage of area irrigated and thats again by assured irrigation systems like Canals. Thus during this period i.e. 1961-73 the districts of Phulbani and Koraput with their low percentage of gross cropped area irrigated (5.43% and 4.86% respectively) as well as Puri, Dhenkanal and Bolangir with their low canal irrigated lands experienced the highest increase in current fallow lands. There were also increase in the current fallows in the districts of Balasore, Bolangir, Mayurbhanj and Sundargarh while the rest of the districts experienced a decline in the extent of current fallows which might be converted either into net sown areas or other than current fallows. Thus during 1972-73 highest concentration of current fallows were occurring in the districts of Sundargarh and Bolangir followed by Keonjhar, Mayurbhanj, Dhenkanal and Koraput districts while lowest concentrations can be found in the districts of Kalahandi and Cuttack.

The period between 1973 and 1981 witnessed an overall decline in the area under fallow lands in all the districts and thus the state. The highest decline occurred in the districts of

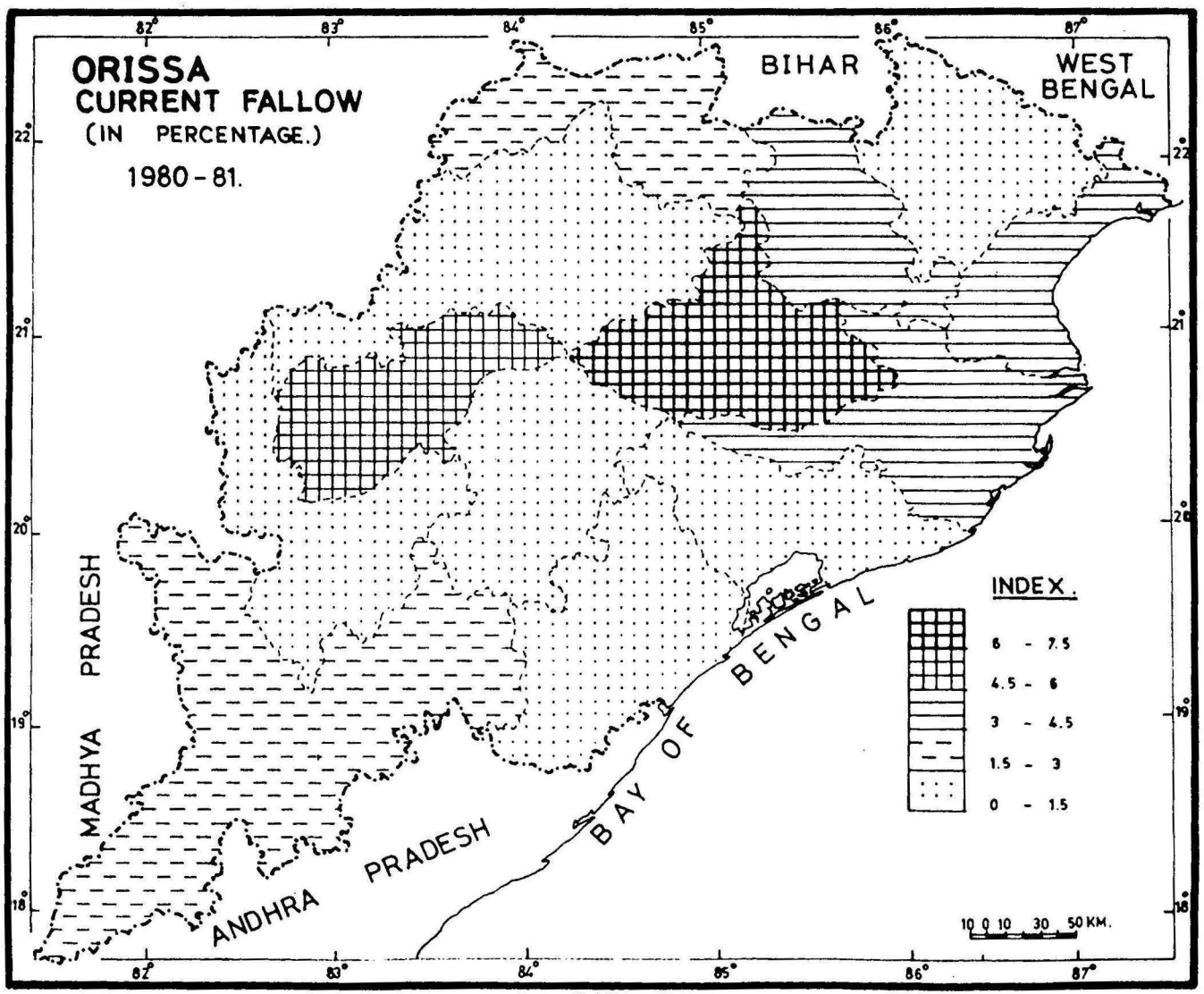
ORISSA
CURRENT FALLOW
(IN PERCENTAGE.)
1980 - 81.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
6 - 7.5
4.5 - 6
3 - 4.5
1.5 - 3
0 - 1.5
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 3.13

Kalahandi, Phulbani and Ganjam followed by Mayurbhanj, Puri, Sundargarh and Keonjhar while the decline was lowest for the districts of cuttack and Dhenkanal. During 1980-81 the highest concentrations of current fallows were occurring in the district of Dhenkanal followed by Bolangir (Fig. 3.13) while the districts with lowest percentage of area in the state were Phulbani, Kalahandi, Ganjam and Puri all of which had less than 1 per cent of their area under current fallows (Table - 3.9 and Fig. 3.13).

3.4 CONCLUSION

The preceeding analysis brings out two distinct conclusive remarks about the overall changes in the other than agricultural land use pattern in Orissa during 1960-61 and 1980-81 e.g. :

1] The role of physical factors like climate should not be overemphasized as also that of the physiography of the region in determining the character of and change in the land use patterns.

2] The government is playing an impressive role in determining the pattern of land use and moulding it with time towards a better pattern of optimum utilization.

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CHAPTER - FOUR

PATTERN OF LAND UTILIZATION : (2) AGRICULTURAL LAND UTILIZATION

4.1 INTRODUCTION

An analysis of the pattern of agricultural land utilization in Orissa and its changes over time aquires special significance in the context of the character of the state's population. Such an attempt becomes rather imperative considering the fact that about 79 per centof the working population of the state earn their livelihood from agricultural. Leave apart all those dependents which they support. Also agriculture is the backbone of the state's economy contributing as much as 66 per cent to the state's total income. According to the state's income estimates the value of agricultural and allied sector output was about Rs.1368.5 crores during 1978-79. Also the state's contribution to all India Production of rice was 8.2 per cent and in all India foodgrain production Orissa's share was 4.4 per cent during 1978-79. (Government of Orissa, Bureau of Economics and Statistics, 1980-81; 11) considering all these aspects it can be rightly concluded that any study without a reference to the state of the state's agriculture is incomplete.

Agricultural land use pattern has been discussed in this chapter under the following heads :

a] Net Sown Area
b] Area Sown Morethan Once
c] Gross Cropped Area
d] Cropping Intensity
e] Distribution of Major Crops and
f] Crop Combination Regions

4.2 NET AREA SOWN

It represents the actual geographical area under the crops, orchard and fodder, where areas cropped are counted only once. In other words it denotes to the total cropped area minus double cropped area. It is obvious that in a predominantly agricultural country like India, the main category of rural land use would be that of the 'Net Sown Area'. "The very ancient history of land occupance and an almost overwhelming dependence on agriculture, to the complete exclusion of all other economic activities, have practically forced the proportion of the net sown area to be persistently very high" (Kaur, 1969; 30).

Orissa presents a picture of diversity. On the one hand, there are districts with so high proportion of the net sown area that other categories of landuse can be said to be negligible, while on the other hand there are districts where the proportion and extent of net sown area is itself negligible. Also there are periodical fluctuations in the proportion of net area Sown due to the overwhelming dependence of agriculture on the Monsoons. A good Monsoon brings with it a bumper harvest as well as a natural boom in the net sown area while a failutre spells out

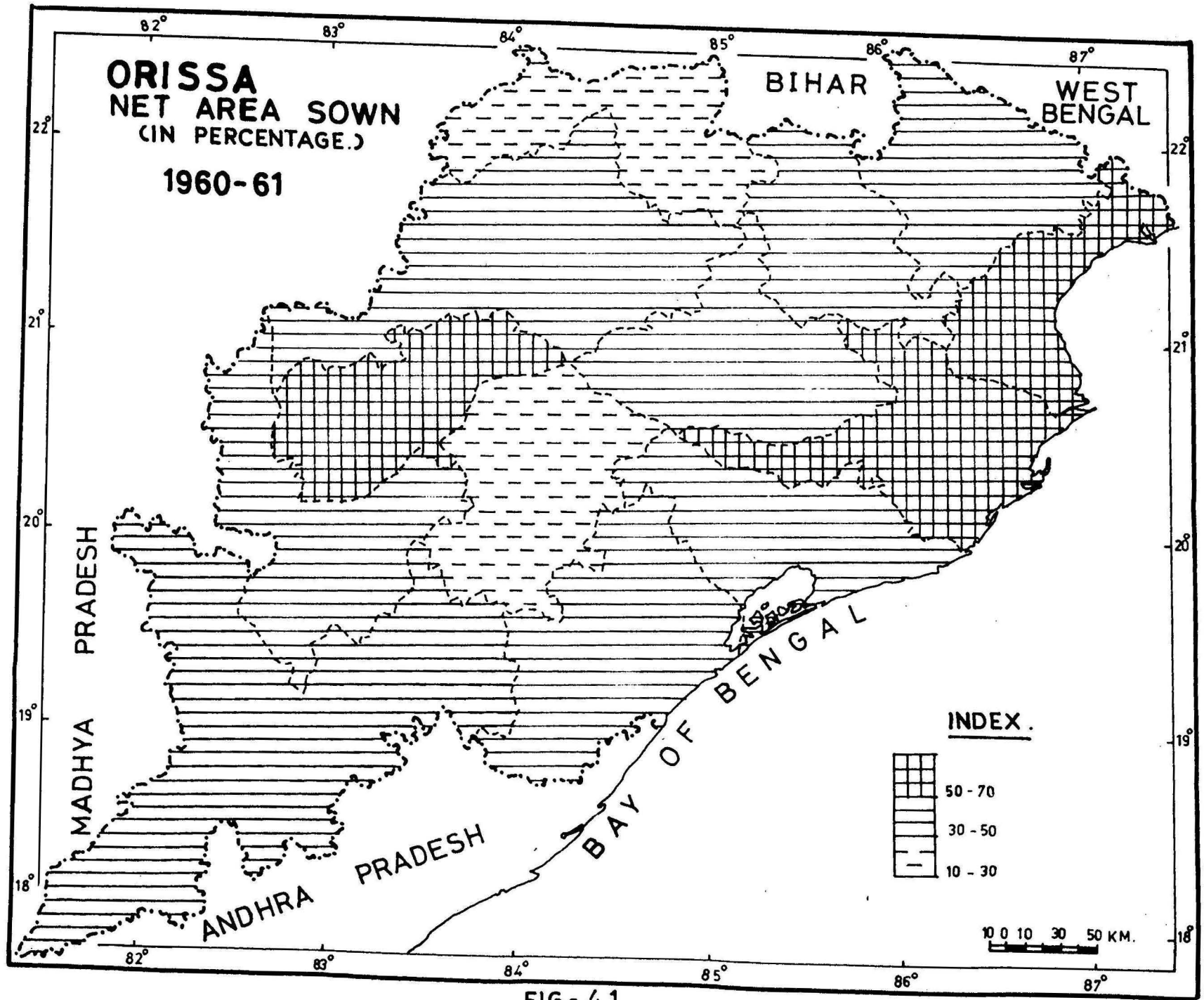

ORISSA
NET AREA SOWN
(IN PERCENTAGE.)
1960-61
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
50 - 70
30 - 50
10 - 30
100 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 4.1

the reverse. Also the role played by the physiography of a region should not be forgotten. It is obvious that a river plain will have more area under crops than a mountainous terrain. Table 4.1 presents a general picture of the pattern of distribution and growth of net sown area in Orissa during 1960-61 and 1980-81.

TABLE - 4.1

GROWTH AND DISTRIBUTION OF NET SOWN AREA IN ORISSA

1961-81

DISTRICTS/ STATE	NET SOWN AREA AS PERCENTAGE OF TOTAL REPORTED AREA			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	67.85	64.85	67.39	- 5.47	5.06
Bolangir	51.20	43.71	47.34	-14.60	8.29
Cuttack	60.90	64.90	64.00	6.64	-1.41
Dhenkanal	34.62	36.54	36.54	5.56	0
Ganjam	31.64	36.39	40.98	15.03	12.61
Kalahandi	30.93	37.82	43.96	8.42	16.21
Keonjhar	30.93	29.00	34.42	- 6.23	18.67
Koraput	31.09	26.61	31.94	- 9.45	20.03
Mayurbhanj	37.88	38.08	40.19	0.51	5.56
Phulbani	17.75	16.58	20.92	- 6.63	26.23
Puri	41.11	44.74	45.60	8.84	19.23
Sambalpur	40.59	32.53	35.56	-19.86	9.31
Sundargarh	29.01	26.25	27.99	- 9.51	6.61
ORISSA	37.24	36.18	39.45	- 2.85	9.04

As the Table 4.1 illustrates as well as a look at the Fig.4.1 will bringout the fact that during 1960-61 highest percentage of area under plough was in the districts of Balasore, Cuttack and Bolangir with more than 50 per cent of the total reported

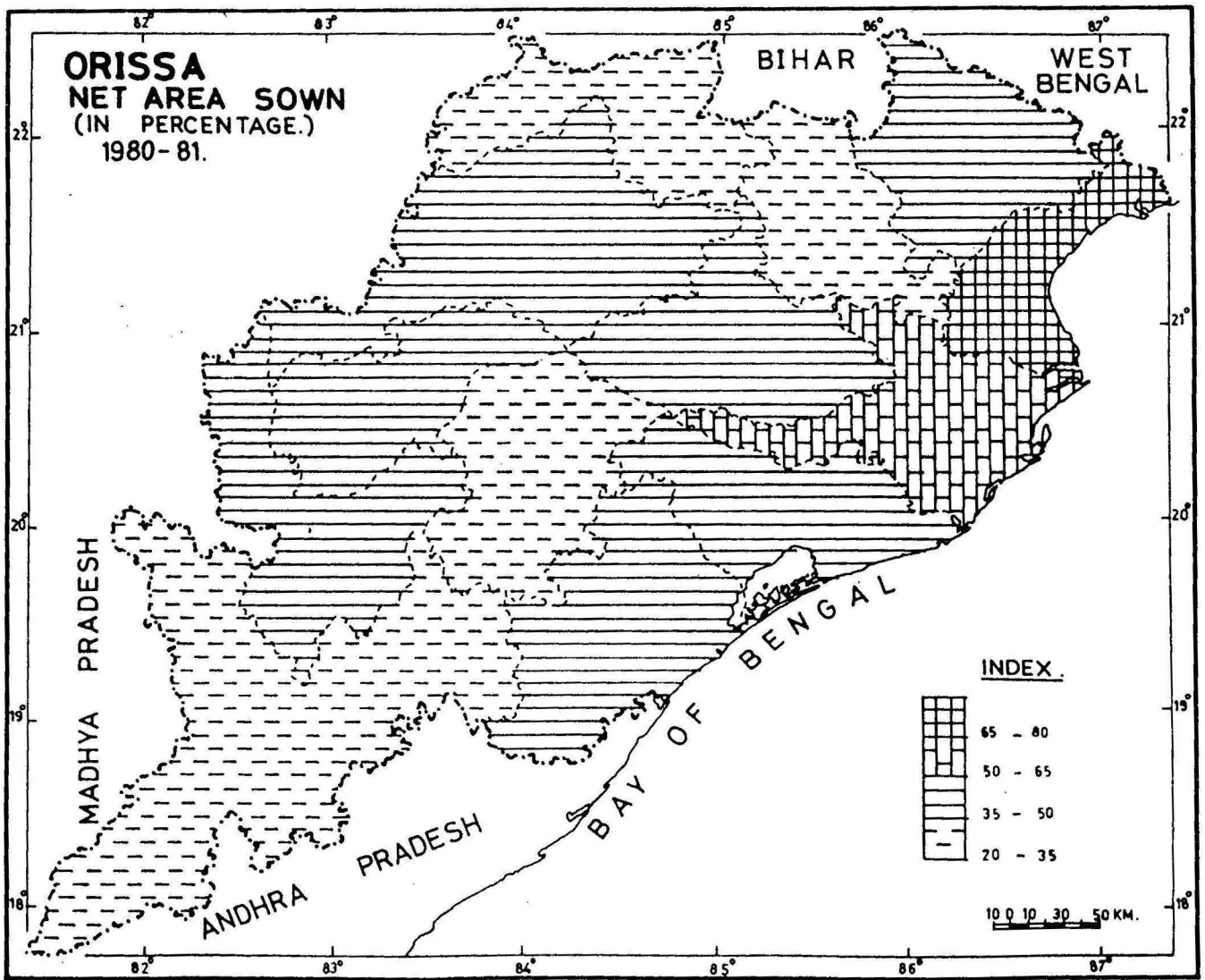

ORISSA
NET AREA SOWN
(IN PERCENTAGE.)
1980-81.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
65 - 80
50 - 65
35 - 50
20 - 35
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.-4.2

area under cultivation. The districts of Phulbani and Sundergarh with a net sown area lower than 30 per cent of the total reported area were the districts with lowest proportion of area under cultivation. Of the remaining districts only Puri, Sambalpur and Mayurbhanj had more than the average state percentage of net sown area (37.24%) while the districts of Kalahandi, Keonjhar, Koraput and Ganjam had only between 30 to 32 per cent of their total area under cultivation.

