

# IMPACT OF UMIAM HYDEL PROJECT ON SOCIETY AND ECONOMY OF THE REGION

By

**SYNSHARLANG KHARSHI-ING**

**SUBMITTED IN PARTIAL FULFILMENT  
OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF PHILOSOPHY  
IN GEOGRAPHY**

TO



**DEPARTMENT OF GEOGRAPHY  
SCHOOL OF HUMAN AND ENVIRONMENTAL SCIENCES  
NORTH-EASTERN HILL UNIVERSITY  
SHILLONG (MEGHALAYA)**

**1994**



DS  
333.9140954164  
KHA;1

~~CONFIDENTIAL~~  
Doc. No. 1030 99  
Acc. by. [Signature]  
Date 27-9-98  
Class by [Signature]  
Sub heading by [Signature]  
Date 27  
VHSAC - 200 50  
Reproduced by [Signature]



पूर्वोत्तर पर्वतीय विश्वविद्यालय  
मयूरभंज परिसर, शिलांग - 793014 (मेघालय)  
**North-Eastern Hill University**  
Mayurbhanj Complex, Shillong - 793014 (Meghalaya)

Phone :  
Grams : NEHU

**CERTIFICATE**

This is to certify that the dissertation entitled **Impact of Umiam Hydel Project on Society and Economy of the Region** submitted by Synsharlang Kharshi-ing in partial fulfillment for the degree of Master of Philosophy in Geography, is bonafide study to the best of my knowledge. All the quotations, extracts and ideas of other studies have been duly acknowledged.

This dissertation may be sent to the examiners for necessary formalities and evaluation.

This dissertation has not been submitted for any other diploma or degree.

*R.K.Rai*

(R.K.Rai)  
Head

Department of Geography  
NEHU : Shillong

**Department of Geography**  
North Eastern Hill University  
Shillong

(D.K.Nayak)  
Supervisor

Department of Geography  
NEHU : Shillong

## ACKNOWLEDGMENT

I express my deepest gratitude and indebtedness to Dr. Debendra Kumar Nayak, Reader, Department of Geography, NEHU, Shillong for his constant guidance, encouragement and keen interest in the present study. It is his personal involvement and sustained inspiration which brought this work to a successful completion. Working under his care and supervision has been a rewarding experience. However, any mistakes which may have been present in the dissertation are entirely mine.

Dr. Niranjana Prasad Goel, Department of Geography, NEHU, Shillong, eminently deserves my thanks for his painstaking help in processing of data in computer and shouldering the enormous responsibility of getting the entire manuscript typed on the computer in record time.

I am also thankful to all the members of the faculty and the non-teaching staff, Department of Geography, North-Eastern Hill University, Shillong for their timely help, valuable suggestions and moral support throughout the preparation of the dissertation.

I owe a debt of gratitude to my friends and fellow research scholars, notably Mr. Jaswinder Singh and Mr. Paul Soren for helping me in many ways difficult to enumerate.

My sincere thanks go to my parents and all other members of the family for their whole-hearted support and constant encouragement in bringing the work to a successful conclusion.

Above all, I give my thanks to the Almighty God and His son Jesus Christ for His grace and His unfailing divine love, enabled me to complete the work.

  
(Synsharlang Kharshi-ing)

## TABLE OF CONTENTS

	Page
Acknowledgment	
List of Tables	
List of Figures	
Chapter - I	1 - 21

### INTRODUCTION

1.1	Introductory Statement	
1.2	Statement of the Problem	
1.3	Theoretical Perspective	
1.4	Choice of the Study Area	
1.5	Objectives	
1.6	Research Questions	
1.7	Sources of Data	
1.8	Methodology	
1.9	Organization of the Manuscript	
1.10	Overview of the Literature	
1.11	Concluding Statement	
Chapter - II		22 - 43

### THE REGIONAL SETTING

2.1	Introductory Statement	
2.1	Geographical Background of the Plateau	
2.3	The Hydrel Project	
2.4	Socio-Economic Composition of the Study Area	
2.5	Concluding Remarks	
Chapter - III		44 - 58

### DEMOGRAPHIC CHANGES

3.1	Introductory Statement	
3.2	Changes in Settlement Structure	
3.3	Growth Rate in the Number of Settlements	
3.4	Changes in Population Size	
3.5	Changes in Growth Rate of Population	
3.6	Changes in Sex-Ratio	
3.7	Concluding Statement	

SOCIO-ECONOMIC CHANGES

- 4.1 Introductory Statement
- 4.2 Changes in Working Population
- 4.3 Changes in Non-Worker, Worker ratio
- 4.4 Changes in the Agricultural Workforce
- 4.5 Cultivators
- 4.6 Agricultural Labourers
- 4.7 Proportion of Scheduled Tribes
- 4.8 Relationship Between Distance and  
Socio-Economic Changes
- 4.9 concluding Statement

Chapter - V A SUMMARY OF CONCLUSIONS AND IMPLICATIONS 83 - 90

Bibliography 91 - 95

## LIST OF TABLES

Table No.	Title
2.1	Study Area : Distribution of Villages in Distance Zones, 1981
2.2	Study Area : Distribution of Settlements in Population Size Class, 1981
2.3	Study Area : Sex-Ratio, 1981
2.4	Study Area : Proportion of Workers, 1981
2.5	Study Area : Proportion of Agricultural Workers, 1981
2.6	Study Area : Proportion of Cultivators, 1981
2.7	Study Area : Proportion of Agricultural Labourers, 1981
2.8	Study Area : Proportion of Tribal Population, 1981
3.1	Study Area : Number of Settlements, 1961-91
3.2	Growth Rate of Settlements
3.3	Study Area : Changes in Population Size
3.4	Growth Rate of Population
3.5	Sex-Ratio
4.1	Study Area : Percentage of Workers to Total Population
4.2	Study Area : Percentage of Male Workers to Total Male Population
4.3	Study Area : Percentage of Female Workers to Female Population
4.4	Study Area : Non-Workers Per Thousand Workers
4.5	Study Area : Percentage of Agricultural Workers to Total Workers
4.6	Study Area : Percentage of Male Agricultural Workers to Total Male Workers
4.7	Study Area : Percentage of Female Agricultural Workers to Total Female Workers
4.8	Study Area: Percentage of Cultivators to Total Workers
4.9	Study Area : Percentage of Male Cultivators to Male Workers
4.10	Study Area: Percentage of Female Cultivators to Female Workers
4.11	Study Area : Ratio of Agricultural Labourers per Thousand Cultivators
4.12	Study Area : Percentage of Scheduled Tribe to Total Population
4.13	Study Area : Co-efficient of Correlation

## LIST OF FIGURES

- 1.1 Location of the Study Area
- 1.2 Study Area : Distribution of Villages
- 2.1 Meghalaya : Relief Features
- 2.2 Meghalaya : Drainage
- 2.3 Meghalaya : Annual distribution of rainfall
- 3.1 Study Area : Changes in the Distribution of Villages, 1961-91
- 3.2 Study Area : Changes in the Population Size, 1961-91
- 3.3 Study Area : Changes in Sex-Ratio, 1961-91
- 4.1 Study Area : Proportion of Main Workers, 1961-91
- 4.2 Study Area : Proportion of Male Main Workers, 1961-91
- 4.3 Study Area : Proportion of Female Main Workers, 1961-91
- 4.4 Study Area : Non-Worker Worker Ratio, 1961-91
- 4.5 Study Area : Distribution of Agricultural Workers, 1961-91
- 4.6 Study Area : Distribution of Male Agricultural Workers, 1961-91
- 4.7 Study Area : Distribution of Female Agricultural Workers, 1961-91
- 4.8 Study Area : Distribution of Cultivators, 1961-91
- 4.9 Study Area : Distribution of Male Cultivators, 1961-91
- 4.10 Study Area : Distribution of Female Cultivators, 1961-91
- 4.11 Study Area : Distribution of Scheduled Tribes, 1961-91

## CHAPTER - I

## INTRODUCTION

### 1.1. INTRODUCTORY STATEMENT

Man's impact on environment is manifold. The expanding human civilization, in order to keep pace with the standards of living, is also disturbing many of the natural systems. The evergrowing demands for water and hydro-electric power are promoting building activities in hilly terrain. As such, the river valleys and the flood plains are the most affected natural eco-systems. To harness the water resources, developmental projects have been undertaken which affect the dynamics and environment of the river valleys. It is in this context that the environmental impacts associated with the river valley projects have drawn the attention of the environmental scientists throughout the world<sup>1</sup>.