An analysis of the distribution of thenet sown area during 1972-73 and 1980-81 shows the highest concentration of net sown area occurring in the coastal districts of Balasore, Cuttack and Puri followed by Bolangir while the districts with lowest percentage of net sown area being confined to the mountainous tracts of Keonjhar, Koraput, Sundargarh, and Phulbani. The rest of the districts had a figure in between these two extremes.

The trend of growth of the net sown area during 1960-61 and 1980-81 when analysed brings out the following conclusions :

1] Orissa as a whole had experienced a negetive growth in the net area sown during 1960-61 and 1972-73.

2] The districts suffering such a reduction in their net sown area were Sambalpur, Bolangir, Sundargarh, Koraput, Phulbani and Balasore (Table 4.1).

3] The only districts with an increase in their net sown area were Ganjam, Puri, Kalahandi Dhenkanal and Mayurbhanj.

4] The period between 1972-73 and 1980-81 witnessed a revival in the agricultural economy of Orissa with a positive growth in the net sown area equivallent to 9.04 per cent.

5] During this period every district except Cuttack experienced a positive growth while Dhenkanal experienced no growth at all.

6] The growth rate was highest for the districts of Phulbani (26.23%) and Koraput (20.03%) followed by Puri (19.23%), Keonjhar (18.67%) Kalahandi (16.21%) Ganjam (12.61%) as well as Sambalpur (9.31%) all of which had a growth rate higher than the state average (9.04%).

4.3 *AREA SOWN MORE THAN ONCE*

The state has experienced a remarkable growth in the area sown more than once. As it can be marked from Table 4.2 the area sown more than once has increased by almost seven fold from its mediocore position of 6.04 per cent of the net sown area during 1960-61 to 42.68 per cent during 1980-81. As regards the distribution of the area sown more than once during 1980-81, it roughly coincides with the distribution of irrigated lands of the same year (Fig. 4.3, a and b) Infact, these two aspects e.g. irrigated area and area sown more than once can be said to be

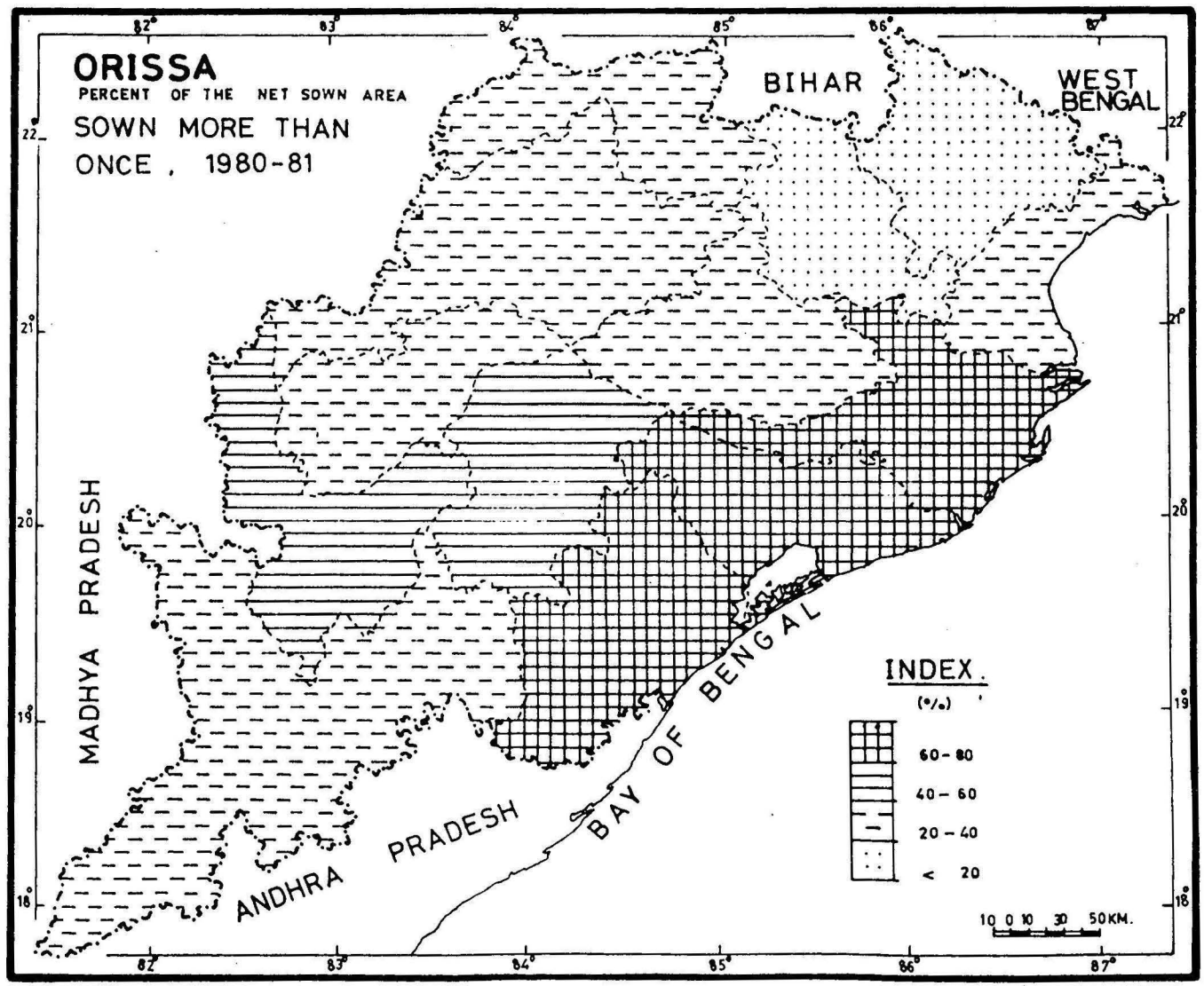

ORISSA
PERCENT OF THE NET SOWN AREA
SOWN MORE THAN ONCE, 1980-81
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX
(%)
60 - 80
40 - 60
20 - 40
< 20
10 0 10 30 50KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

Fig.4.3 (a)

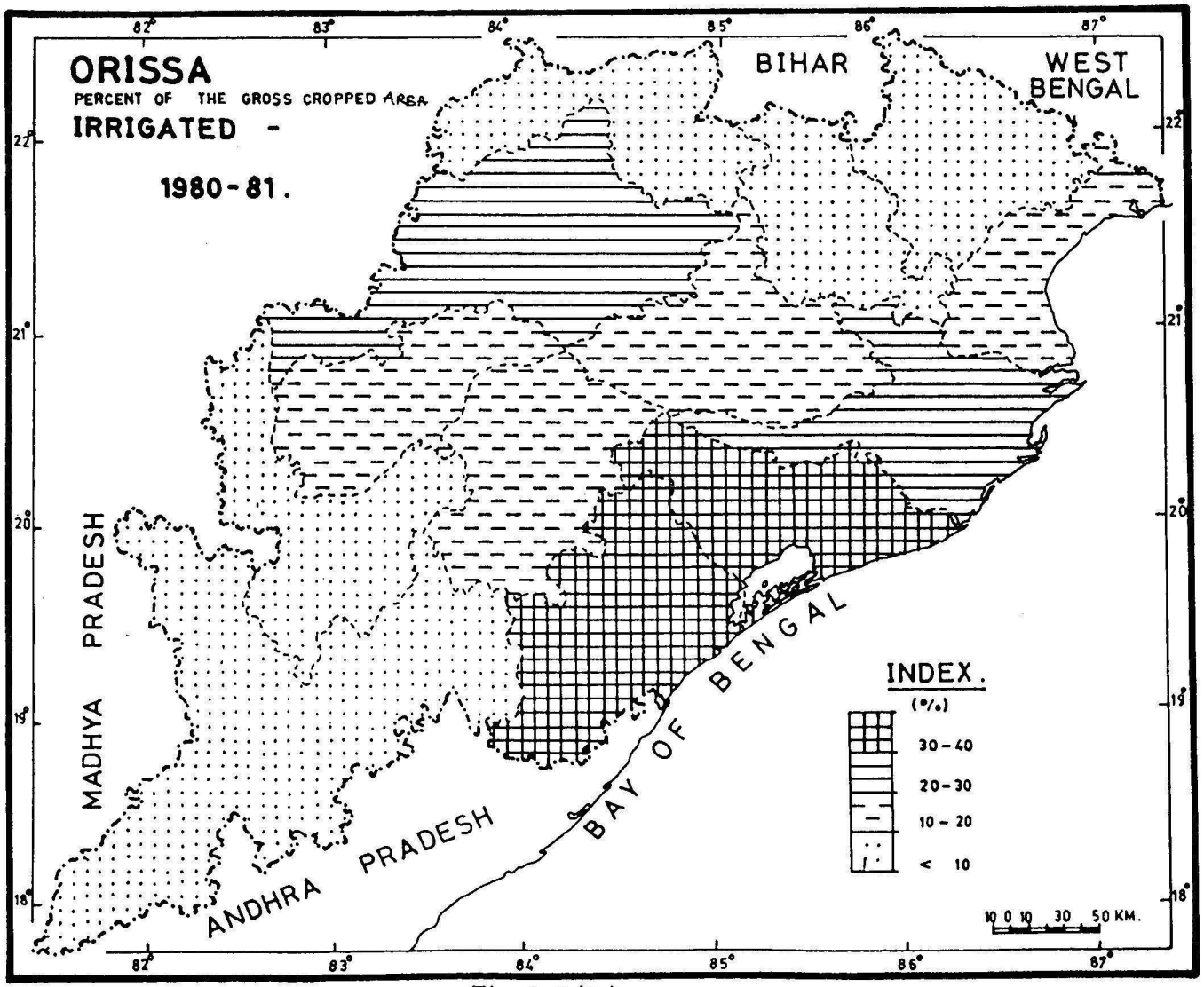

ORISSA
PERCENT OF THE GROSS CROPPED AREA
IRRIGATED -
1980-81.
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
(%)
30-40
20-30
10-20
< 10
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

Fig. 4.3 (b)

positively correlated. As the Fig. 4.3(a) shows during 1980-81 the districts with highest percentage of area sown more than once were Cuttack, Puri and Ganjam with more than 70 per cent of their net sown area being sown more than once. The other districts with a figure higher than the state average (42.68%) were Kalahandi and Phulbani while the rest of the districts had a figure below the state average. The districts with lowest percentage of area sown more than once were Mayurbhanj, Keonjhar and Sundergarh with less than 25 per cent of their net sown area sown more than once.

TABLE - 4.2

PATTERN OF DISTRIBUTION OF AREA SOWN MORE THAN ONCE IN ORISSA DURING 1961-81

DISTRICTS/ STATE	PERCENT OF THE NET SOWN AREA BEING SOWN MORE THAN ONCE		
	1960-61	1972-73	1980-81
Balasore	2.96	14.46	35.32
Bolangir	7.30	20.21	32.78
Cuttack	12.52	43.00	76.04
Dhankanal	2.12	19.80	31.08
Ganjam	3.37	47.07	70.00
Kalahandi	2.23	24.89	48.72
Keonjhar	2.72	9.54	19.23
Koraput	2.90	6.40	27.23
Mayurbhanj	4.31	10.86	18.66
Phulbani	1.53	15.30	45.89
Puri	15.81	40.60	71.91
Sambalpur	9.72	20.39	30.55
Sundargarh	1.41	10.89	24.09
ORISSA	6.05	23.37	42.68

As it can be marked from the Table 4.2 during 1960-61 only four districts e.g. Puri, Cuttack, Sambalpur, and Bolangir had

the highest proportion of area. Sown more than once with a value higher than the state average (6.05%). Similarly during 1972-73 the concentration of area sown more than once was highest in the districts of Ganjam, Cuttack, Puri and Kalahandi which had more than the state's average area sown more than once (23.37%). The districts with lowest proportion of area sown more than once were Sundargarh, Phulbani, Dhenkanal, Kalahandi, Keonjhar, Koraput and Mayurbhanj during 1960-61 with less than 5 per cent of their net sown area being sown more than once. Similarly during 1972-73 the districts with lowest proportion of area sown more than once were Koraput (6.40%) and Keonjhar (9.54%) followed by Mayurbhanj (10.86%) Sundargarh (10.89%) and Balasore (14.46%).

As regards the growth during 1961-73 it can be said that the state witnessed a complete transformation in the field of area sown more than once and the State itself experienced an almost four fold leap forward. This may be due to the increased and assured water supplies. However, the growth during 1973 and 1981 was some what of lesser magnitude as compared to that of 1961-73. Such a behaviour can be explained by the fact that where as during 1961-73 there was a fall in the net sown area of the state, the period between 1973 and 1981 was marked by an increase in the said aspect thus contributing to the variability in the rate of growth.

4.4 GROSS CROPPED AREA

It includes the net sown area and area sown more than once thus :

GCA = NSA + Area sown more than once

Table - 4.3 reveals the pattern of distribution and growth of the gross cropped area (GCA) of the state during 1960-61 and 1980-81.

TABLE - 4.3

PATTERN OF DISTRIBUTION AND GROWTH OF GROSS CROPPED AREA IN ORISSA 1961-81

DISTRICTS/ STATE	GCA AS PER CENT OF THE TOTAL REPORTED AREA			PER CENT OF GROWTH	
	1960-61	1972-73	1980-81	1961-73	1973-81
Balasore	69.86	73.42	91.19	5.09	24.21
Bolangir	54.93	52.55	62.85	-4.33	19.61
Cuttack	68.50	92.84	112.67	35.52	21.36
Dhenkanal	35.44	43.86	47.89	23.77	9.19
Ganjam	32.62	53.52	69.67	64.07	30.17
Kalahandi	31.62	47.24	65.37	32.45	38.39
Keonjhar	31.77	31.77	41.03	0	29.17
Koraput	32.03	28.31	40.63	-6.48	43.53
Mayurbhanj	39.42	42.12	47.69	6.83	13.24
Phulbani	18.03	19.11	30.52	6.03	59.72
Puri	47.51	63.00	78.39	32.33	24.43
Sambalpur	44.54	39.17	46.42	-12.07	18.54
Sundargarh	29.42	29.11	34.73	- 1.05	19.30
ORISSA	39.49	44.63	56.28	13.02	26.10

Following facts can be marked from the above table :

1] Though there is a consistent growth in the gross cropped area from 1960-61 to 1980-81 for the state as a whole the

rate of growth is not identical between the two periods It was only 13.02 per cent for the period between 1960-61 and 1972-73 when the gross cropped area of the state increased from 39.49 per cent to 44.63 per cent. Similarly the period between 1972-73 and 1980-81 experienced a higher rate of growth amounting to 26.10 per cent, as the gross cropped area of the state increased from its 1972-73 value of 44.63 per cent to 56.28 per cent during 1980-81.

2] The growth rate was not equal for all the districts. Though most of the districts had experienced a positive growth rate during 1961-73 there were districts like Bolangir, Koraput, Sambalpur and Sundargarh which had reduced their gross cropped area while Keonjhar experienced no growth at all. The highest positive growth or increase in the gross cropped area was experienced in the districts of Ganjam (64.07%) followed by Cuttack (35.52%) Kalahandi (32.45%) and Puri (32.33%) Similarly during 1972-73 and 1980-81 though all the districts had increased their gross cropped area this was highest for the districts of Phulbani (59.72%) Koraput (43.53%) Kalahandi (38.39%) Ganjam (30.17%) and Keonjhar (29.17%). The lowest growth rate was associated with the districts of Dhenkanal and Mayurbhanj with a growth rate less than 15 per cent.

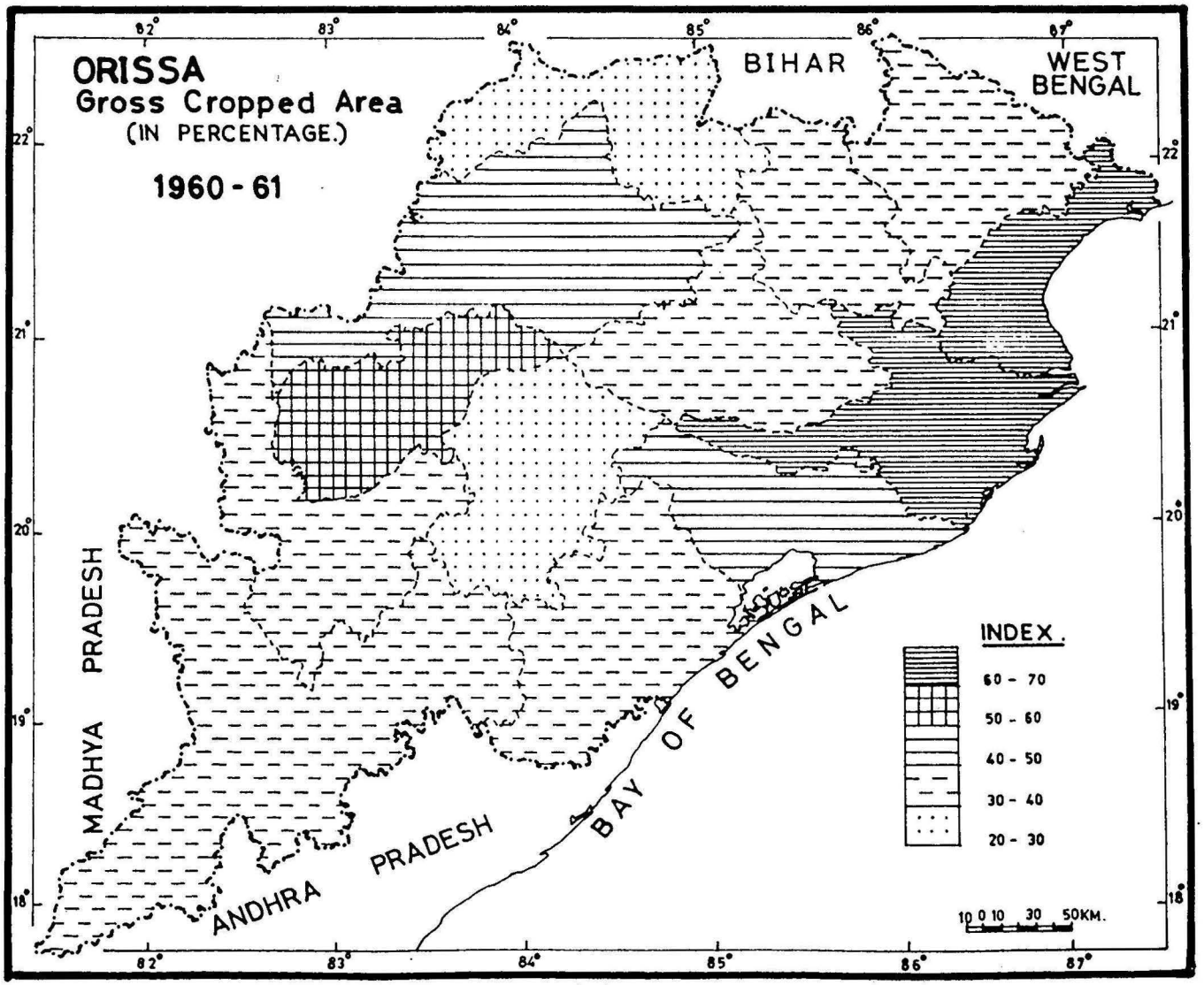

ORISSA
Gross Cropped Area
(IN PERCENTAGE.)
1960 - 61
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
60 - 70
50 - 60
40 - 50
30 - 40
20 - 30
10 0 10 30 50KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 4.4

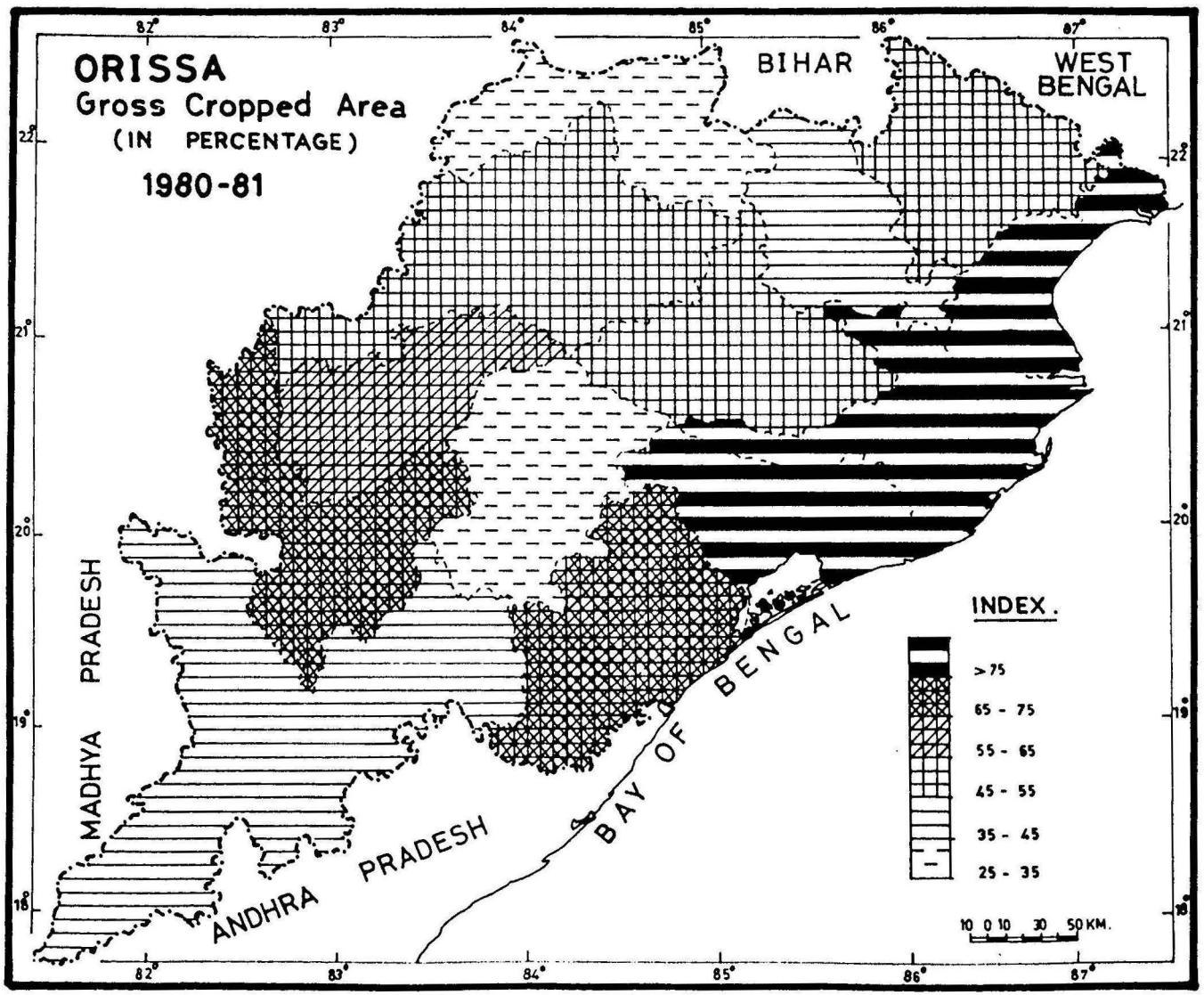

ORISSA
Gross Cropped Area
(IN PERCENTAGE)
1980-81
BIHAR
WEST BENGAL
MADHYA PRADESH
ANDHRA PRADESH
BAY OF BENGAL
INDEX.
>75
65 - 75
55 - 65
45 - 55
35 - 45
25 - 35
10 0 10 30 50 KM.
82°
83°
84°
85°
86°
87°
22°
21°
20°
19°
18°

FIG.- 4.5

3] As far as the distribution of the gross cropped area is concerned it can be marked from the Fig. 4.4 that during 1960-61 the districts with highest concentration of gro-s cropped area were Balasore and Cuttack having more than 70 per cent of their total reported area under crop followed by Bolangir, Puri and Sambalpur while the districts with lowest proportion of gross cropped area were Phulbani and Sundargarh (less than 30 per cent). The distribution is more or less similar during 1972-73 and 198-81. Thus during 1980-81 the districts with highest concentration of gross cropped area were Cuttack, Balasore and Puri (More than 75%) followed by Ganjam and Kalahandi (65 to 75%) while the lowest concentration were confined to the districts of Phulbani and Sundargarh (less than 35%) Preceeded by Koraput and Keonjhar (35 to 45%) (Fig. 4.5).

Such a diversity in the prevailing pattern of distribution as well as the differential rate of growth among the districts can be attributed to the variations in the distribution and growth of the net sown area and area sown more than once which are governed by the variations in the physiographical, climatic, as well as infra-structural elements. Thus, lowest concentration of the gross cropped area are associated with the hilly mountanius and Plateau lands of Phulbani, Koraput, Sundargarh and Keonjhar districts while the highest concentrations occur in the coastal districts of Cuttack,

Puri and Balasore. Similarly the concentration of gross cropped area is highest in the districts like Cuttack, Puri and Ganjam where the irrigation is highly developed, as compared to the districts of Keonjhar, Koraput,Kalahandi, Sundargarh, Mayurbhanj and Phulbani. The differential growth rates between the two periods (i.e. 1961-73 and 1973-81) can be similarly attributed to the prevailing climatic viscitudes. The comparitively lower growth rate during 1961-73 may be due to the prevailing drought conditions during 1965-66, 1966-67 and 1971-72 along with the Cyclonic devastations of 1967, 1968 and 1971. The years 1965-66 saw the worst drought which severely affected the rural economy almost in all districts and in particular of Kalahandi, Bolangir,Sambalpur, Sundargarh and Dhenkanal. Drought continued also in 1966-67 though with lesser severity. (Govt. of Orissa, Bureau of Economics and Statistics, 1971; 38). Similarly cyclones caused large scale devastations in the coastal districts of Balasore, Cuttack and Puri during 1967 and Ganjam, Cuttack and Puri during 1968. While the affected districts of 1971 cyclone were Balasore, Cuttack, Dhenkanal, Keonjhar, Mayurbhanj and Puri (Govt. of Orissa, Bureau of Economics and Statistics, 1971; 4).

The state also experienced severe drought conditions during 1974-77 and 1979-80 (Govt. of Orissa, Bureau of Economics and Statistics, 1981; 21). Also the year 1980-81 witnessed one of the worst floods after 1955 (Govt. of Orissa, Bureau of Economics and Statistics, 1981; 11). All these factors along with the increase

in population should be considered while analysing the general pattern of growth and distribution of gross cropped area in general and the agricultural characteristics of the state in particular.

4.5 CROPPING INTENSITY

The intensity of cropping implies the degree of cropping or the number of crops grown in the same plot during one agricultural year. It is an indicator of how intensively a plot of agricultural land is being utilised. Theindex of cropping intensity was calculated with the help of the foloowing formula :

$$I = \frac{\text{Total Cropped Area}}{\text{Net Sown Area}} \times 100$$

where I = intensity Index.

This formula of cropping intensity simply brings out the fact that in case only one crop is grown during the whole agricultural year the intensity of cropping will be one and the index number of crop intensity will be 100 per cent. However, if within one agricultural year on a plot of land if more than one crops are being grown then the index of cropping intensity will increase from its base value of 100 per cent. Thus in this way the index number of crop intensity increases with the increase in the area sown more than once. "Land use is intensified when

either the area under irrigation or cropped more than once or both increases, and because of the inter relationship of these two factors,cropping intensity is bound to increase". (Sharma, 1978; 85). The data becomes very useful because it shows the cropping pattern and productive capacity of the land as well as because it throws light on the possibilities or otherwise of intensification of agriculture, enhancing of production through expansion and double cropping.

Table - 4.4 presents the general picture of distribution and pattern of growth in the intensity of cropping in Orissa during 1960-61 and 1980-81.

TABLE - 4.4

INTENSITY OF CROPPING INDEX OF ORISSA

DISTRICTS/ STATE	INDEX OF CROPPING INTENSITY IN PERCENTAGE			PER CENT OF GROWTH	
	1960-61	1973-73	1980-81	1961-73	1973-81
Balasore	102.96	114.46	135.32	11.17	18.22
Bolangir	107.30	120.21	132.78	12.03	10.46
Cuttack	112.52	143.00	176.04	27.09	23.10
Dhenkanal	102.38	120.05	131.08	17.26	9.19
Ganjam	103.11	147.07	170.00	42.63	15.59
Kalahandi	102.23	124.89	150.20	22.17	20.27
Keonjhar	102.72	109.54	119.23	6.64	8.85
Koraput	103.02	106.40	127.23	3.28	19.58
Mayurbhanj	104.06	110.61	118.66	6.29	7.28
Phulbani	101.53	115.30	145.88	13.56	26.52
Puri	115.81	140.81	171.91	21.59	22.09
Sambalpur	109.72	120.39	130.55	9.72	8.44
Sundargarh	101.41	110.89	124.09	9.35	11.90
ORISSA	106.05	123.37	142.68	16.33	15.65

The analysis of the Table 4.4 brings out the following facts :

a] The cropping intensity has been growing since 1960-61 although not uniformly all over the state.During 1960-61 the state has an average cropping intensity index of 106.05 per cent which increased upto 123.37 per cent during 1972-73 and further upto 142.68 per cent during 1980-81.

b] The over all growth rate is,however, very marginal amounting only to 16.33 per cent during 1961-73 and 15.65 per cent during 1973-81.

c] Maximum intensification during 1961-73 occurred in the districts of Ganjam (42.63%) Cuttack (27.09%) Kalahandi (22.17%) and Puri (21.59%) followed by Dhenkanal (17.26%) all of which recorded a growth rate more than the state's average growth rate. While the lowest intensification of cropping was confined to the districts of Koraput (3.28%), Mayurbhanj (6.29%), Keonjhar (6.64%), Sundargarh (9.35%) and Sambalpur (9.72%). Rest of the districts had a growth rate that is lower than the state average varrying between 10 to 15 per cent.

d] During 1973-81 the highest growth in the cropping intensity was recorded in the districts of Phulbani (26.52%), Cuttack (23.10%), Puri (22.09%) and Kalahandi (22.27%) followed by

Koraput (19.58%), and Balasore (18.22%) all of which had a growth rate greater than the State's average growth rate (15.65%). Similarly, the districts characterised by lowest rate of growth were Mayurbhanj (7.28%), Sambalpur (8.44%) Keonjhar (8.85%) and Dhenkanal (8.19%). The rest of the districts had a growth rate ranging between 10 to 16 per cent but lower than the state average.

e] Fig. 4.6 as well as Table 4.4 also clearly reflect the general pattern of the distribution of cropping intensity in Orissa. A look at the Fig. 4.6(a) will bring out the fact that during 1960-61 the highest intensity of cropping was confined to the districts of Puri and Cuttack with an index value greater than 110 per cent followed by Sambalpur and Bolangir all of which had an index value greater than the state's average index value (106.05%)

The rest of the districts had an intensity of cropping index value that is smaller than the state's average. The pattern of distribution during 1972-73 as reflected by Fig. 4.6(b) is characterised by one remarkable. Change i.e. the emergence of Ganjam as the district with highest cropping intensity followed by Cuttack and Puri. The rest of the districts except for Kalahandi (124.89%) had an Index of cropping Intensity value less than the