The problems of environmental degradation and ecological disturbances in India are assuming a scale unprecedented in the recent history. Despite its claim to the contrary, the state itself has been the single major factor in adversely affecting the ecological harmony by way of constructing mega-projects with scant regard to the sufferings of millions of people uprooted from such sites. The loss to government and people is being rationalized in terms of growth, development and security of the nation. This unhappy situation has forced

---

1. Mithal, R.C, Joshi, B.C. and Gohain, K. (1984) : "Environmental Impacts of the Ram Ganga Dam", National Geographical Journal of India, Vol. 30, pt. II, pp. 81-91.

people from nearly all walks of life to agitate to keep the environment safe from the inhuman plunder to spread consumerism, helping the big business interests. Geographers, traditionally concerned with the understanding of "social man in the natural space" have an exceedingly important role in exposing the danger the humanity faces at the present juncture.<sup>2</sup>

## 1.2. STATEMENT OF THE PROBLEM

The proposed research intends to study the socio-economic impacts of developmental interventions in hilly and tribal areas of India by taking a case study of Umiam Hydel Project located near Shillong, the capital of Meghalaya. The study aims at evaluating the social, economic and demographic impacts of the hydel project on the people living close to the river in down-stream areas from the dam site at Barapani. The study is confined to an analysis of these impacts on the villages situated along the river course roughly for a distance of over 60 kms. within Meghalaya Plateau. The primary aim of the research is to assess the impacts on the village economy and society and come to a conclusion as to the viability and effectiveness of such small scale developmental interventions in tribal areas of Meghalaya in particular and in the country in general by way of inference and generalization.

---

2. Nayak, D. K. (1990) : "Geography, Environment and Social Concern", Transaction of the Institute of Indian Geographers, Vol. 12, No. 2, p. 155.

Studies on river valley projects in India have generally indicated their adverse impacts on tribal society and economy largely due to their inability to quickly adjust to the changed environmental conditions. The significance of the study is related, therefore, to the present day concern of the consequences on tribal ecosystem in the name of development of people with scant regard to the differential nature of the gains in diverse geographical conditions. The social scientists are engaged in a fierce debate as to the efficacy of large scale multipurpose river-valley projects in the context of its overall negative consequences on environment, economy and society of the people affected by such interventions and the positive benefits accruing to people who may not be sacrificing anything for these development. There are enough evidences to suggest that these projects have had quite contradictory consequences for people located in up stream and down stream areas as well as for the people who are to be displaced from areas submerged after the completion of the project. It is often pointed out that the development gains reach to those people who are far away from the immediate vicinity of the project site at the cost of those who are directly affected owing to either a rise or diminution in water supply. The impacts, in short, assume different characteristics in different geographical areas which are vastly different, implying diverse capacity to internalize both positive and negative gains.

While studies abound with regard to impacts of multi-purpose, large river valley projects on the people displaced or are threatened with such a fate, very little attention has been paid to the consequences of small-scale river valley projects on the people living in down stream who may be directly affected due to these constructions. The present effort is directed towards an understanding in this area of concern.

### 1.3. THEORETICAL PERSPECTIVE

Before analyzing the social, economic and demographic consequences of river valley projects in tribal area in developing countries like India, it is imperative to outline the original frame in which such issues can be meaningfully understood. Theoretically speaking, changes come in a society in the natural course of social evolution. "It may be rapid if social groups has generated an internal dynamism of its own which encompasses all segments of population. Such an endogenetic change may be lasting until it gets reinforced by exogenous contact and continued renewal. On the other hand, it may be slow, even imperceptible, if it gets stagnated by historically determined or socially caused inertia which threats internal dynamism and arrests progress. In any case change has to be seen in a time-space frame. Denuded of its time context and space-milieu, it would be as incoorageous unintelligible.

3  
-----  
3. Ahmad, A. (1984) : "Socio-Cultural Change in a Developing Society - The Case of India" (mimeo.), pp. 1-2.

in the hilly areas cannot avoid these basic issues concerning conceptual basis of development. Again conceptually, change is not uni-directional. It may be progressive or regressive. This element of change undoubtedly raises the inevitable question of value system which involves the necessary logic for discriminating between positive and negative dimensions of change. The former, as the cumulative human experience shows, can be attained through institutionally directed intelligent intervention in the situation. Then it is called development as it brings about a qualitatively new, irreversible sequence of changes, eventually leading to transformation. The most important question concerning development in hilly and tribal areas inevitably leads one to ponder over its specific consequences considering the uniqueness of geographical, ecological and social setting of the area concerned.

#### 1.4. CHOICE OF THE STUDY AREA

The study area (Fig. 1.1) is confined to a narrow zone along the Wah Umiam from the project site in the down-stream. The area of study, however, is confined to the Meghalaya plateau only.

The area forms part of the Central Shillong Plateau, by and large exposing the Shillong group of rocks. However, its north-western corner is represented by gneissic complex. Significantly the varied geology has controlled the evolution of landforms in the area.

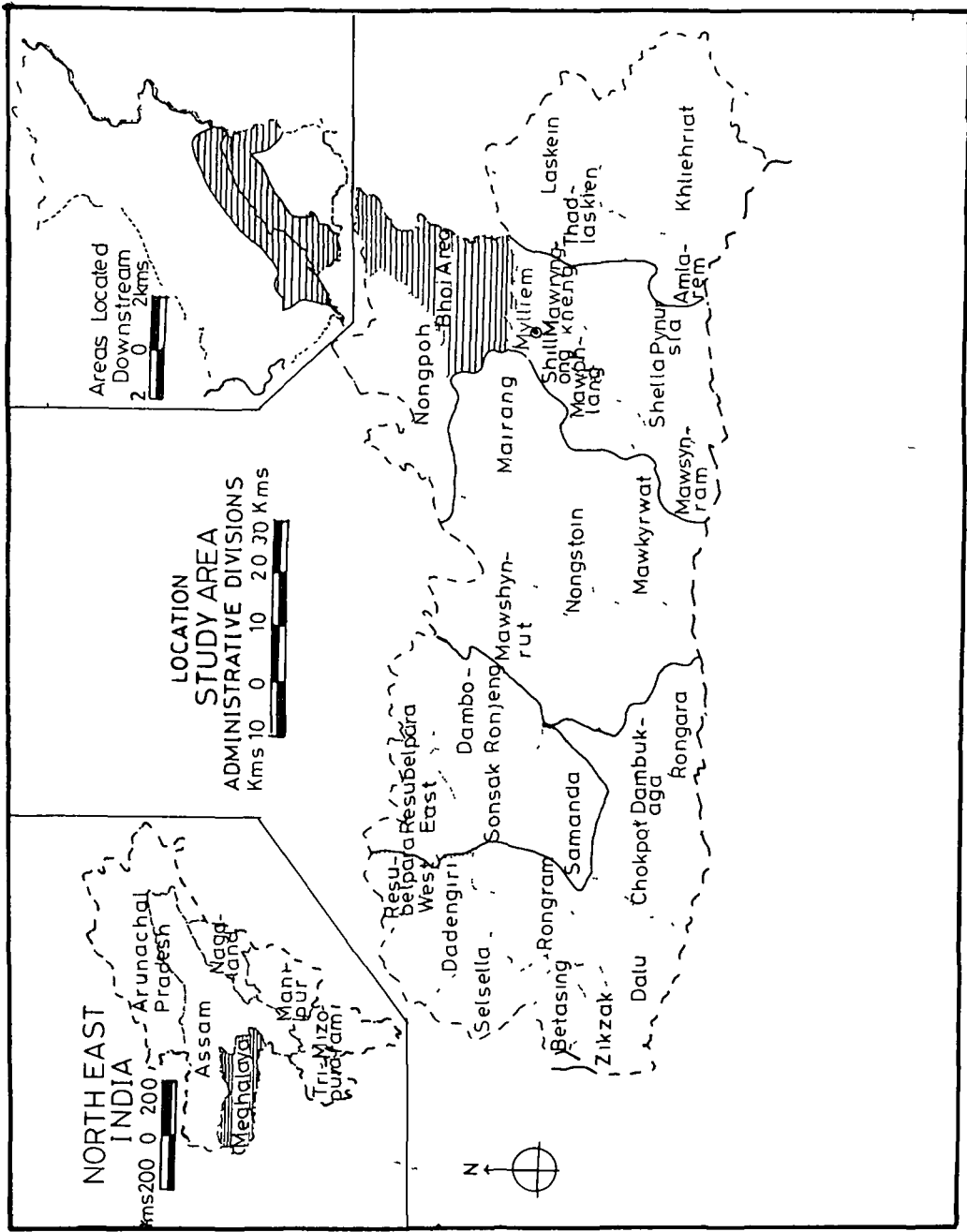


Fig 11

The different geomorphological features in any study area have relief manifestations on different scales. The relief is based on difference of elevation. The important relief elements are absolute relief, relative relief and altitudinal distribution. The relief analysis of the area helps in revealing the evolutions of different relief features.

The area has the lowest elevation (800 m) in the north-western corner. Significantly this is underlain by gneissic complex. In general the absolute relief rises towards the south. The height of above 1800 m appears as patches towards the southern corner of the area. The lowest relative relief of less than 50 m is confined to the north-western corner, the central part and the south-eastern corner of the area. In the area of study, the relief increases with the rise in absolute relief.<sup>4</sup>

The area in which the hydel project is located is dominated by hilly terrain. The site of the project is only 15 kms. away from Shillong, the capital town of Meghalaya. The study area is interspersed with settlements exclusively or largely dominated by the local tribes, i.e., the Khasis. The project after being completed, has fulfilled some of the developmental requirements of the region through generation of hydro-electric power as well as providing economic base for fishing and tourism.

---

4. Aggarwal, Mandira (1989) : Geomorphological Studies Around Umiam Lake and Adjoining East Khasi Hills, Meghalaya, Unpublished M.Phil Dissertation, NEHU, Shillong, p. 4.

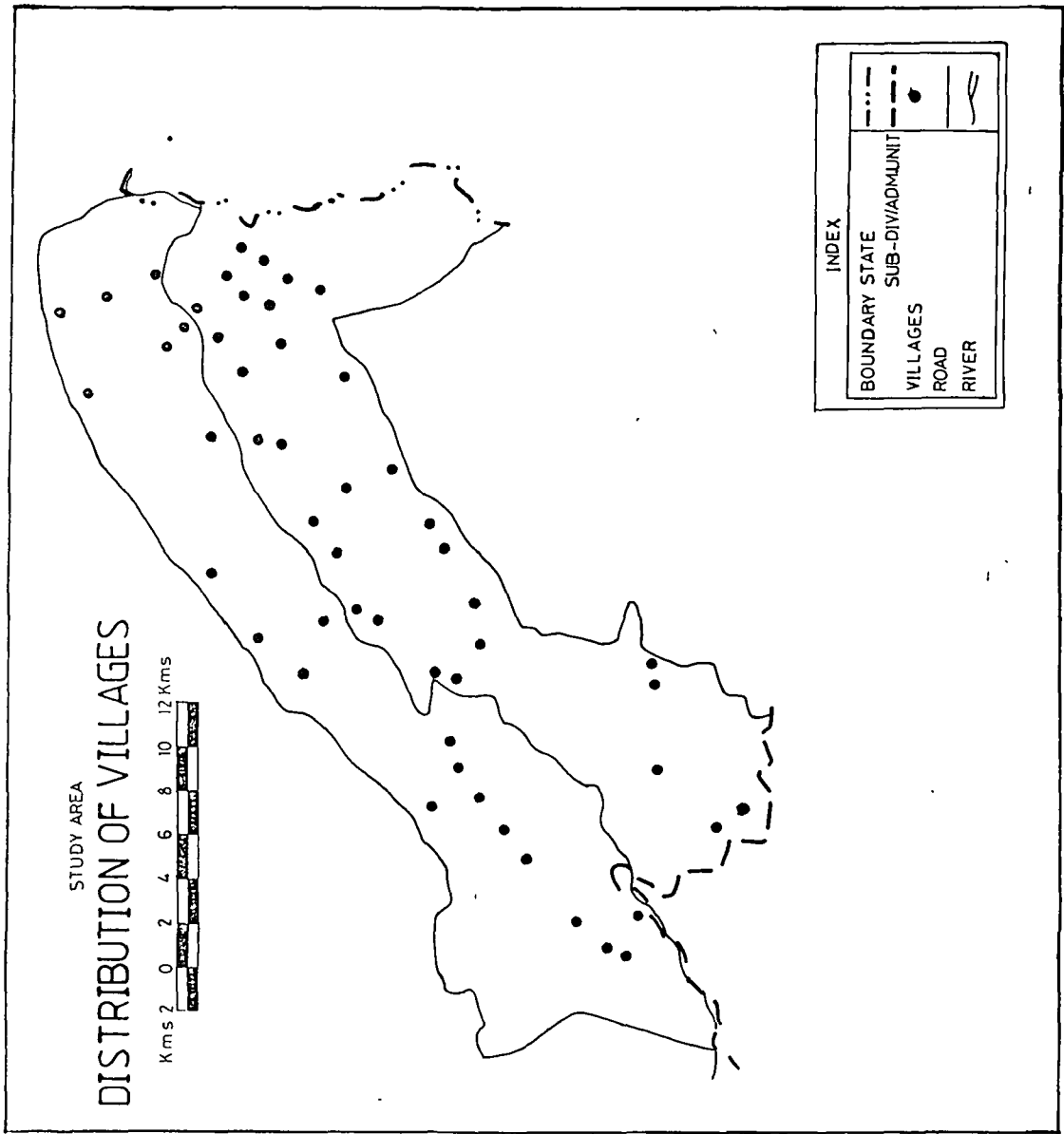


Fig12

## 1.5. OBJECTIVES

The following broad objectives are set before the research.

- (a) to describe and examine the patterns of social, economic and demographic adjustments in the study area prior to the construction of the hydel project;
- (b) to analyze the changes introduced into the social, economic and demographic life of the people living in the study area after the construction of the dam;
- (c) to assess the consequences of the hydel project on the economy and society in the down-stream areas and
- (d) to evaluate the socio-economic viability of such projects in the hilly and tribal areas of the country.

## 1.6. RESEARCH QUESTIONS

The following broad research questions have been investigated :

- (i) What have been the responses of the people living in the down-stream areas to the diminution in the water supply as a consequence of the construction of the dam at Barapani?
- (ii) Whether the changes in the economy and society in these areas have a distance-decay relationship with particular reference to the zone in the immediate vicinity of the dam.
- (iii) Whether small-scale interventions into the natural ecosystem in hilly and tribal areas have positive or negative impacts on the process of regional development.

## 1.7. SOURCES OF DATA

The data is obtained mainly from secondary sources - toposheets, maps, census handbooks for the period 1961-1991. Identification of the study area, understanding of the

topographical features and location of villages are based on toposheets.

Socio-economic and demographic data pertaining to the identified villages are collected from the census data of 1961, 1971, 1981, and 1991.

#### 1.8. METHODOLOGY

Based on data mostly collected from successive Indian censuses from 1961 onwards, the study attempts to fulfill the objectives stated earlier. The choice of 1961 census as a starting point has a vintage value as it effects the condition prior to the construction of the dam at Barapani. The year 1971 records data immediately after the construction. The informations after this year provides valuable insights into the process of stabilization and adjustment achieved after the period of relative turmoil owing to the construction of the dam.