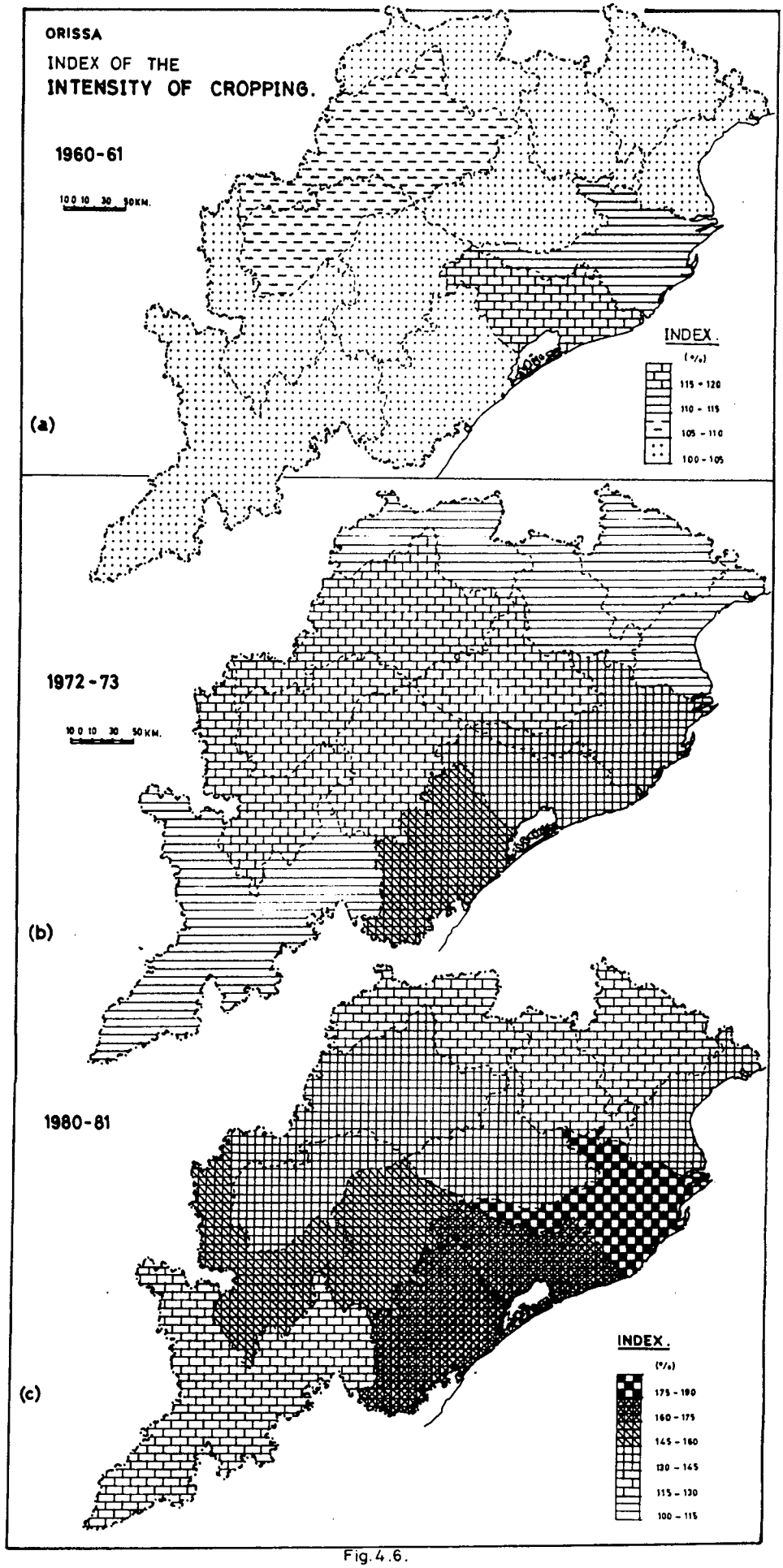

ORISSA
INDEX OF THE
INTENSITY OF CROPPING.
1960-61
100 0 10 30 50KM.
INDEX.
(%)
115 - 120
110 - 115
105 - 110
100 - 105
(a)
1972-73
100 0 10 30 50 KM.
(b)
1980-81
INDEX.
(%)
175 - 190
160 - 175
145 - 160
130 - 145
115 - 130
100 - 115
(c)

Fig. 4.6.

state average (123.37%) ranging between 115 to 124 per cent.

During 1980-81 another interesting pattern with can be marked, with Cuttack (176.04%) taking over the leadership in regards of cropping intensity followed by Ganjam and Puri (160-175%) (Fig. 4.6(c)) the other districts with an index value greater than the State's average index value (142.68%) were Kalahandi and Phulbani while the rest of the districts were still below the state's average cropping intensity index.

The above analysis only reiterates the role of physiography and population in shaping the agricultural scenario of a region. It can be marked from the above analysis that the coastal districts with their fertile plain lands had the highest cropping intensity index followed by the lands of central river basins while the districts characterised by the Mountainous and Plateaulands had the lowest cropping intensity index. However the role of irrigation should not be forgotten altogather and also the pressure of population demanding more and more food and hence an intensification of cropping.

4.6 *MAJOR CROPS AND THEIR DISTRIBUTION*

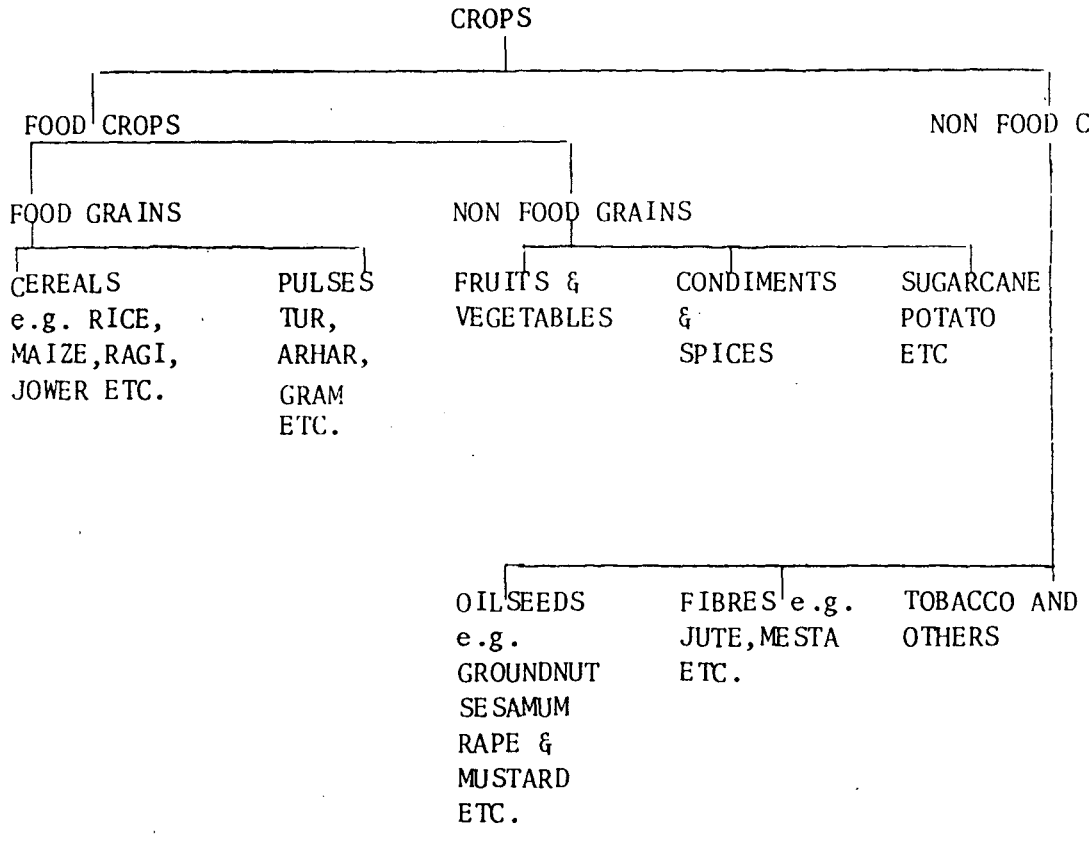
The gamut of crops being grown in Orissa can be subdevided into two main categories e.g.

1] Food crops which can be further subdevided into

a] Food Grains which includes (i) Cereals like Rice, Maize, Ragi, Jower etc and (ii) Pulses like gram , Tur etc. and

b] Non Food grains like fruits and vegetables, condiments and spices like chillies, ginger etc. as well as crops like sugarcane, potato, etc.

2] Non Food Crops include the oilseeds, Fibres, Tobacco and other cash crops if any.



While analysing the pattern of distribution of different crops the crops were analysed on the basis of their Concentration as reflected by the percentage of gross cropped area they occupy and not by the extent of actual area as the former provides a better picture of the relative position and hence the importance of a crop in an areal unit. Also, the crops occupying atleast one

per cent of the gross cropped area of the state during 1980-81 were considered as the major crops and were discussed vividely.

TABLE - 4.5

DISTRIBUTION OF THE DIFFERENT TYPES OF CROPS GROWN IN ORISSA, 1961-81

YEAR	PER CENT OF GROSS CROPPED AREA UNDER -							
	[1] FOOD CROPS				TOTAL FOOD CROPS	[2] NON-FOOD CROPS		TOTAL NON-FOOD CROPS
	(a) FOOD GRAINS			(b) NON FOOD GRAINS		OIL SEEDS	FIBRES	
	CERALS	PULSES	TOTAL					
1960-61	64.19	8.04	72.23	23.45	95.68	3.34	0.91	4.32
1972-73	71.72	13.55	85.28	7.85	93.13	5.57	1.09	6.87
1980-81	59.26	19.73	78.99	11.21	90.02	8.42	1.14	9.80

As Table 4.5 illustrates, the agricultural land utilization pattern of Orissa is dominated by the overwhelming cultivation of food crops which accounts for more than 90 per cent of the total cropped area. Infact the area under non food crops was only 4.32 per cent during 1960-61, 6.87 per cent during 1972-73 and 9.80 per cent during 1980-81. An interesting trend can be observed from the table that there has been a continuous decrease in the area under food crops over the year in contrast to the increase in the area under non-food crops.

Another remarkable feature can also be marked from the above table i.e. the dominance of food grains over non-food grains

in the broad category of food crops and oilseeds over all other types of non-food crops. Again, within the food grain category of crops, cereals occupy the highest proportion of area as compared to other types of food grains. All these features can be interpreated as characteristics of a still subsistence type of agriculture.

Regarding the distribution of the principal crops and their relative positions in a particular period of time, Table 4.6 presents a greatly simplified picture.

TABLE - 4.6

CROPS OF ORISSA, 1961-81

YEAR →	1960-61		1972-73		1980-81	
CROPS ↓	PER CENT OF THE GCA OCCUPIED	RANK	PERCENT OF THE GCA OCCUPIED	RANK	PER CENT OF THE GCA OCCUPIED	RANK
Rice	61.68	1	64.53	1	47.92	1
Maize	00.36	9	01.12	6	02.07	4
Ragi	01.08	3	02.42	3	03.85	3
Wheat	00.11	13	00.74	8	00.77	10
Small Millet	00.76	4	02.57	2	04.14	2
Gram	00.33	11	00.38	13	00.57	11
Tur	00.23	12	00.73	9	00.94	8
Groundnut	00.39	8	01.24	5	01.97	5
Sesamum	01.51	2	01.74	4	01.79	7
Rape & Mustard	00.74	5	00.94	7	01.85	6
Castor	00.34	10	00.38	13	00.50	13
Jute	00.66	6	00.60	10	00.50	13
Sugarcane	00.42	7	00.44	12	00.56	12
Chillies	00.11	13	00.55	11	00.87	9

(a) RICE :

Rice is the single most dominant crop of the state as well as of all the districts. During 1960-61 the area under rice in the state was as high as 61.68 per cent of the total cropped area. The share of rice during 1972-73 was still higher with 64.53 per cent of the gross cropped area being utilised for this crop. However, during 1980-81 it was much lower amounting only to 47.92 per cent of the gross cropped area but still was the first ranking crop of all the districts. As it can be marked from the Table 4.7 winter rice is the most dominant category being cropped, followed by Autumn and Summer rice.

TABLE - 4.7

DIFFERENT CATEGORIES OF RICE & THE AREA THEY OCCUPY

YEAR	AREA (IN HECTARES) UNDER -		
	i.AUTUMN RICE	ii. WINTER RICE	iii. SUMMER RICE
1960-61	384,000	3,382,000	19,159
1972-73	769,000	3,524,000	182,840
1980-81	865,000	3,154,000	171,710

As it can be marked from the Fig. 4.7(a) during 1960-61 the districts having highest proportion of area under rice were Balasore, Puri and Sundargarh with more than 70 per cent of their gross cropped area under rice cultivation. The districts with lowest percentage of gross cropped area under rice during this period

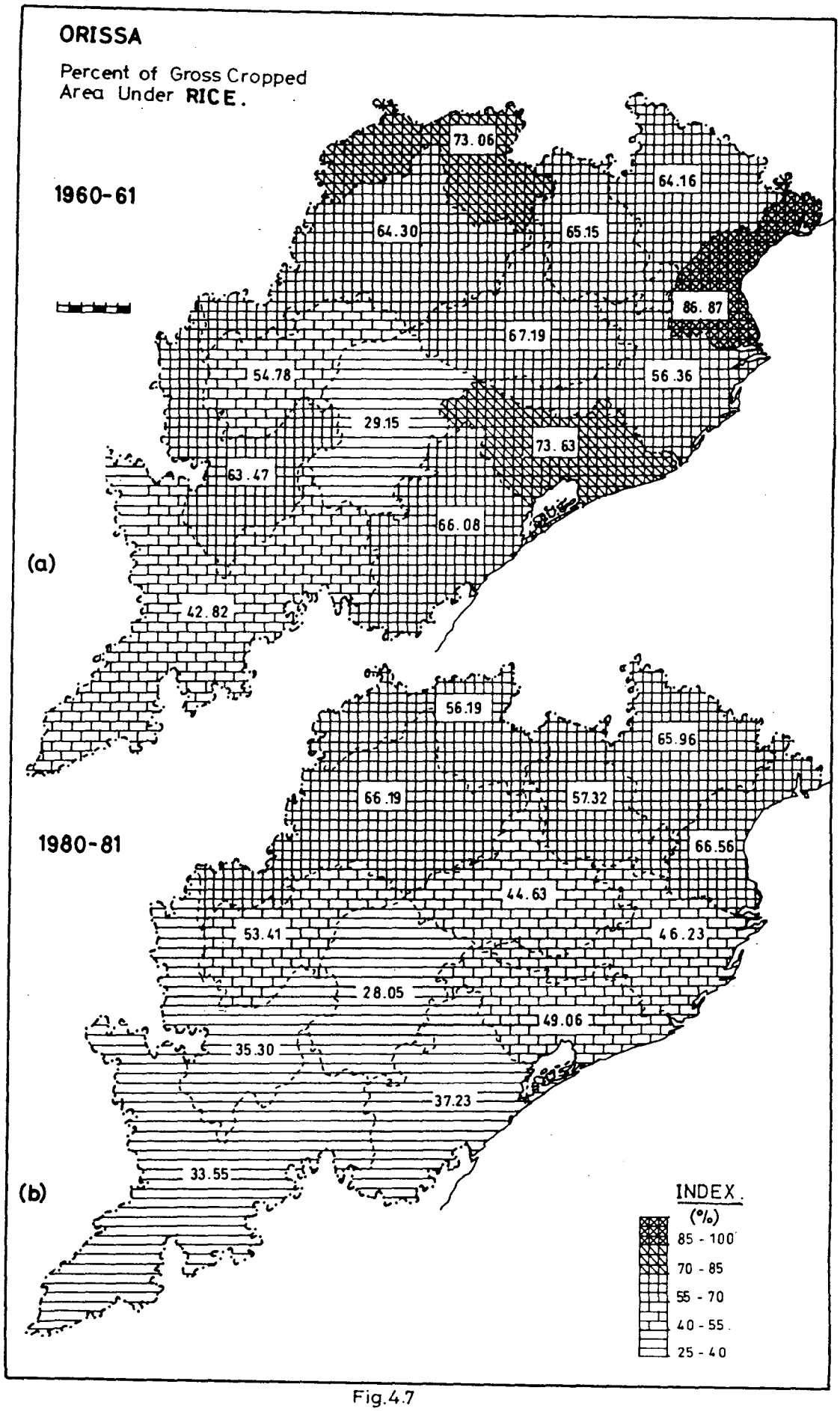

ORISSA
Percent of Gross Cropped Area Under RICE.
1960-61
73.06
64.16
64.30
65.15
86.87
67.19
54.78
56.36
29.15
73.63
63.47
66.08
(a)
42.82
56.19
65.96
66.19
57.32
1980-81
66.56
44.63
53.41
46.23
28.05
49.06
35.30
37.23
33.55
(b)
INDEX.
(%)
85 - 100
70 - 85
55 - 70
40 - 55
25 - 40

Fig.4.7

were Phulbani and Koraput with less than 50 per cent of their gross cropped area under rice. Infact, Phulbani had only 29.15 per cent of its total cropped area under rice during 1960-61.

The year 1972-73 witnessed an overall increase in the area under rice when every district except Balasore, Dhenkanal, Ganjam, Kalahandi and Sundargarh increased their area under rice. The districts with highest proportion of area under rice during this period were Balasore, Sambalpur and Mayurbhanj with more than 75 per cent of their total cropped area under rice, closely followed by Keonjhar (70.39%) and Sundargarh (72.94%). The lowest acrage under rice were confined to the districts of Phulbani, and Kalahandi which had less than 50 per cent of their total cropped area under rice.

During 1980-81 as it can be marked from Fig. 4.7(b) the districts with highest proportion of the total cropped area under rice were Balasore, Sambalpur and Mayurbanj with more than 60 per cent of their total cropped area under rice. The districts with lowest proportion of their gross croppe area under rice were Phulbani, Koraput, Kalahandi and Ganjam with less than 40 per cent of gross cropped land under rice. As rice is predominantly a crop cultivated with assured water supply, such spatial and temporal variation can be attributed to the variations in the rainfall and irrigation as well as other infrastructural differences.