The study is restricted to an understanding of the conditions in around 43 villages (as per 1981 census) located in the down stream areas, starting from the project site and extending upto the end of the plateau. The villages have been classified into five broad zones depending upon their distance from the project site and with the assumption that the impacts of the construction would vary with relative distance from the project site. The zones are :

1. Upto 20 kms.
2. 20-30 kms.
3. 30-40 kms.
4. 40-50 kms.
5. Above 50 kms.

The socio-economic impacts of villages located in each of these distance zones are analyzed with the help of the following variables :

- (a) Changes in the number and population size
- (b) Changes in the growth rates of population
- (c) Changes in sex-ratio
- (d) Changes in the worker non-worker ratio
- (e) Changes in the proportion of workers (classified into males and females separately)
- (f) Changes in the proportion of agricultural work force (classified into males and females separately)
- (g) Changes in the proportion of cultivators to total workers (classified into males and females separately)
- (h) Changes in the ethnic composition of the villages with particular reference to the percentage of tribal population in the total.

The assesment of each of these indicators is based on the following criteria,

- (i) Changes at the aggregate level
  - (a) state
  - (b) regions under consideration
- (ii) Changes in each distance zone.

A correlation analysis has been attempted to indicate the association, if any, between distance of the villages from the project site on the one hand and the changes in respect of each of the indicators listed above. Data collected for each of the variables have been presented cartographically to indicate spatial variations in the nature of the changes.

## 1.9. ORGANIZATION OF THE MANUSCRIPT

The study is organized into five broad chapters. The first chapter presents the research design and outlines the main objectives, research questions and methodology adopted. The second chapter devotes itself to an understanding of the regional setting of the study area. Social, economic and demographic changes are analysed in the following two chapters. The final chapter highlights a summary of the findings.

## 1.10. AN OVERVIEW OF LITERATURE

There are two schools of thought as far as the developmental projects are concerned. One school of thought is in favour of such developmental projects. According to this school of thought, such developmental projects are vital to the social and economic development of any country and region. According to Udaya Bhaskar Reddy; the multi-purpose dams were known mainly for their contribution to economic development by providing irrigation, electricity and flood control. In a developing country like India, where an overwhelming majority of population are depending on agriculture, dams are regarded as essential for meeting the country's critical requirements of agriculture, electricity for various purposes and flood control.

- 
5. Reddy, Udaya Bhaskara (1991) : "The Implications of Large Dams in India - A Case Study of the Narmada Valley Project", Geographical Review of India, Vo. 53, No. 3.

Another school of thought is against the construction, most of them belong to the environmentalist and conservationist group. According to this school of thought, the construction of dams are detrimental to the environment of the regions. In the words of R.S. Mithal, B.C. Joshi and K. Gohain, "the environmental impacts associated with the river valley projects have drawn wide attention of the environmental <sup>6</sup> scientists throughout the world.

These two views can be clearly understood by a reference to a description and explanation of the impacts of the river valley projects:

R.S. Mithal, B.C. Joshi and K. Gohain in their study on the impact of the Ram Ganga Dam on the physical landforms stated that due to the reservoir, most of the geomorphic units have been submerged in water, and thus have reduced the extent of the pasture lands and grazing fields to be used by the wild <sup>7</sup> atmosphere .

Himalayas have very fragile rocks and rock slippage and landslides are common. The river erode their banks and frequently change their courses. Construction of roads and developmental projects accelerate the process of soil erosion.

Watershed management in the river catchment is a remedy for arresting soil erosion. This includes suitable agronomic practices, vegetation management and engineering measures.

- 
6. Mithal, R.C. *etal.* (1984) : *op.cit.*, 81-91.
  7. *Ibid.* : p. 90.

These engineering measures may include terracing of land, construction of gully control structures, rivetments, checkdams, desilting basins, basin stabilization and channel improvement .

The Lower Himalayan formations in the catchment area of the Ram Ganga are geologically disturbed formations, with soft rocks and thin soil cover. Thus, during the rainy season, the soil is washed down and carries a heavy silt load. the life of the reservoir was calculated for a period of hundred years and the sediment volume accumulated over the same period worked out to be as 13,40,787 ha., for the total catchment area (Ram ganga Project Report, 1963).

The sediment carried by the river is deposited in storage reservoir and reduces the effective life of storage (Ranga Nadi Hydel Project Report).

The annual rate of siltation per 100 sq. kms of catchment area was assumed to be 1.55 ha.m. of silt. But later survey showed that the siltation increased to 5.62 ha/m because of deforestation in the catchment area (Alveras and Billarey, 1988). Such a phenomenal increase is bound to reduce the life span of the dam and cripple its economic viability. Water

8. Ibid. : p. 90.

9. Ibid. : p. 90.

10. Pal, T.K. and Nath, P. : "Ranganadi Hydel Project - Environmental Aspects and Prospects in Fisheries", Indian Journal of Landscape System and Ecological Studies, Institute of landscape and Esketics, Vol. 13, No. 2, pp. 38-42.

11. Mithal, R.S. etal. (1984) : op.cit.,

logging and excessive salination turns millions of hectares  
infertile besides farming major sources of seismic activity. <sup>12</sup>

The lands around Narmada Sagar is very rich in black cotton soil having high water retention capacity. A study conducted by Indian Institute of Science, Bangalore, has warned that as high as 40 per cent of the total command area, one lakh hectare of black cotton soil under Narmada Project would suffer chronic water logging which in turn increases salinity and render soil infertile. <sup>13</sup>

Studies have revealed that the big multi-purpose dams which were constructed in the past with the avowed aim of controlling the menace of flood hazards have actually increased its incidence. <sup>14</sup>

An emergency release of water during peak floods, or due to land slides from the fragile hill side around the reservoir could inundate the towns and hundred of villages down stream. <sup>15</sup>

The location of the zone in the seismic zone bears the risk of seismic activity which is the case of the Ranga Nadi Hydrel Project. <sup>16</sup>

---

12. Pal, Mahi (1988) : "Socio Economic Viability of Big Projects", National Herald, July 24.

13. Ibid. :

14. Ibid. :

15. Kpthari, A. (1992) : "Tehri Dam - Memorable Fast", Mainstream, Vol. 30, No. 26, April 18.

16. Ibid.

The strongest argument against the construction of the Tehri dam project has been that it falls in a highly earthquake prone area, which could experience quakes with an intensity of 5+ on the Richter scale. The dam is designed to withstand an earthquake of maximum 7.2 intensity. If a quake causes the dam to burst, the resultant floods would devastate towns like Hardwar.

It is important to mention here that the Ram Ganga and its tributaries contribute a significant amount of flow to the ganga system during the cold winter and dry summer months also. The rains fall in the catchment, mainly during the period June to October and occasionally in the month of December and January. The hydrological data pertaining to Kala Garh Dam site for more than 60 years upto 1964 (Ram ganga Project Report, 1963) is as follows -

1. Average annual precipitation = 1550 mm.
2. Average annual run-off = 0.268 M.ha.m.
3. Maximum annual run-off = 0.468 M.ha.m.

The discharge of the river at Kalagarh gauge site varies from 10,000 m<sup>3</sup>/sec. during monsoon to more than 5 m<sup>3</sup>/sec. in winters.

There is hardly any appreciable amount of snowfall in this area as the catchment lies below the perpetual snowline. Therefore, the amount of flow in lean period is a contribution from the ground water only. This is imperative as the

---

17. Ibid.

catchment is mainly comprised of the highly permeable porous sedimentary Siwalik and lesser Himalayan formation, viz., sandstone and limestone with some meta sediments, viz., phyllites and quartzites, minor foliated gneisses coupled with numerous fractures due to faults and thrust encompassing the entire catchment.

18

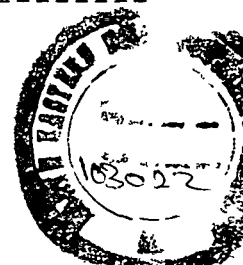
The construction of the Ramganga Dam created a reservoir of 67.34 sq. km. in area. The reservoir occupies parts of the valley of the Ramganga, the Sonanadi and Mandalti and is spread over the middle and Upper Siwalik formations. During the maximum floods level the reservoir covers an area of 80 sq. km. Due to the filling of the reservoir all the level terraces upstream of the reservoir has been submerged, endangering the grass and thick tree population grown on these terraces. During the high flood level the reservoir water spreads upto the forest rest house at Dhikala.

The rock formations around the reservoir consist of alternate bands of sandrocks and clay shales dipping into the reservoir. Hence there is a leakage of reservoir water and no change in the ground water level in the nearby areas in the catchment. However, in the command area it has been reported that after damming and diversion of the river the ground water level decline enough to abandon shallow dug and artisan wells along the down-stream courses of the "Ramganga".

19

18. Mithal, R.S. etal. (1984) : op.cit., pp. 81-91.

19. Ibid. :



The construction of the Dam would result into the wiping out of the rich flora and fauna of a large space by inundation of the forest area. Moreover, fragile hill-slopes may topple over due their slippage by absorption of water from the reservoir. This may further cause the destruction of more forest areas on the sides of the reservoir. Aquatic weed growth would almost certainly be induced in the leutic lake-water.

Before filling the reservoir luxurious growth of vegetation including Sal trees had to be removed from the reservoir area. The terraces of the up-stream site are now submerged into water thereby reducing a 32 sq. km. area of grassy field. The growth of the aquatic weeds/plants has been observed in the reservoir, which are new to the floral population of the lake area.

The creation of the reservoir has been acting as a barrier for the wild animals in the National Jim Corbett Park. Formerly, the elephants, tigers, deers, etc., were crossing the river during the dry periods and thus these animals were evenly distributed along the banks of the river. The deep reservoir act as a demon to these animals causes migration of their habitat to the higher ridges. Anther cause of migration is also the reduction of the grazing fields which have been submerged. The new lake is also now acting as the herald of the migrating birds in the winter and for big fishery. On the other hand the dam is also acting as a barrier to the control

of flow and deposition of sediments into the reservoir nutrients for the fishes down-stream have been reduced, thus affecting the population.

Malaria and filariasis are common water -borne diseases transmitted by mosquitoes, have been observed to be concerned with many river valley projects.

At the same time Pal and Nath stated "it would not be appropriate to overspeculate or overpublicise health hazards. It is required to associate health organization or unit right from the implementation state for devising adequate safeguards and taking preventive measures.

Power generation and irrigation are the major benefits related to the construction of the dam. The Ramganga Dam Project (biggest in the region) has maximum contribution to the developmental activities in this area with an irrigation potential of 6,66,000 hectares and 198 MW of power generation. The power although was targeted at 198 MW by the three turbines, yet generation achieved so far is hardly one third of the total potential, main reason being the reported paucity of a regular supply of water to run all three turbines simultaneously.

According to Aunohita Mazumdar, though the Auranga River Project will irrigate a large area (11 blocks in all), the

- 
20. Ibid. :  
21. Pal, T.K. and Nath, P. : op.cit.  
22. Ibid. :

question that is important, especially in country of such vast wealth discrepancies, is that of the beneficiaries, who will the dam be benefitting? The benefits of large scale irrigation are most readily available to the large land owners who can afford to invest in other inputs (such as fertilizers and better quality of seeds) which are necessary for the actual utilization of irrigation. Irrigation may also entail a change in the cropping pattern which the richer peasantry are better equipped to meet.

23

The project site has been made attractive for the tourists with parks and terrace gardens in the vicinity both at the foot-hills and and close to the project site. Since completion of the project area attracts a large number of tourists and a beautiful township is being developed which may ultimately come as a tourist resort in addition to the closeby National Jim Corbett Park. The reservoir and the surrounding area could be used for recreation, boating, swimming. The project site has nearly all the infrastructures for the attraction of visitors.

24

People dependent directly or indirectly upon the land acquired for the project construction or submergence will be affected. With the change in their surrounding landscape and environment, they may face loss of their livelihood and change in profession.

25

The influx of large number of workers from -----  
23. Mazumdar, Aunohita (1989) : "Dam or People", Mainstream, June 17.

24. Mithal, R.S. etal. (1984) : op.cit.

25. Mithal, R.S. etal. (1984) : op.cit.

the outside may also create problems of social contradiction  
with local tribal people.

26

At the same time Pal and Nath argued that the project can directly affect large population. However, suitable rehabilitation programme, if required, forming an integral part of the river valley project may help settlement of the displaced persons. This may include adequate payment of compensation for land, houses and other property acquired; introduction of suitable educational and vocational training schemes for the people so that they are trained for new trades as well as accept the project happily . Whereas Mazumdar in one of his publications entitled "Dam or People, a study on the Auranga River Valley Project" stated, that the project is to displace 10,000 to 12,000 villagers from 30 villages. Since they belong to the most backward sections, it seems that the self declared objective of welfare" has been lost sight of  
somewhere on the way.

27

28

According to Reddy, all the proposed dams in the Narmada river basin would lead to eventual displacement of over two million inhabitants. This as even the World Bank admits, will be the largest river basin population resettlement to date. These two dams will displace nearly two lakhs people, who will face total economic, social and cultural deprivation and disruption in Madhya Pradesh, Maharashtra and Gujarat. While

---

26. Mithal, R.S. etal. (1984) : op.cit.

27. Pal, Tk. and Nath, P. : op.cit.

28. Mazumdar, A. (1989) : op.cit.

another 365 villages will be partially submerged as a result  
29  
of the execution of the Project.

#### 1.11. CONCLUDING STATEMENT

It is evident from the preceding overview of literature that understanding on the impacts of river valley projects are by and large confined to mega-projects and the impacts of minor projects are generally ignored. Secondly, most studies emphasise on the broad environmental impacts of these projects while studies on the social and economic adjustments of people affected by such projects are few. Thirdly, very few studies attempt to study the impacts on down-stream population who may also be directly or indirectly affected due to these constructions.

The present research, therefore, aims at fulfilling these gaps in research and undertakes a closer examination of small-scale projects on river valleys located in hilly and tribal areas. The specific focus of this research is on the changes overtaking the down-stream areas with particular reference to the demographic, economic and social adjustments of the people living in these areas. The attempt is to determine the impact of the project as reflected by the changes taking place in the region down-stream to the project site after the construction of the dam. It is expected that the nature of socio-economic changes in the down-stream areas would permit a

-----  
29. Reddy, Udaya Bhaskara (1991) : op.cit.

value judgment on the efficacy and desirability of such interventions in the hilly and tribal areas of the country.

## CHAPTER - II

## THE REGIONAL SETTING

### 2.1. INTRODUCTORY STATEMENT

In this chapter, an attempt is made to get a fuller insight into the physical setting of the region in which the study area is located. The main objective of this chapter is to provide a background to the problem to be investigated. The background is necessary as it helps in an understanding of the geographical setting of Meghalaya plateau of which the study area forms a part. The next section is devoted to a description of the hydel project and the consequent lake formation. The third section provides a description of the socio-economic condition of the study area. The area of study falls in the Survey of India toposheets surveyed in 1964-65.

The area falls under the Bhoi C.D. Block, formerly of the East Khasi Hills district, but now it falls under the newly formed Ri Bhoi district. The important township of Shillong is located to the south of the study area. It is connected with Guwahati by National Highway No. 40. The Umiam Lake, locally known as Barapani, is located around 18 Kms. away from Shillong and is accessible by the National Highway No. 40.