(b) MAIZE :

During 1980-81 Maize had occupied fourth position among the crops in terms of per cent of the gross cropped area occupied. This was amounting to 2.07 per cent of the total cropped land. The districts with highest proportion of their gross cropped area under Maize cultivation were Phulbani, Keonjhar and Koraput with more than 5 per cent of the gross cropped area under maize cultivation, while, the lowest acreage under Maize was in the districts of Balasore, Cuttack and Sambalpur with less than one per cent of their total cropped lands under Maize. The pattern of distribution was also more or less similar during 1960-61 and 1972-73 as can be marked from the Table 4.8.

TABLE - 4.8

MAJOR MAIZE PRODUCING AREAS OF ORISSA, 1961-81

PER CENT OF GCA UNDER MAIZE	PRODUCING AREAS		
	1960-61	1972-73	1980-81
Less than 0.5 per cent	Balasore, Sambalpur, Ganjam, Balangir, Cuttack, Puri, Mayurbhanj, Keonjhar Kalahandi	Balasore, Cuttack, Sambalpur, Puri, Ganjam	Balasore, Cuttack, Sambalpur
0.5 to 1 per cent	Dhenkanal, Koraput Sundargarh	Bolangir, Dhenkanal Sundargarh	
1 to 2.5 per cent	Phulbani	Kalahandi Mayurbhanj	Bolangir, Ganjam, Mayurbhanj, Puri, Sundargarh
More than 2.5 per cent		Keonjhar, Koraput, Phulbani	Dhenkanal, Kalahandi, Keonjhar, Koraput, Phulbani

(c) RAGI :

Ragi is the third important crop of the state in terms of the percentage of gross cropped area under it. Infact, it has occupied the same position during 1960-61 and 1972-73 as during 1980-81. The districts with the highest percentage of their gross cropped area under ragi during 1980-81 were Koraput (11.28%) Ganjam (8.89%), and Phulbani (6.09%) while the districts with lowest proportion of their gross cropped land under Ragi during this period were Sambalpur (0.19%) and Mayurbhanj (0.28%) as well as Balasore which had only a very negligible area (10 hectares) under it. This pattern of distribution was almost similar to the distribution during 1972-73. However, during 1960-61 Ganjam was the district with highest proportion of its gross cropped area (5.44%) under Ragi cultivation followed by Kalahandi (3.30%), while, the districts with no ragi cultivation were Balasore, Keonjhar, Mayurbhanj and Sambalpur along with a very low proportion of area (less than one per cent of the Gross Cropped Area) devoted towards ragi cultivation in the districts of Sundargarh, Dhenkanal, Cuttack and Phulbani.

(d) SMALL MILLETS :

During 1980-81 as well as during 1972-73 small millets were the second important crop of Orissa after rice with 4.14 and 2.57 per cent of the gross cropped area under it during the respective years. However, during 1960-61 it was the fourth important crop of the state with 0.76 per cent of the total cropped area of the state

under it. All these show the increasing cultivation of small millets in the state. Table 4.9 presents the pattern of the distribution of small millets during different years in Orissa.

TABLE - 4.9

DISTRIBUTION OF SMALL MILLETS IN ORISSA, 1961-81

PER CENT OF GROSS CROPPED AREA UNDER SMALL MILLETS	PRODUCING AREAS		
	1960-61	1972-73	1980-81
Less than 1 per cent	Dhenkanal, Koraput Cuttack, Ganjam, Mayurbhanj	Balasore	Balasore, Cuttack, Puri
1 - 3 per cent	Sambalpur	Dhenkanal, Ganjam, Keonjhar, Mayurbhanj, Sambalpur, Sundargarh	Ganjam, Keonjhar, Mayurbhanj
3-5 per cent	Bolangir		Sambalpur
5 - 7 per cent		Bolangir, Koraput, phulbani	Dhenkanal, Phulbani, Bolangir
More than 7 per cent	Phulbani	Kalahandi	Kalahandi, Koraput

As the above table reflects, the highest proportion of gross cropped area under millets during 1980-81 and 1972-73 were confined to the districts of Kalahandi and Koraput while during 1960-61 Phulbani had the highest proportion of area under mi-lets. The districts with lowest proportion of total cropped area under millets during 1980-81 were Balasore, Cuttack and Puri while in Sundargarh no millets were grown during this period. Similarly,

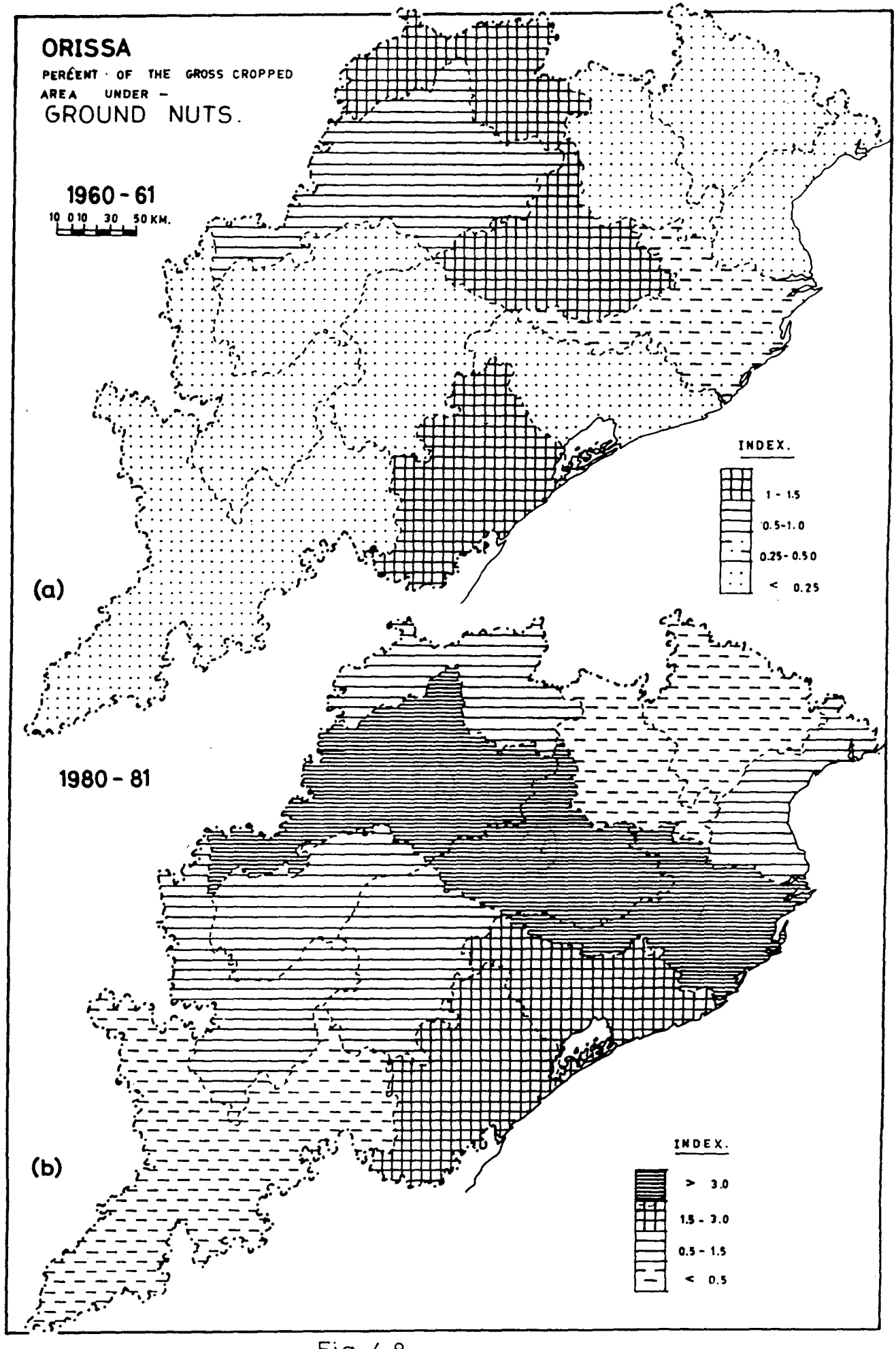

ORISSA
PERCENT OF THE GROSS CROPPED AREA UNDER -
GROUND NUTS.
1960 - 61
10 0 10 30 50 KM.
INDEX.
1 - 1.5
0.5 - 1.0
0.25 - 0.50
< 0.25
(a)
1980 - 81
INDEX.
> 3.0
1.5 - 3.0
0.5 - 1.5
< 0.5
(b)

Fig. 4.8.

during 1960-61 these were as many as four districts viz. Balasore, Kalahandi, Keonjhar and Sundargarh not producing millets.

(e) GROUND NUT :

Fig. 4.8 shows the distribution of ground nut producing areas of the state. As it can be marked from Fig. 4.8(a) during 1960-61 the major groundnut producing districts were Dhenkanal, Sundargarh and Ganjam having more than one per cent of their gross cropped area under groundnuts while the districts with lowest proportion of area under groundnuts being Balasore, Phulbani, Keonjhar, Puri, Koraput, Kalahandi and Mayurbhanj with less than 0.15 per cent of their gross cropped area under ground nuts. However, there has been a steady increase in the area under groundnuts and by 1980-81 every districts except Kalahandi, Keonjhar, Koraput, Mayurbhanj, Phulbani and Sundargarh had more than one per cent of their gross cropped area under groundnuts. It can be marked from Fig. 4.8(b) that during 1980-81 highest proportion of area under ground nuts were confined to the districts of Cuttack (5.27%), Dhenkanal (3.18%), and Sambalpur district (3.11%) followed by Ganjam (2.44%) and P¶ri (1.74%) districts.

(f) SESAMUM :

An analysis of the pattern of the distribution of sesamum in the districts of Orissa during 1960-61 and 1980-81 brings out the following features :

1] During 1960-61 highest proportion of area under sesamum were confined to the districts of Bolangir (5.59%) and Kalahandi (4.16%) followed by Dhenkanal (2.23%) Phulbani (1.87%), Sundargarh (1.97%) and Sambalpur (1.30%) while during 1980-81 the districts with highest proportion of areaunder sesamum were Dhenkanal (4.89%), Phulbani (3.40%) and Ganjam (2.76%) followed by Bolangir (2.65%).

2] Another interesting feature emerges from the analysis There is a decrease in the area under sesamum in the districts which had highest proportion of lands under it during 1960-61. Thus by 1980-81 Bolangir had only 2.65% of its total cropped area under Sesamum. So also the case of Kalahandi which reduced its area under seasamum from 4.16% during 1960-61 to 1.85% during 1980-81. But the districts with a moderate proportion of area under seasmum during 1960-61 like Dhenkanal, Sambalpur, Phulbani etc. have increased their area during this period so also the districts with lowest area under sesamum during 1960-61.

(g) RAPE & MUSTARD

During 1980-81 the highest concentration of rape and mustard cultivation were observed in the districts of Phulbani whichhad 7.26 per cent of its total cropped area under it. The other districts with a significant proportion of total cropped area

under it were Kalahandi (3.27%), Keonjhar (2.39%) while the districts with more than one per cent of their gross cropped area under rape and mustard were Balasore, Bolangir, Cuttack, Dhenkanal, Koraput, Mayurbhanj, Puri, Sambalpur and Sundargarh. Thus during this period almost all the districts had a significant proportion of their gross cropped area under rape and mustard. But as compared to this during 1960-61 although all the districts were growing rape and mustard the districts having more than one per cent of their total cropped area were very few. These include Kalahandi (2.84%) Phulbani (1.81%) Keonjhar (1.13%) and Koraput (1.00%). Infact, it was only during 1980-81 that the state had more than one per cent of its total cropped area under rape and mustard.

(h) PULSES :

Fig. 4.9 shows the general pattern of the distribution of pulses cultivation in Orissa. It can be marked from the Fig. 4.9(b) that during 1980-81 the Major Pulses growing districts were Ganjam and Puri with over 30 per cent of their gross cropped area under pulses. The districts following immediately were Cuttack (27.81%) Dhenkanal (21.88%) and Kalahandi (21.74%) while the lowest proportion of gross cropped area devoted towards pulses cultivation were confined to the districts of Mayurbhanj which had only 9.80 per cent of its total cropped area under pulses. The rest of the districts had a figure between 10 to 20 per cent.

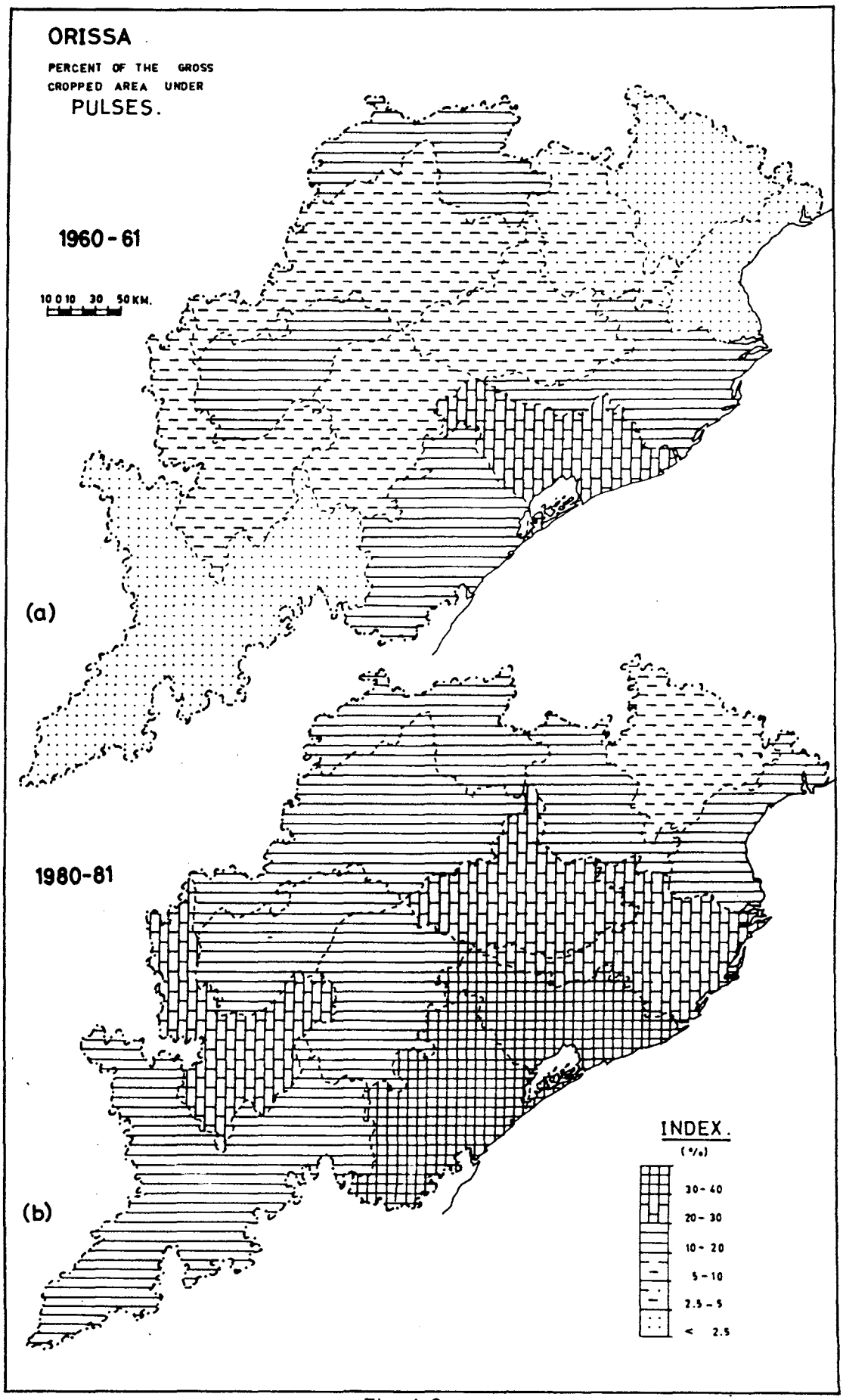

ORISSA
PERCENT OF THE GROSS CROPPED AREA UNDER PULSES.
1960-61
10 0 10 30 50 KM.
(a)
1980-81
(b)
INDEX.
(%)
30-40
20-30
10-20
5-10
2.5-5
< 2.5

Fig. 4.9

As far as the distribution during 1960-61 and 1972-73 is concerned the reflect a similar pattern of distribution like that of 1980-81 with highest proportion of gross cropped area under pulses cultivation found in the districts of Puri, Ganjam and Cuttack while lowest acreage devoted to pulses cultivation were in the districts of Balasore, Mayurbhanj and Keonjhar.

So far as the area under different types of pulses is concerned it can be marked from Table 4.10 that during 1960-61 Gram had the highest proportion of area among the pulses while during 1980-81 as well as 1972-73. Tur had the maximum proportion of area under it being cultivated in all most all the districts but with highest predominance in the districts of Phulbani (2.25%) Koraput (1.89%), Sundargarh (1.85%), Kalahandi (1.79%) and Dhenkanal (1.74%). The rest of the districts had less than are per cent of their gross cropped area under it. This pattern of distribution was more or less prevelent during 1972-73 while during 1960-61 Gram was the major pulse grown in the state and particularly in the districts of Kalahandi, Keonjhar and Bolangir.

TABLE - 4.10

AREA UNDER PULSES IN ORISSA

YEAR	PER CENT OF THE GROSS CROPPED AREA UNDER -			
	Gram	Tur	Other pulses	Total Pulses
1960-61	0.33	0.23	7.48	8.04
1972-73	0.38	0.73	12.44	13.55
1980-81	0.57	0.94	18.22	19.73

(i) FIBRES :

Jute and Mesta are the major fibre crops grown in Orissa. During 1980-81 they had occupied 0.50 per cent and 0.48 per cent of the total cropped area of the state respectively. Besides these certain quantities of Sunhemp was also being grown in the districts of Balasore, Bolangir, Ganjam, Mayurbhanj, Phulbani, Kalahandi and Dhenkanal. The major fibre growing districts are Cuttack with 2.91 per cent and 4.36 per cent of its total cropped areas under fibres in the years 1980-81 and 1960-61 respectively followed by Balasore, Keonjhar and Bolangir. The other districts having morethan one per cent of total cropped area under fibres were Koraput and Mayurbhanj during 1980-81 and Dhenkanal during 1972-73. Jute is being gown predominantly in the districts of Cuttack, Balasore, Keonjhar and Puri while the major mesta growing districts are Dhenkanal, Bolangir, Keonjhar, and Ganjam as well as Mayurbhanj. Table 4.11 provides a picture of the general pattern of distribution of fibre crops in Orissa.

TABLE - 4.11

DISTRIBUTION OF FIBRE CROPS IN ORISSA

PER CENT OF GCA UNDER THE CROP	AREA OF CULTIVATION		
	1960-61	1972-73	1980-81
0.5 per cent	Bolangir, Kalahandi Koraput, Mayurbhanj, Sambalpur, Dhenkanal, Puri & Phulbani	Phulbani, Puri, Kalahandi, Sambalpur, Sundargarh	Puri, Sambalpur, Sundargarh
0.5 to 1 per cent	Ganjam, Keonjhar Sundargarh	Ganjam, Koraput Mayurbhanj	Dhenkanal, Ganjam, Kalahandi, Phulbani
	Balasore	Dhenkanal, Keonjhar	Balasore, Bolangir, Keonjhar, Koraput, Mayurbhanj
1.5 per cent	Cuttack	Balasore, Bolangir Cuttack	Cuttack

(j) SUGARCANE :

Sugar cane is one of the important cash crops of the state. During 1980-81 it had occupied 0.56 per cent of the total cropped lands of the state. Over the years the sugar cane cultivation is gaining momentum in the state. Hence, the area under sugar cane cultivation in the state has been increasing continuously from 0.42 per cent of the total cropped land during 1960-61 to 0.44 per cent during 1972-73 and 0.56 per cent during 1980-81. The major sugar cane growing districts are Koraput,

Bolangir, Dhenkanal, Kalahandi and Puri. Besides, sugar cane is also cultivated in the rest of the districts and particularly in the districts of Ganjam, Cuttack and Sambalpur. During 1980-81, the major sugar growing districts were Koraput (0.81 per cent of its total cropped land under it) Bolangir (0.77 per cent) Dhenkanal (0.69 per cent) and Kalahandi (0.66 per cent and Puri (0.63 per cent) while the districts where sugar cane had occupied a very minute proportion of the total cropped land were Mayurbhanj (0.13 per cent) Keonjhar (0.18 per cent) and Sundargarh (0.25 per cent). The pattern of distribution was also more or less similar during 1960-61 with the major growing districts being Dhenkanal (0.75 per cent), Bolangir (0.60 per cent) and Koraput (0.60 per cent) while, the districts with lowest proportion of area under sugar cane were Balasore and Mayurbhanj (0.15 per cent each) followed by Sundargarh (0.17 per cent). The picture during 1972-73 was also similar with the major growing districts being Koraput (0.64 per cent), Puri (0.63 per cent) and Kalahandi (0.60 per cent).

(k) CHILLIES :

Chillies occupy an important place in the agricultural landscape of the state. Thearea under chillies has been increasing from its negligible figure (only 0.11 per cent of the total cropped lands) during 1960-61 to 0.55 per cent during 1972-73 and 0.87 per cent during 1980-81. During 1980-81 the major chilli growing district was Kalahandi , 1.25 per cent of the gross cropped area

under it followed by Bolangir (1.14 per cent), Koraput (1.06 per cent) Balasore (1.04 per cent), Ganjam (1.03 per cent) and Sambalpur (1.00 per cent) while, the districts with lowest proportion of area under chillies were Keonjhar (0.20 per cent) and Puri (0.35 per cent). The rest of the districts had betw-en 0.5 to 1 per cent of the total cropped land under chilli cultivation. The major chilli producing districts during 1972-73 were Ganjam (1.08 per cent) followed by Kalahandi (1.03 per cent) while as chilli occupied a very negligible proportion of Gross cropped area during 1960-61, no districts had more than 0.5 per cent of their total cropped land under it.

(k) OTHER CROPS :

Besides all these crops which were discussed earlier potatoes are being cultivated mostly in the districts of Cuttack and Puri while Tobacco cultivation is mostly confined to the districts of Koraput, Kalahandi, Phulbani, Dhenkanal and Bolangir districts (Appendix - II). Linseed is being cultivated mostly in the districts of Kalahandi, Keonjhar, Mayurbhanj and Puri districts while castor cultivation is predominant in the districts of Koraput, Kalahandi and Dhenkanal districts (Appendix - II)

4.7 CROP COMBINATION REGIONS :

The grographical investigation of agriculture which purports to select various crops or agricultural elements to be

studied collectively in an areal unit may be termed as crop combinational analysis. (P.V. Reddy, 1983; 73-74) Such an analysis is basic in the demarcation of crop regions and their knowledge would help in the assessment of agricultural resources available in an area thus helping in the formulation of development plans for that region crops are the principal index of agricultural typology. (K.P. Dixit, 1973; 384). However, a crop, how so ever rewarding, is rarely grown in complete isolation. Rather, a number of them are raised side by side in different fields during a crop season or succeed each other in the same field during different seasons. "Areal strength of each crop in a crop complex bears a definite cause and effect relationship" (J. Singh, 1979; 256). Thus it can be said that a systematic study of crop land relationship not only helps us in agricultural regionalisation but also it "Provides a scientific basis for land resource allocation to various agricultural crops and planning for maximum productivity". (K.N. Singh & B. Singh, 1970; 221) Infact crop combination regions or crop association regions are an integrated reality of agricultural land use and any study relating to the crop geography of a region will not be complete without a complete investigation and analysis of its crop associations.

In delimiting crop combination regions, any statistical technique which succeeds in dropping less important crops from each total combination will be the best and for the purpose Doi's

Method* was used in arriving at different crop combinational regions of the state.

According to Doi's method the crop combinations are calculated by the formula -

$$\Sigma d^2$$

or calculating the squared deviations from a theoretical value. Thus a region with the lowest deviation from the table/theoritical value will be assigned as being whether a mono-cultural region or a crop combinational region. In this analysis only crops having more than one per cent of the gross cropped area of the areal unit where it is being cropped were taken into consideration. The crops were then ranked according to their areal strength. The crop contribution regions were calculated taking the theoritical value for different crop combinations as follows :

a] Monoculture - 100
b] 2 crop combination - 50
c] 3 crop combination - 33.33
d] 4 crop combination - 25
e] 5 crop combination - 20
f] 6 crop combination - 16.66
g] 7 crop combination - 14.28
h] 8 crop combination - 12.5
i] 9 crop combination - 11.11 and
j] 10 crop combination - 10

The result of the analysis as illustrated in the Appendix- recognises different crop combination regions during different years.

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*Doi's Method has been cited by N. Mohammad (1975) in his paper published in "The North Eastern Geographer", Vol.7, No.1 & 2.

However, when the state is considered to be the areal unit, the state came out as a mono cultural region during the three years i.e. 1960-61, 1972-73 and 1980-81 for which calculations were being made, with rice as the dominant crop. The results of the crop combinational analysis for the different years taking districts as the units of study and considering only those crops which have more than one per cent of the gross cropped area of the region for which calculations were being made, are as follows :

[1] 1960-61

During 1960-61 the whole of the state was dominated by a single crop i.e. Rice. Thus when the whole of the state was taken as the areal unit of study the result comes out in the form of a mono cultural design. However, when districts were considered as the units of investigation a more complex crop combinational structure arises. As shown in the figure 4.10(a) the districts where only a single crop dominates the agricultural land utilization and hence giving the district a mono cultural crop combination were Balasore, Cuttack, Dhenkanal, Ganjam, Kalahandi, Keonjhar, Mayurbhanj, Puri, Sambalpur and Sundargarh with Rice as the Single important crop.

As compared to this the district of Bolangir had a two crop combinational structure with Rice as the first ranking crop followed by sesamum. Koraput was characterised by a four crop

Bolangir had a two crop combinational structure with the crops being Rice and Millet (small). As it can be marked from Fig. 4.10 (c) Cuttack was a three crop combinational region during the said period with crops as Rice, Groundnut and Jute while both Koraput and Puri had a four crop combinational structure. But the crops combining to give the district their crop composition vary from Rice, Ragi, Millets and Maize in case of Koraput to Rice Ragi Groundnut and Maize for Puri.

Dhenkanal had a five crop combinational composition with the major crops as Rice, Millets, Sesamum, Groundnut and Maize, while Phulbani had its six crop combinational structure. The crops being Rice, Rape and Mustard, Millets, Ragi, Maize and Sesamum. Ganjam was a seven crop combinational region with the crops like Rice, Ragi, Sesamum, Millet, Groundnut, Maize and (Dry) chillies. However, during the period the district with highest crop combination was Kalahandi with nine crops in the form of Rice, Millet, Ragi, Rape and Mustard, Maize, Linseed, Sesamum, Tur and Castor (Fig.4.10c).

An analysis of the emerging crop combinational structure over the last twenty years simply suggest that Orissa though still a monocultural crop region, is slowly drifting away from its mono cultural characteristics to a more diversified multiple crop combinational sphere. Table 4.12 clearly reflects this aspect of change where one can mark the gradual reduction in the number of mono cultural districts from their highest figure of 10 districts during

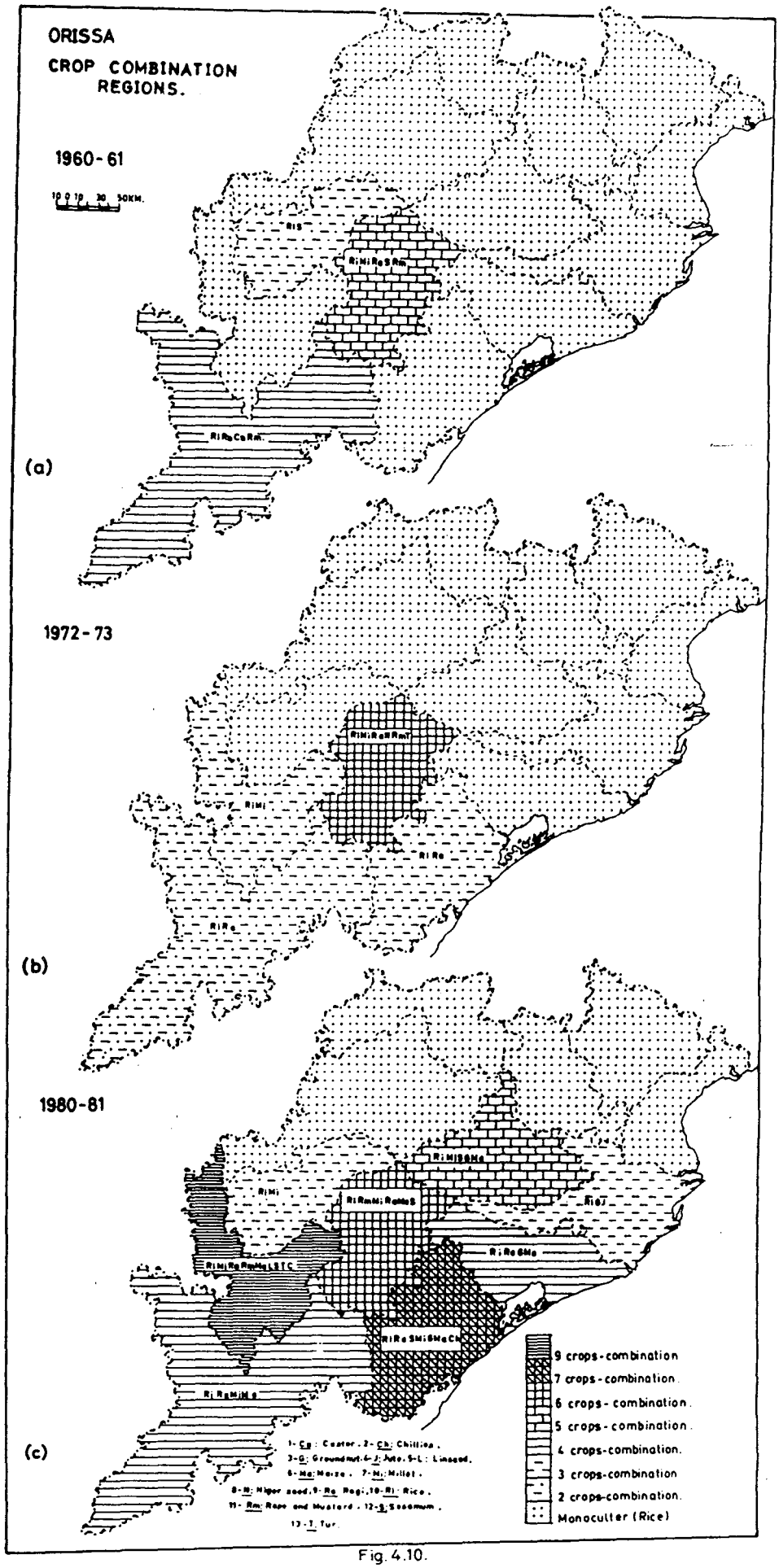
ORISSA
CROP COMBINATION REGIONS.
1960-61
10 0 10 30 50KM.
(a)
1972-73
(b)
1980-81
(c)
9 crops-combination
7 crops-combination
6 crops-combination
5 crops-combination
4 crops-combination
3 crops-combination
2 crops-combination
Monocutter (Rice)

Fig. 4.10.

combinational structure with the first ranking crop as rice followed by Ragi, Castor and Rape and Mustard. The only district with a five crop combinational structure was Phulbani with the crops being Rice, Millet, Ragi, Sesamum and Rape and Mustard (Fig. 4.10 a).

2] 1972-73

During 1972-73 nine districts had a monocultural crop combination. These districts include Balasore, Bolangir, Cuttack, Dhenkanal, Keonjhar, Mayurbhanj, Puri, Sundargarh and Sambalpur, with the single most dominant crop as rice. Two crop combinational characteristics were marked in three districts e.g. Ganjam, Kalahandi and Koraput. However, the constitutents of two crop combination vary from district to district. While Ganjam and Koraput had rice as the first ranking crop followed by Ragi, Kalahandi had the second crop in the form of millets. With rice as the first ranking crop. Phulbani was characterised by a Six crop combinatkonal structure with the crops being Rice, Millet, Ragi, Nigar Seed, Rape and Mustard, and Tur (Fig. 4.10b) However, Orissa as a whole was behaving like a monocultural region.

3] 1980-81

During 1980-81 the districts with monocultural crop combinations were Balasore, Keonjhar, Mayurbhanj, Sambalpur and Sundargarh with rice as the single dominant crop (Fig. 4.10c) Similarly

1960-61 to a districts during 1972-73 and further to 5 districts during 1980-81. Another interesting feature can be marked that Rice is still the first ranking crop in all the districts whereas there are numerous positional shifts among other crops during these years.