### 2.2. GEOGRAPHICAL BACKGROUND OF THE PLATEAU

#### 2.21. Physiography

Physiographically Meghalaya represents a remnant of an ancient plateau of Pre-Camarian Indian Peninsular Shield,

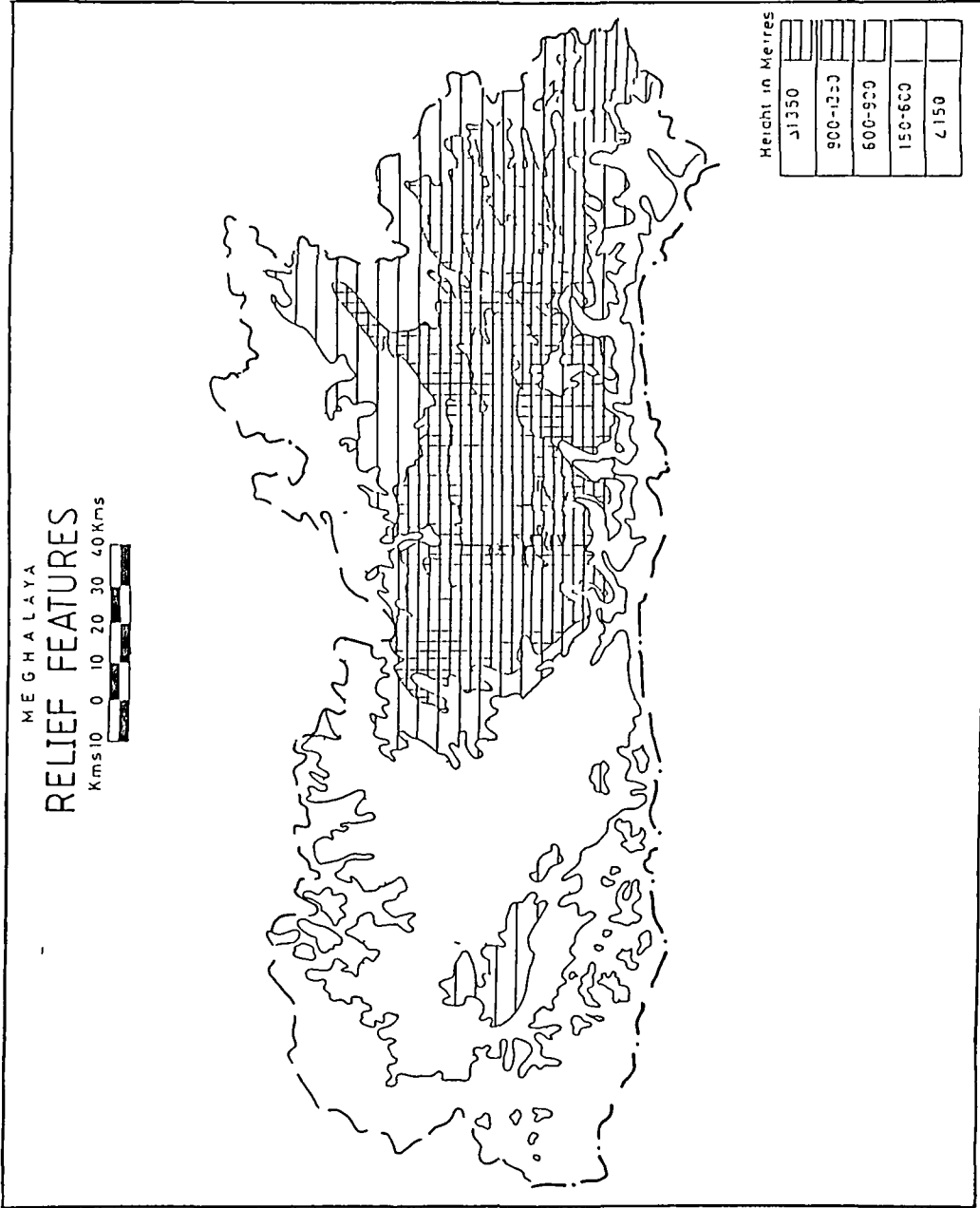


Fig 21

block rejuvenated to its present height of about 600-1900 meters above the mean sea level. Shillong Peak, the highest peak of the plateau is at 1951 meters. above mean sea level. The kernel of the plateau is comprised of the oldest rocks in the state, the Gneisses complex alone with the Shillong group of rocks.

The ancient peneplained surface of the plateau is still preserved with marks of different cycles of denudation, in the central and northern part. It is hidden beneath the mesozoic traps along the central southern fringe and cretaceous tertiary and post-tertiary sediments over the south, southern and south-western parts.

The plateau forms a watershed between the Surma Valley of the Bengal Plains in the south (Bangladesh) and Brahmaputra Valley in the north. The Shillong plateau a horst which has been block-uplifted during mesozoic time to its present height and its tectonic history begins with the diffusion of Sylhet traps through fractures and faults in the basements and uplift and subsidence of adjacent basement blocks. In the western part of the plateau in the Garo Hills, the Tura range is a horst which is bounded to the south by the Depsi Fault.

Thus Meghalaya plateau has indeed a chequered evolutionary history of emergence and peneplanation with several phases of erosion, sedimentation, diastrophism,

---

1. Agarwal, Mandira (1989) : op.cit., p. 5.

intrusion, movement of land and sea. The plateau has experienced the influence of an alternate phase of transgression of sea waters from mesozoic to early tertiary.

Based on the above facts, Meghalaya plateau has been divided as upper, middle and lower plateau. The upper plateau ranges from 600 to 1900 m elevation above mean sea level. The middle plateau is ranging from 300 to 600 m above mean sea level. Some high undulations having very steep slopes are present over the plateau at some places which is due to the local horst (Fig. 2.1). On the north broken ranges of irregular hills round topped hills are present in the south and south eastern border of the entire plateau.<sup>2</sup>

At some places in the central and south eastern plateau, magnificent gorges more than 600 m deep are present. Thus the main physiographic units in the entire plateau are based on degrees of undulations and slopes which is the result of severe dissection by stream, rivulets and rivers. The undulations mostly have rounded tops in the northern part of the plateau, which represent the gneissic complex.

The major physiographic units are as follows :

- a) Upper plateau, middle plateau and lower plateau of Gneissic complex.

---

2. Ibid. : pp. 6-7.

- b) Upper plateau, middle plateau and lower plateau of Granite.
- c) Upper plateau, middle plateau and lower plateau of Sedimentary sequence.
- d) (Cretaceous-Tertiary), mostly concentrated on the south west, south and south eastern parts of the plateau.
- e) Valleys.
- f) Piedmont zone mostly concentrated on the northern border of the plateau.
- g) Alluvial plains.
- h) Hills.

#### 2.22. Drainage

The drainage of Meghalaya is controlled by the Tura range and the central upland zone which act as water divide (Fig. 2.2). In the Garo Hills, the important rivers of the northern system from west to east are, the Kalu, Ringgi, Chague, Ajagar, Didram, Krishnai and Dudnai. Of these only Krishnai and Kalu are navigable. The important river system are Darrang, Singsang, Sanda, Bandra, Bhogai and Dareng. Singsang is the largest in Garo Hills and navigable only for about 30 kms. Its main tributaries are Rongakai, Rongdi and Chibok.