TABLE - 4.12

CROP COMBINATION REGIONS OF ORISSA

TYPE OF CROP COMBINATION	NAME OF THE DISTRICTS		
	1960-61	1972-73	1980-81
Mono-culture	Balasore, Cuttack, Dhenkahal, Ganjam, Kalahandi, Keonjhar, Mayurbhanj, Puri Sambalpur, Sundargarh	Balasore, Bolangir, Cuttack, Dhenkanal Keonjhar, Mayurbhanj Puri, Sambalpur Sundargarh	Balasore, Keonjhar Mayurbhanj, Sambalpur Sundargarh
Two crop combination	Bolangir	Ganjam, Kalahandi Koraput	Bolangir
3-crop combination			Cuttack
4-crop combination	Koraput		Koraput, Puri
5-crop combination	Phulbani		Dhenkanal
6-crop combination		Phulbani	Phulbani
7-crop combination			Ganjam
9-crop combination			Kalahandi

The crop combination regions appears to be valid for it makes possible the areal differentiation on the basis of the real dominance of crops, that are spatially related and occur togather in varying strengths. It may also be pointed out that such a delimination of crop combination regions is merely to facilitate the

description and comprehension of the agricultural complexities and pecularities of the area. However, the delimination is not an end in itself but only a tool towards a better understanding of the agricultural situation of a state facing accute draught conditions over the last 20 years.

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CHAPTER - FIVE

CONCLUSION

The preceeding analysis of the pattern of land utilization in Orissa and its changes over time has helped in arriving at the following conclusions :

1] The whole state can be devided into three distinct morphological units with their unique and characteristic land use patterns.

2] 'Forests' and 'Net sown area' are the most important land use categories in the state, sharing between them almost sixty per cent of the total reported area available for land utilization purposes.

3] Among other categories of land use, 'Other uncultivated lands excluding fallow lands' occupy the third position behind the above mentioned two categories in terms of the proportion of the total reported area of the state under it.

4] 'Land not available for cultivation' and 'Fallow lands' rank fourth and fifth respectively in terms of the per cent of total reported area of the state under them.

5] It is quite clear that, with time, the area under 'Forests' is increasing continuously, where as, there is a continuous decline in the 'Land not available for cultivation' and 'Other uncultivated lands excluding fallow lands'.

6] 'Fallow lands' and 'Net Sown Area' exhibit no clear trend of growth, with alternate phases of decline and increase.

7] However, a decline in the 'Fallow lands' in general and 'Current Fallows'in Particular is accompanied by an increase in the 'Net sown area' and vice versa.

8] The physiographical diversities of the state are clearly reflected in the variations of land use pattern from region to region. Thus, the Eastern Ghats mountainous region comprising the districts of Phulbani,Koraput, Ganjam and Kalahandi as well as the northern dissected plateaulands of Sundargarh and Keonjhar has a higher Proportion of forests than the agricultural lands (net area sown). In contrast to this, the coastal districts of Balasore, Cuttack, and Puri has the primier land use category as 'Net Sown Area' while 'Forests' occupy a secondary position.

9] Also, the coastal districts with their fertile alluvial soil and thus, a highly rewarding agriculture, supports

more population than the Mountainous and plateau lands as reflected by the variations in the density of population. Thus, these coastal districts of Cuttack, Puri, Ganjam and Balasore have a very intensified agriculture as compared to the other districts to support the population. In fact the Physiological density is among the highest in these districts, forcing the agri-culture to be more intensified.

10] The role of population in shaping the pattern of land utilization in Orissa has been amply recognised from the pattern of growth and distribution of the Forests, Net Area Sown, Cultivable waste, Land Put to Non-Agricultural uses, Cropping Intensity and Gross cropped area. It has been observed that the districts with high population density like Cuttack, Balasore and Puri have the maximum area under agricultural uses to support their huge population. Thus every inch of cultivable land in these districts have been fully brought under the plough as reflected in the low area under the cultivable wastes. Infact the proportion of cultivable wastes in these districts are among the lowest in the state. Again the pressure of population has not only resulted in an expansion of the cultivated area horizontally but also

vertically in the form of intensification of cropping. All these have resulted in the depletion of forested lands and thus these districts have the lowest proportion of forested lands in the state. But once our attention gets diverted toward other districts with their sparse to medium population density, the whole scenario becames for different. Thus in the districts live Phulbani, Sundargarh, Koraput and Keonjhar the dominant category of land use turn out to be forest, shile, the not so intense population pressure has resulted in a comparatively low cropping intensity and lower proportion of net sown area and gross cropped lands.

11] Perhaps, the role of climatic conditions in determining the character of the land use pattern in Orissa can be best Marked from the observed variations in the pattern of the growth of net sown area, 'fallow lands' and 'land under miscellaneous tree crops'. With a continuously growing population and improving technology, it is expected that the net sown area will increase with time. But in reality, there was a reverse during 1961-73 when repeated droughts and cyclones had struck Orissa in quick successions. Thus, during this period, the net sown area of the state declined as a whole, and what's

more, there was an increase in the fallow lands indicating that parts of thenet sown area were left fallow or were used for a more minor productive uses than before, as reflected by the boom in the area under missellaneous tree-crops and groves. This interrelationship between the climate and land use pattern is again validated by the reversing trend during 1973-81 when there was no such major droughts resulting in an increase in the net sown area and a fall in the area under fallow lands and miscellaneous tree-crops and groves.

12] The role of technology in the determination of the land use . Pattern of a region is brought out by the declining trend of cultivable wastes and the intensification of cropping and increase in the area sown more than once. It is obvious that every day marks a further advancement in the technology to meet the growing demands of population. This was resulted in a decline in the cultivable waste lands as the lands which were previously considered to be difficult to bring under cultivation, now were being cultivated with comparatively less cost due to advancement in technology. It is not only the horizontal expansion that the technological advancement helps in,

but also it helps in the vertical extension by the use of improved high yielding varieties of seeds, assured water supply, fertilizers etc. As one of the Prime Objectives of the technological revolution is, to reduce the dependence upon uncertain climatic conditions, it can be said that the technological advancement has gone a long way in achieving its objective. Thus, though there is a decline in the net sown area during hard periods of natural calamities, the gross cropped area as related to the area sown more than once has been continuously increasing undeterred by the climatic viscitudes.

13] It was also observed that climate, physiography, Population, technology and other biotic as well as non-biotic factors have played a great role in determining the character of crops that are being grown in Orissa. Most parts of the state still has a poor agriculture dominated by food crops. Again there was no diversification of crops due to the poor infrastructural facilities as well as the subsistence type of agriculture. Given its climatic characteristics, Orissa is best suited for the paddy cultivation as amply justified by the dominance of rice. However, the nature of soil and pressure of population have determined the extent of rice cultivation. Thus,

the coastal districts with their highly fertile and rewarding alluvial soils and high population density have a very small number of crops grown in association with rice, where as, the other districts have a more satisfactory crop combination. Also, the role of physiography in the cropping pattern is reflected by the fact that the plains with their fertile soil have the excessive dominance of rice. So also the case of certain mountainous tracts like Sundargarh and Keonjhar resulting in a poor pattern of crop association. However, all the characteristics of the agriculture of Orissa re rapidly changing as can be marked from a more balanced crop combinational pattern and the declining importance of rice.

14] Lastly, the role of government in the evolving land utilization scenario of the state can not be overlooked It can be examplified by the concerted drive towards increasing the area under crops not as much as by horizontal expansion but by intensification through assured and improved irrigation facilities and other infrastructural amenities, thus aiming for an optimum utilization of the available land. The growth in the forested area provides. Perhaps the best example of the governmental association in the land use planning and development process in the state.

However, any attempt in singling out any factor solely responsible for the growth and concentration of any land use category is only a futile exercise. It is not that, only one factor governs the land use of a particular region independently, but , it is a gamut of inter-related factors that give a region its peculiar land use pattern. Thus, the whole pattern of land utilization in Orissa and its changes over time can not be analysed in the context of only a factor or two, rather, the analysis could better be carried out taking into account the role of all the factors at a time and as a whole.

The agricultural scenario of Orissa is rapidly changing with an increased and assured irrigation system and governmental involvement in the decision making process. The agriculture is moving towards a more rewarding and developed state. However, there is nothing to be euphoric about, for even today, much parts of the state with a very poor intensity of cropping are highly backward in respect of land use development. With a dominantly rural population, about seventy five per cent of which are still engaged in the agricultural activities and a very low level of exposure towards the modern agricultural findings and literacy, the agriculture of the state is still of a subsistence type with only are crop and that's again a food crop dominating the whole agricultural scenario. Though, there is no doubt that signs of

recover from such a quagmire is beginning to be felt, the pace of such a recovery is too slow and uneven. Most of the districts still have a monocultural crop combination which restricts further diversification of crops. Orissa is still one of the worst suffers of drought particularly because of crop loss. And whe, a crop occupying as much as sixty per cent of the total cropped area gets damaged, the situation becomes indeed very critical. Infact, rice, the major crop of the state, not only needs large amount of water but needs it at the right points of time, failing which the crop can be totally lost. Thus, without a developed and assured irrigation system, stabilization of agriculture in Orissa remains a destant dream.

In other words, a drought -proofing plan for Orissa must take in to account the extention of irrigation as well as a targeted drive towards small scale diversification with governmental assistance for seeds, fertilizers and other inputs. As the crop combinational analysis suggests, there are efforts being made to achieve such a target although, the achievement is still marginal.

APPENDICES AND BIBLIOGRAPHY

APPENDIX - I

PATTERN OF LAND UTILIZATION IN ORISSA (in '000 hectares)

1960-61

Districts/ State	Total Reported area According to village Papers	Land not available for cultivation				Other uncultivated lands excluding fallow lands				Fallow lands					
		Forests	Land put to non-agricultural uses	Barren and uncultivable lands	Total	Permanent postures and other grazing lands	Land under miscellaneous Tree crops & Groves	Cultivable wastes	Total	Other than current fallow	Current Fallow	Total	Net Area Sown	Area sown more than once	Gross cropped Area
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Balasore	647	39	47	19	66	23	7	21	51	14	38	52	439	13	452
Bolangir	883	163	18	49	67	55	11	65	131	19	51	70	452	33	485
Cuttack	1089	130	84	18	102	57	21	54	132	10	52	62	663	83	746
Dhenkanal	1092	338	56	110	166	43	15	95	153	19	37	57	378	8	387
Ganjam	1220	209	67	173	240	47	116	115	278	20	87	107	386	13	398
Kalahandi	1306	443	57	46	103	77	1	152	230	17	109	126	404	9	413
Keonjhar	831	174	91	50	141	53	19	71	143	15	102	117	257	7	264
Koraput	2554	493	251	383	634	125	206	231	562	12	59	71	794	23	818
Mayurbhanj	1040	225	53	143	196	53	3	70	125	13	86	99	394	17	410
Phulbani	1104	492	58	121	179	14	9	200	223	5	9	14	196	3	199
Puri	1046	309	62	63	125	52	19	72	143	8	31	39	430	68	498
Sambalpur	1749	297	164	203	367	73	10	128	211	17	147	164	710	69	779
Sundargarh	979	254	137	19	156	65	24	75	164	14	107	121	284	4	288
Orissa	15540	3566	1145	1397	2542	737	461	1349	2547	183	915	1098	5787	350	6137

SOURCE : Statistical Abstract of Orissa - 1961-63

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1972-73															
Balasore	647	33	45	25	70	31	20	25	76	12	41	53	415	60	475
Bolangir	883	169	31	41	72	60	17	54	131	35	90	125	386	78	464
Cuttack	1089	96	95	10	105	58	26	43	127	04	50	54	707	304	1011
Dhenkanal	1092	509	32	15	47	20	10	17	47	10	80	90	399	79	479
Ganjam	1220	558	57	13	70	28	20	20	68	10	70	80	444	209	653
Kalahandi	1158	324	29	28	57	59	184	37	280	09	50	59	438	109	547
Keonjhar	831	382	24	18	42	38	06	34	78	08	80	88	241	23	264
Koraput	2702	1480	51	74	125	57	52	34	143	45	190	235	719	46	765
Mayurbhanj	1040	402	35	35	70	30	08	20	58	24	90	114	396	43	438
Pulbani	1104	829	13	2	15	04	05	05	14	03	60	63	183	28	211
Puri	1046	291	58	21	79	57	24	61	142	06	60	66	468	191	659
Sambalpur	1749	530	45	48	93	59	237	95	391	46	120	166	569	116	685
Sundargarh	979	485	25	10	35	42	10	10	62	30	110	140	257	28	285
Orissa	15540	6088	540	340	880	543	619	455	1617	242	1-91	1333	5622	1314	6936

Source: Indian Agricultural Statistics, Vol-II
1970-74.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1980-81															
Balasore	647	40	46	24	70	26	26	20	72	8	21	29	436	154	590
Bolangir	883	213	35	30	65	40	14	47	101	35	51	86	418	137	555
Cuttack	1089	140	96	10	106	38	30	10	78	20	48	68	697	530	1227
Dhenkanal	1092	454	43	15	58	45	40	7	92	21	68	89	399	124	523
Ganjam	1220	569	58	5	63	38	30	5	73	5	10	15	500	350	850
Kalahandi	1158	527	32	3	35	41	30	5	76	5	6	11	509	248	757
Keonjhar	831	407	25	18	43	38	6	9	53	10	32	42	286	55	341
Koraput	2702	1400	94	45	139	94	91	30	215	20	65	85	863	235	1098
Mayurbhanj	1040	468	37	35	72	30	13	6	49	10	23	33	418	78	496
Phulbani	1104	829	15	2	17	4	5	5	14	5	8	13	231	106	337
Puri	1046	343	59	21	80	57	27	32	116	10	20	30	477	343	820
Sambalpur	1749	701	65	47	112	70	101	63	234	20	60	80	622	190	812
Sundargarh	979	549	27	10	37	39	10	10	59	20	40	60	274	66	340
ORISSA	15540	6640	632	265	897	560	423	249	1232	189	452	641	6130	2616	8746

SOURCE : Statistical Abstract of Orissa 1981,
Director of Agriculture and Food production Orissa

APPENDIX - II

AREA UNDER VARIOUS CROPS (IN HECTARES)

1960-61 , 1972-73 & 1980-81

District/State	Rice	Maize	Bajra	Jawar	Ragi	Wheat	Small Millets	Total Cereals	Gram	Tur	Other Pulses	Total Pulses	Ground-nut	Rape & Mustard	Sesamum	Leenseed
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1960-61																
Balasore	392630	40	19	-	-	40	-	392722	40	-	2752	2792	40	202	40	-
Botangir	265666	1012	40	324	5018	1335	15459	288854	4330	2954	55644	62928	1052	2833	27119	3480
Cuttack	420451	1942	40	-	3237	1255	40	427250	971	526	81260	82757	2752	4047	6070	405
Dhenkanal	260041	2104	16	8	1214	81	2509	265973	2792	2154	25203	30149	5059	2428	8620	3076
Ganjam	263018	607	-	162	21650	-	283	285721	40	405	43544	43989	4977	3925	2509	445
Kalahandi	262121	1821	-	3318	13638	850	-	281758	4451	4047	23719	32217	405	11736	17199	9308
Keonjhar	172000	971	850	40	81	121	-	174064	2630	971	4007	7608	243	2995	526	202
Korapur	350243	4532	3076	2995	13354	809	2388	377397	1821	364	9834	12019	809	8094	6151	364
Mayurbhanj	263040	1255	-	-	121	243	162	264821	364	809	3643	4816	486	1700	526	40
Phulbani	58000	4006	-	8	1457	283	14730	78485	688	931	15458	17077	40	3602	3723	-
Puri	366671	1295	40	40	5989	283	405	374724	40	567	104407	105014	324	2064	4290	364
Sambalpur	500862	728	16	162	486	1214	10400	513868	1497	202	51031	52730	4411	728	10117	81
Sundargarh	210416	2064	850	-	324	243	-	213896	607	405	38121	39133	3642	1214	5585	40
ORISSA	3785159	22379	4897	7041	66570	6758	46376	3939533	20274	14326	459029	493629	24240	45567	92429	21812
1972-73																
Balasore	395200	720	9	16	20	2619	344	398928	428	241	19220	19889	667	2025	1556	-
Botangir	295300	3379	-	16	4176	3827	26652	333350	1414	2100	55063	58577	8142	3465	16610	103
Cuttack	660260	2029	-	182	11910	6275	-	680565	442	2311	162888	165641	14205	6098	4716	814
Dhenkanal	314600	4755	-	30	4120	4488	6447	334440	786	4656	59656	65098	13539	4314	17063	-
Ganjam	341980	2972	426	1959	42532	798	8712	399379	146	4006	158890	162042	15447	2597	14660	164
Kalahandi	262200	9590	195	3537	13743	3437	50913	343615	8367	7170	92855	108392	2500	10678	12330	11142
Keonjhar	185830	9495	146	961	614	1650	2952	201648	1506	1594	15234	18335	543	4296	3191	719
Koraput	422740	19982	2470	10553	68519	3105	42936	570305	3775	12030	50159	65964	2867	9127	8423	196
Mayurbhanj	338970	6175	-	753	469	3377	6690	356434	4837	2384	24719	31940	3262	2447	2276	3056
Phulbani	93950	11124	-	692	5582	1187	13704	126239	674	7908	26944	35526	1300	8748	3076	-
Puri	411660	2972	-	6	13342	2967	-	430947	893	1664	144341	146898	3969	5408	9022	3826
Sambal pur	545270	1621	58	399	909	11773	11301	571331	566	933	34888	36387	17754	3609	6286	-
Sundargarh	207880	2810	92	1795	2065	5559	7313	227514	2610	3803	17791	24204	1900	2499	2638	1190
ORISSA	4475840	77624	3396	20899	168001	51062	177964	4974786	26444	50800	862648	939892	86095	65261	101847	21210

(Contd..)