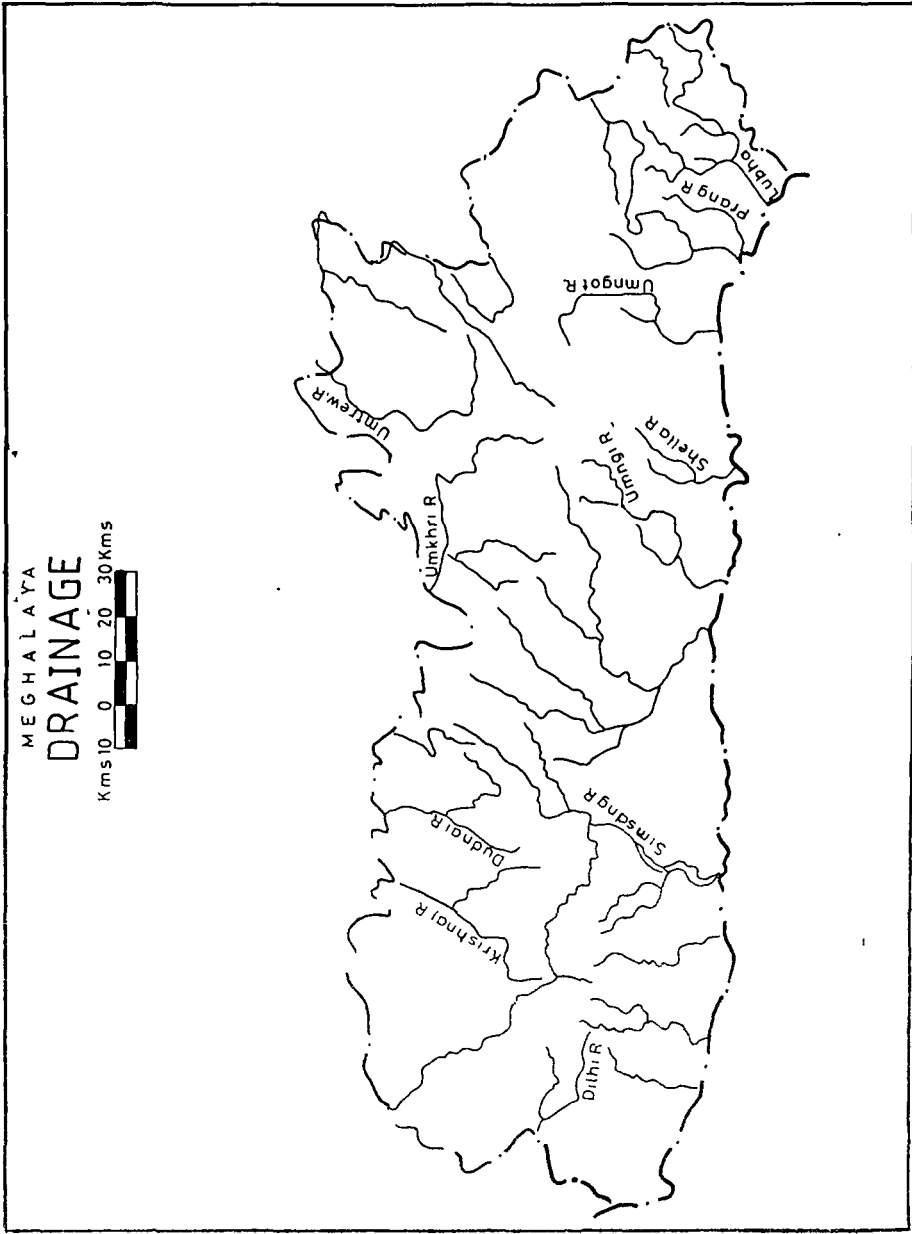


Fig.22

In the central and eastern sections of the plateau the two river systems are northward and southward flowing. The important northward flowing rivers are Umkhri, Digaru and Umiam. Correspondingly, southward flowing rivers are Kynshiang, Mawpa, Umiew, Umngotand Myntdu. The northward flowing rivers form flat embankment when they enter the plains. Whereas the south flowing rivers form deep valleys and faulted surfaces before descending to the plains.<sup>3</sup>

### 2.23. Climate :

Climate is influenced by elevation and distribution of physical relief. There is a significant influence of alternating pressure cells located in the northwest India, and by depression in the Bay of Bengal in the south. Thus on the basis of weather conditions, the Meghalaya plateau has four distinct seasons :

- (a) The rainy season from May to early October.
- (b) The cold season from early October to November.
- (c) The cold season from December to February.
- (d) The warm season or hot season from March to April.

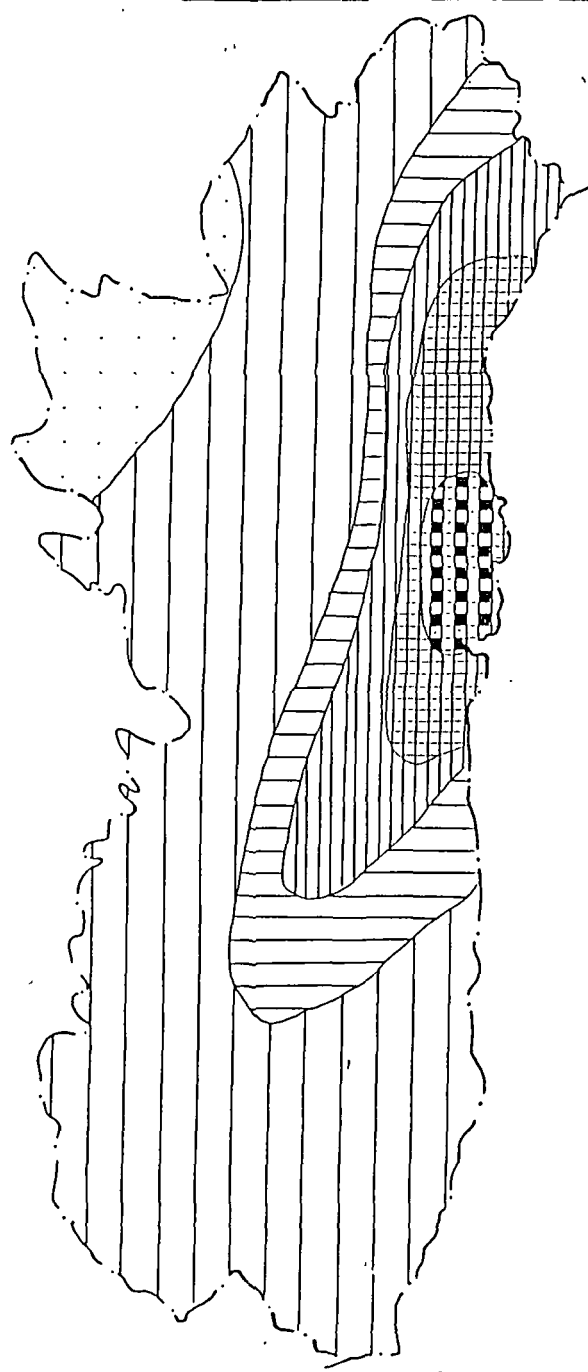
In this period the entire plateau witness strong winds. In the plateau area, the Garo Hills which is at a lower elevation compared to Khasi and Jaintia Hills is experiencing higher temperature and humidity from February to October.

---

3. Gopalakrishnan, R. (1989): Geography of Meghalaya, Rajesh Publication, pp. 5-16.

MEGHALAYA  
ANNUAL DISTRIBUTION OF RAINFALL

Kms 0 10 20 30Kms



Rainfall In MM
>10000
8000 - 10000
6000 - 8000
4000 - 6000
0007 - 0091
7 1500

Fig 21

April and May are the warmest months with an average temperature exceeding 32<sup>o</sup> C. On the other hand, the temperature of the coldest month, January has an average temperature 24<sup>o</sup> C. The nights are cold and experiences heavy dew.

Correspondingly, the amount of rainfall also significantly varies, with more than two-thirds of its falling in the rainy period of the monsoon season. Garo Hills recorded an annual average of 3330 mm. The winter months are almost dry and have recorded an average of 20 mm between December and February. The nature of elevation and slope has also influenced the distribution of rainfall. The rainfall is heaviest in south eastern Garo hills (7400 mm) and decreases in the central regions (3000-4000 mm) and in the north (2500-3000 mm) (Fig. 2.3).

The Khasi and Jaintia Hills, on the other hand, because of higher elevation, experience a moderate climate. But for the foothills region in the south and sub-montane region in the north and central uplands, warm and humid conditions are prevalent. On the average, the plateau experiences a temperature of 24<sup>o</sup> C throughout the year. The night temperature goes below 1-5<sup>o</sup> C in winter but maintain a mean average temperature of 3-5<sup>o</sup> C to 4-5<sup>o</sup> C in December and January. Winter is also characterized by heavy frost.

The southern parts of the plateau has the Cherra-Mawsynram region. The zone has a maximum of 24<sup>o</sup> C in June and

20 C<sup>o</sup> in January. It receives the heaviest rainfall with an annual average of 12070 mm. This is due to its location at the head of Bangladesh plains. The south-west monsoon strikes these regions as it rains abruptly from the plains.<sup>4</sup> The vertical movement of this moist monsoon streams precipitate heavily in the escarpment region. This type of rainfall is known as orographic rainfall.

On the whole, the Khasis and Jaintia hills receive an average of 7700 mm of rainfall. With more than three-fourth falling in the monsoon season. The rest of the year is dry and receives an average of 60 mm rainfall mainly in December and January.<sup>5</sup>

#### 2.24. Soils :

The soils of the plateau, like other region in the country are influenced by geology, relief, climate, and vegetation. There are four distinct categories of soils. These are -

- (a) The red loamy soils of central Garo hills and upland zones in Khasi and Jaintia hills and derived from weathering of granites, gneisses, diorites and others. They are rich in clay forming minerals and poor in silica. With a general loamy character, they vary from clayey to sandy.<sup>6</sup>

---

4. Ibid. : pp. 16-19.  
5. Ibid. : pp. 16-18.  
6. Ibid. : p. 19.

Their surface profile is about 300 m in thickness in colours ranging from reddish brown to dark brown. They have rich organic content but show a significant deficiency in phosphate and potash.