AREA UNDER VARIOUS CROPS (IN HECTARES)

1960-61, 1972-73 & 1980-81

District/State	Castro Seed	Total oil Seeds	Cotton	Jute	Mesta	Sunhemp	Total Fibre	Sugarcane	Tobacco	Potato	Chillies	Other Crops	
	18	19	20	21	22	23	24	25	26	27	28	29	
1960-61													
Balasore	17	28399	3	6050	20		6073	688	4	81	81	49260	
Bolangir	1700	36184	526	71	749		1346	2914	445	324	850	91155	
Cuttack	2833	16107	1619	29669	1273		32561	3278	688	6070	2023	175266	
Dhenkanal	3885	23068	1093	47	607		1746	2914	324	971	283	61572	
Ganjam	445	12301	40	243	2603		2914	971	364	40	1093	50607	
Kalahandi	1700	40348	526	40	4		571	1659	405	405	-	55637	
Keonjhar	40	4006	162	1093	61		1315	850	40	121	40	75956	
Koraput	8255	23673	931	868	344		2143	4816	1214	81	769	395888	
Mayurbhanj	162	2914	162	830	405		1396	607	243	324	121	134758	
Phulbani	1072	8377	-	-	77		77	769	40	243	607	93325	
Puri	364	406	162	1174	24		1360	2023	81	769	40	6583	
Sambalpur	607	15944	283	149	1809		2241	3521	364	769	728	188835	
Sundargarh	162	10643	1983	47	40		2071	486	81	283	202	21205	
Orissa	21165	205213	7487	40279	8044		55810	25495	4290	10481	6839	1395710	
	Source : Statistical Abstract of Orissa, 1961-63												Niger Seed
1972-73													
Balasore	711	4959	5	6497	-	1107	7609	1226	40	167	2826	39356	-
Bolangir	1919	30239	-	34	4064	2915	7013	2303	1210	204	2297	28807	-
Cuttack	1038	25873	-	31585	1075	-	32660	4773	640	3248	4805	91714	-
Dhenkanal	3443	38434	8	138	3405	1394	4945	2113	725	371	1568	31306	-
Ganjam	1705	37349	-	162	3654	726	4542	2752	265	524	7054	39093	2776
Kalahandi	6518	45499	21	-	1825	467	2313	3272	2675	55	5647	35532	1614
Keonjhar	387	18804	12	1691	2151	4	3858	384	188	62	1152	19570	9668
Koraput	7286	64859	156	109	3340	321	3926	4927	7432	127	4067	43393	36855
Mayurbhanj	436	23213	-	411	1688	471	2570	231	411	86	1550	21565	11733
Phulbani	1164	23452	-	-	-	-	-	800	920	176	1112	22775	9164
Puri	895	23260	-	926	1600	-	92526	4156	168	1222	565	49258	140
Sambalpur	547	28207	4	19	2333	313	2669	3331	434	524	4290	37827	11
Sundargarh	460	10449	172	-	480	-	652	422	220	168	1457	19914	1811
Orissa	26512	386204	385	41572	25615	7718	75290	20690	15328	6934	38390	467486	73772

Source : Indian Agricultural Statistics Vol. - II

1980-81

Districts/ State	Rice	Maize	Bajra	Jowar	Ragi	Wheat	Small millets	Total cereals	Gram	Tur	Other Pulses	Total Pulses	Ground nut	Rape & Mustard	Sesamum	Linseed
Balasore	392690	1744	6	45	10	5374	178	400047	1622	362	76040	78024	7026	9001	5692	-
Bolangir	296450	8297	-	1544	17460	6908	33882	364541	3793	2081	80073	85947	7085	8611	14695	503
Cuttack	567290	4952	-	1210	15069	9673	1438	599632	1593	3699	335914	341206	64613	18529	10446	1160
Dhenkanal	233420	14173	128	116	11102	3829	30372	293140	2552	9095	102805	114452	16620	7561	25599	-
Ganjam	316460	12814	2366	4219	75584	697	21206	433340	392	8087	259281	267760	20732	6759	23431	130
Kalahandi	267240	19200	352	5883	33191	7117	81736	414719	12510	13515	138567	165592	7401	24775	13983	17375
Keonjhar	195450	18158	350	807	5126	1992	6485	228368	2313	2544	34393	39250	1577	8151	2437	2118
Koraput	386360	56319	5860	16813	123878	6673	102299	680202	10204	20801	103330	134335	1871	20037	20221	2306
Mayurbhanj	327150	11212	50	1280	1399	4644	13300	359041	6605	3472	38526	48603	2210	8199	1833	8624
Phulbani	94530	18384	-	1712	20516	1465	21396	158003	1340	7567	51628	60535	1680	24467	11466	-
Puri	403150	12642	-	596	27601	1836	4770	443395	270	1758	244287	246315	14282	9602	1001	3726
Sambalpur	537490	2574	-	156	1578	9985	39241	591024	1406	2553	81966	85925	25270	10186	12863	52.
Sundargarh	191030	7435	338	2254	3863	6898	-	217818	5449	6284	46852	58585	2038	6239	3821	286
Orissa	4190710	180704	9450	36635	336407	67091	362309	5183306	50049	81818	1593654	1725521	172405	162117	156488	36280

1980-81

Districts/ State	Castor seed	Other oil seeds	Total oil seeds	Cotton	Jute	Mesta	Sunhemp	Total Fibre	Sugar-cane	Toba-cco	Potato	Chillies	Other crops	Gross Cropped Area
														[000 ha]
Balasore	1409	49	23177	95	5557	240	1845	7737	2932	94	142	6117	71730	590
Bolangir	1968	999	33861	728	10	4070	2128	6936	4300	1278	75	6300	51762	555
Cuttack	1558	480	96786	50	33872	1728	-	35650	6435	420	2975	10000	133896	1227
Dhenkanal	3887	62	53729	155	85	4771	47	5058	3601	748	554	3471	48247	523
Ganjam	3641	6860	61553	290	152	4512	2120	7074	5450	399	440	8713	65271	850
Kalahandi	12971	10752	87257	685	-	2617	1050	4352	5005	2868	16	9459	68732	757
Keonjhar	388	16588	31259	130	1978	2770	-	4878	622	342	153	694	35434	341
Koraput	13140	76456	134031	965	338	10561	856	12720	8904	12837	330	11672	102969	1098
Mayurbhanj	600	16917	38383	65	760	3894	991	5710	626	448	133	4656	38400	496
Phulbani	1724	25533	64870	507	20	904	976	2445	1398	1138	433	1782	46396	337
Puri	597	9135	38343	60	1004	2050	-	3114	5185	108	1738	2880	78922	820
Sambalpur	1130	102	49603	170	-	3413	30	3613	3295	234	701	8098	69507	812
Sundargarh	763	10446	23593	115	-	387	-	492	847	250	392	2487	35536	340
Orissa	43776	165379	736449	4005	43776	41917	10043	99741	48600	21164	8082	76329	846812	8746

SOURCE Statistical Abstract of Orissa, 1981.

APPENDIX III

CROP COMBINATION ANALYSIS OF ORISSA, 1961-81

	1960-61					1972-73						
Hypotthetical Values (in percent)	100	50	33.3	5	20	100	50	33.3	25	20	16.6	14.28
	(Σd^2) for various crop combinations											
	1 Crop	2 Crop	3 Crop	4 Crop	5 Crop	1 Crop	2 Crop	3 Crop	4 Crop	5 Crop	6 Crop	7 Crop
Balasore	172.40	3727.18				282.24	3467.12					
Bolangir	2044.84	1995.08	2135.84			1322.04	2144.98					
Cuttack	1904.45	2158.28				1203.39	2432.12					
Dhenkanal	1076.49	2577.46				1177.86	2402.53					
Ganjam	1150.56	2244.15				2268.61	1896.99	2038.02				
Kalahandi	1334.44	2282.74				2711.28	1659.95	1737.57				
Keonjhar	1214.52	2617.79				892.21	2563.14					
Koraput	3269.55	2391.20	2136.25	2015.22		2001.66	1711.94	1841.40				
Mayurbhanj	1284.50	-				511.21	2989.39					
Phulbani	5019.72	2249.48	1918.28	1390.51	1225.68	3076.92	1923.04	1630.56	1540.14	1497.66	1481.07	1504.46
Puri	695.37	2939.81				1408.50	2457.58					
Sambalpur	1274.49	2572.28				416.16	3123.87					
Sundergarh	725.76	2841.52				732.24	2775.84					
Orissa	1468.42	1555.50				1258.12	2314.25					

	1980-81									
Hypothetical Value (in %)	100	50	33.3	25	20	16.6	14.28	12.5	11.11	10.00
	1crop	2crop	3crop	4crop	5crop	6crop	7crop	8crop	9crop	10 crop
Balasore	1118.23	2623.57								
Bolangir	2170.62	1938.83	2053.27							
Cuttack	2891.21	2014.98	1885.55	1886.37						
Dhenkanal	3065.83	1981.58	1691.18	1634.10	1618.14	1626.29				
Ganjam	3940.07	1853.10	1543.97	1410.41	1332.46	1309.46	1306.27			
Kalahandi	4186.09	1752.73	1346.61	1204.81	1147.45	1117.42	1109.02	1105.21	1104.00	1104.80
Keonjhar	1821.58	2049.88								
Koraput	4415.60	1769.83	1059.98	902.00	922.77					
Mayurbhanj	1158.72	2493.90								
Phulbani	5176.80	2308.50	1431.94	1029.40	818.31	607.63	709.72			
Puri	2584.70	2175.05	2143.36	2142.94	2155.60					
Sambalpur	1143.11	2302.43								
Sundergarh	1919.31	2324.10								
Orissa	1712.32	2107.45	1931.34	1933.55						

APPENDIX I - IV

AREA IRRIGATED (Source Wise)

(In hactares)

Districts/ State	1960-61					1972-73					1980-81			
	Canals	Tanks	Wells	Other Sources	Total	Canals	Tanks/ Minor Irrigation Projects	Tube-well & Lift Irrigation Projects	Other wells (Pvt.) & CD	Total	Major & Medium Irrigation Projects	Minor Flow Irrication Projects	Minor Lift Irrigation Projects, CD & Other Pvt. sources	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Balasore	11129	1160	182	24788	37259	71010	3860	5960	3660	84490	84250	6980	11639	107869
Bolangir	-	39702	3387	12456	55575	68970	5720	120	25190	100000	21817	8842	5873	36832
Cuttack	94292	26507	2428	18413	141640	219600	3880	27470	7050	300000	65238	11739	37526	104503
Dhenkanal	7208	106005	4047	4937	122197	9700	19120	1920	22260	53000	314330	12756	31926	359012
Ganjam	65863	92418	923	21121	180326	66370	76230	6190	11440	160230	11940	20880	19315	52765
Kalahandi	5261	40064	3642	2833	51800	-	8110	-	9650	17760	100465	105025	65367	270857
Keonjhar	687	8241	1845	4330	15105	-	6500	260	5680	12440	15770	19956	15941	51667
Koraput	4581	3658	660	30817	39716	-	14980	4390	18470	37840	10510	10284	9103	29897
Mayurbhanj	20052	11522	1032	4443	37049	3840	18490	2430	7720	32480	5070	14535	28159	47764
Phulbani	10895	-	-	-	10805	21040	5350	30	5810	32230	14530	22005	12137	48672
Puri	7447	26983	1447	75731	111610	134290	17450	1410	4710	157860	263730	22478	12094	314700
Sambal pur	160282	59932	4317	5592	230126	178590	9790	2020	37170	227570	192830	19280	19287	231397
Sundargarh	6002	1249	-	60	7311	-	7780	1890	4680	14350	4230	12066	11817	28213
ORISSA	393611	417441	23910	205558	1040521	845410	197260	54090	163490	1260250	1109710	286826	287212	1683748

Sources (1) 1960-61 - Statistical Abstract of Orissa, 1961-63

(2) 1972-73 - Indian Agricultural Statistics, Vol. II, 1970-74

(3) 1980-81 - Statistical Abstract of Orissa, 1981

APPENDIX - V

Districts/State	1972-73						1980-81					
	No. of Tractors	Electric Pumps & Pumps for Tube-well	Consumption of Fertilizers (Tonnes) N	P_2O_5	K_2O	Total	No. of Tractors	Electric Pumps & Pumps for Tubewell	Consumption of Fertilizers (Tonnes) N	P_2O_5	K_2O	Total
1	2	3	4	5	6	7	8	9	10	11	12	13
Balasore	38	54	1655	3091	265	2229	6	8	3492	1019	793	5304
Bolangir	92	73	1478	610	324	2412	-	57	3052	1469	536	5057
Cuttack	278	11	10199	2549	2297	15045	10	237	11251	2440	1825	15516
Dhenkanal	29	15	543	184	135	862	-	16	1280	272	232	1784
Ganjam	117	91	8165	848	526	9539	1	79	10080	952	666	11698
Kalahandi	217	32	332	95	65	492	36	40	249	95	88	432
Keonjhar	53	4	253	160	85	498	28	20	532	340	100	972
Koraput	411	17	1577	340	245	2162	23	54	2610	634	391	3635
Mayurbhanj	11	7	610	275	140	1025	-	11	914	662	222	1798
Phulbani	4	1	192	86	60	338	-	-	496	197	103	796
Puri	143	31	3086	355	431	3872	1320	208	6389	560	544	7493
Sambalpur	290	34	12099	3957	1189	17245	7	82	10273	4172	1543	15988
Sundargarh	65	34	319	215	94	628	16	76	1064	455	199	1718
ORISSA	1748	404	40508	9983	5856	56347	1447	888	51682	15860	8821	76363

Sources: (1) Agricultural Implements (Tractors & Pumps) - Statistical Abstract of Orissa, 1973 & 1981.

(2) Fertilizer Consumption - "Statistics on Fertilizers & Agriculture in Eastern India".

APPENDIX - VI

INDEX OF MECHANIZATION

Districts/State	1972-73		1980-81		1972-73			1980-81		
	No. of Tractors per 1000 hac. of NSA	No. of Irrigation machinery per 1000 hac. of NSA	No. of Tractors per 1000 hac. of NSA	No. of Irrigation machinery per 1000 hac. of NSA	a	b	a+b	a	b	a+b
1	2	3	4	5	6	7	8	9	10	11
	(Qi)	(Pi)	(Qi)	(Pi)						
Balasare	0.092	0.130	0.014	0.018	0.1948	0.7536	0.9484	0.0139	0.1005	0.1144
Bolangir	0.238	0.189	-	0.136	0.5038	1.0956	1.5994	0	0.7599	0.7599
Cuttack	0.393	0.016	0.014	0.340	0.8319	0.0927	0.9246	0.0139	1.8997	1.9136
Dhenkanal	0.073	0.038	-	0.040	0.1545	0.2202	0.3747	0	0.2235	0.2235
Ganjam	0.264	0.205	0.002	0.158	0.5588	1.1884	1.7472	0.0019	0.8828	0.8847
Kalahandi	0.495	0.073	0.071	0.079	1.0478	0.4231	1.4709	0.0705	0.4414	0.5119
Keonjhar	0.220	0.017	0.098	0.070	0.4657	0.0985	0.5642	0.0973	0.3911	0.4884
Koraput	0.572	0.024	0.027	0.063	1.2108	0.1391	1.3499	0.0268	0.3520	0.3788
Mayur bhang	0.028	0.018	-	0.026	0.0592	0.1043	0.1635	0	0.1452	0.1452
Phul bani	0.021	0.005	-	-	0.0444	0.0289	0.0733	0	0	0
Puri	0.306	0.066	2.767	0.436	0.6477	0.3826	1.0303	2.7495	2.4361	5.1856
Sambal Pur	0.510	0.060	0.011	0.132	1.0796	0.3478	1.4274	0.0109	0.7375	0.7485
Sundar garh	0.253	0.132	0.058	0.277	0.5355	0.765	1.3005	0.0576	1.5477	1.6053
ORISSA	0.311	0.072	0.236	0.145						
	E(Q)	(E(P)	E(Q)	E(P)						
X	0.267	0.075	0.236	0.137						
	S(Q)	S(P)	S(Q)	S(P)						
SD( )	0.178	0.065	0.731	0.130						

$$a = \frac{S(P)}{S(Q)E(P)+S(P)E(Q)} \times Qi \qquad b = \frac{S(Q)}{S(Q)E(P)+S(P)E(Q)} \times Pi$$

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