- (b) The laterite soil are found in a broad belt extending from west to east in the northern parts of Meghalaya plateau. They have formed through weathering of quartzite, schist, conglomerate etc. The soil is reddish or yellowish in colour and are rich in iron.
- (c) Red and yellow soils are largely found in the foothills regions along the east west belt. The soils are of fine textures ranging from loam to silty loam.
- (d) Alluvial soils are found along northern, western and southern fringes of the plateau. They vary from sandy to clayey loam with varying nitrogen content. They are highly acidic. They are rich in potash but poor in phosphate. In general the soils are thin, immature and light in colour. They are clayey and less fertile on the hill tops and are thick, mature, deep in colour, more clayey and fertile in the valleys.

## 2.25. Natural Vegetation :

The region has a variety of natural vegetation ranging from tropical mixed forest to pine forest. This reflects the variations in physical and bio-climatic conditions. In western Meghalaya, the northern and southern foothills with warm and humid climate are characterised by dense tropical mixed forest's with sal (shovia robust) and bamboo. Other species that are found in the region are Gurga, haldu, Ganes etc. In higher altitude notably in Tura range, temperate forests are found with pines and firs as common occurrence.<sup>7</sup>

Mixed tropical hardwood forests are found in the northern and southern parts of the central upland. The main species are sal, nohar, champa, gomari, etc. Large thickets of bamboos are scattered all along with wild banana. Rolling grassland are found between 900 - 1300 m. Pine forests are found above 1350 m. Main species are found mixed with willow, magnolia, oak, etc.

Most of the ridges in the area comprising Shillong Group of quartzite and sandstone support luxurious vegetation. In general the ridge slopes above 900 m have mainly pine forests (*Pinus Longifolia* and *Pinus Khasiana*). The pine forests are devoid or are poor in bushy undergrowth. The ridge slopes below 900 m generally contain mixed forests of bamboo, rhodendron, camellia, and bushy undergrowths.

---

7. Ibid. : p. 20.

### 2.3. THE HYDEL PROJECT

The Umiam hydel project is located along the Wah Umiam at a distance of 18 kms from Shillong connected by National Highway No.40. The plan for the construction was conceived in the late 1950's and the project began in 1960 and it was completed in the year 1965. Although the estimated total cost for the construction was Rs 9 crores, but the actual cost is Rs 14 crore, 5 crores more than the estimated total cost.

The construction of the Umiam hydel project has led to the submergence of the Umsaw Khwan village, occupying an area of 3600 acres. As a result 600 people were displaced. Out of the evicted people, the majority are the local tribes (the Khasis) for whom the serious impact of displacement is the break from their natural surroundings.

In general the positive impacts of the hydel project includes generation of hydel-electricity, irrigation, flood control, fishery and recreation. However the Umiam hydel project is meant specially for generation of electricity and also includes fishery development, drinking water and recreation.

The hydel project has a power output of 105 M KWH. The power production however directly depends on the availability of water, i.e., rainfall. An estimated yearly average

8. These informations have been collected from the office of the Meghalaya State Electricity Board, Shillong.

production is around 150 M KWH. The electricity is being supplied not only for the state of Meghalaya but also parts of the adjoining state of Assam.

The Umiam lake presents a beautiful scenic view, and act as an attractive tourist spot. Since the time when the Meghalaya Government handed over the lake to the Meghalaya Tourism Development Corporation, the lake was made attractive from tourist point of view. Besides, there is also a tourist resort centre at the vicinity. The reservoir is also used for recreation, boating and fishing. However, fishing on the main dam is prohibited. The area attracts a large number of tourists and the Meghalaya Tourism Development Corporation has been trying to improve the existing infrastructural facility and also providing the new ones.

The volume of water in the reservoir is about  $141.8 \times 10^6 \text{ M}^3$ . However, the volume of water fluctuates which increases during summer (rainy season) but decreases in winter (dry period), where water level drops considerably. During the rainy season when the water level rises, it reaches a certain level where it is considered dangerous. So a certain quantity of water has to be released. The release of the excess volume of water is detrimental as it leads to the inundations of the paddy fields located in and around the river basin (downstream areas). The volume of inflow water is  $380.7 \times 10^6 \text{ M}^3$  whereas the outflow or discharge is  $365 \times 10^6 \text{ M}^3$ . The maintenance cost of the Umiam hydel project is estimated at Rs. 2 crores annually.

### 2.31. The Barapani Lake :

The lake is spread over an area of about 10 km<sup>2</sup>, submerging an area south-west of the Barapani upto 960 m contour. The lake is aligned in north-east south-west direction occupying the lowlands. It has irregular boundary depending upon 980 m contour configuration. The bottom profile of the lake is also highly irregular due the rolling nature of the pre-lake topography. The lake has been formed by construction of about 72 m high concrete dam across the Wah Umiam near Barapani. The north-eastern limit of the lake has been restricted by the construction of two dykes. The main dykes located north of the dam is an earth dam of 454 m long and 28 m high. The N.H. 40 passes over it. The second dyke which is also an earth dam is 168 m long and 15 m high, over which the village road passes. The lake shows wide fluctuations in water level during the last 12 years (i.e. from 1977-88). During these periods the highest and lowest water level recorded are 981.70 m in Oct. 1983, and 961.91 m in 1986 respectively. The variations in water level causes emergence and submergence of islands in the lake.

The down-stream impounding of the Wah Umiam due to the construction of the dam has changed the hydro-dynamic conditions of the river upstream. The Wah Umiam inlet has become sluggish because of lack waters due to the formation of the lake. The result is the formation of the channel fill deposits at the inlet site. The normal load carrying capacity

of the stream has decreased in the lake section of the stream. Moreover, the outlet of the Wah Umiam downstream of the dam has almost no flowing water except when the lake is discharged for regulating water level. Thus practically no backload is transported out of the lake. The total effect of this situation is large accumulation of bed load in the reservoir area.

#### 2.4. SOCIO-ECONOMIC COMPOSITION OF THE STUDY AREA:

As many as forty three villages have been selected for the present study. The number of the selected villages are restricted to a total of 43 due to changes in their location in different census periods, as also due to addition of new villages in successive census counts. These 43 villages have unchanged locations. These villages are located in the downstream of the Wah Umiam most of which are in the low lying areas. The average distance of these villages from the project site is 28 kms. Nearest village is located at a distance of 0.5 kms. whereas the farthest village is about 55 kms. away from the project site.

##### 2.41. Distribution of Villages :

These villages have been divided into five categories on the basis of their distance from the site of the dam (table 2.1).

---

9. Agarwal, Mandira (1989) : op.cit., p. 60.

Table - 2.1  
Study Area : Distribution of Villages in Distance Zones, 1981

Distance of the Villages from the project site (kms)	Number of Villages
Below 20	13
20 - 30	6
30 - 40	14
40 - 50	2
50 & Above	8

It is evident from the above table that the area located at a distance of 30 - 40 kms from the project site have the largest concentration of villages. On the other hand, only a few villages are found at a distance of 40 - 50 kms from the dam site, i.e., only 2 villages. However, as many as 13 villages are located closer to the dam site at a distance of less than 20 kms. But the number of villages decline to only 6 in the next distance zone, i.e., 20 - 30 kms from the dam. There are 8 villages beyond a distance of over 50 kms. On the average, the villages are far more numerous within a distance of 40 kms from the site of the dam.

#### 2.42. Size of Population :

The table 2.2 shows that most of the villages in the study area have a small size of population.

Table - 2.2  
Study Area : Distribution of Settlements  
in Population-size Classes, 1981

Population size Classes	No. of villages
Below 100	12
100 - 160	9
160 - 220	3
220 - 280	5
280 - 340	4
340 - 400	4
400 and above	6
Total	43

As many as 12 villages in the study area support less than 100 persons each. On the other hand, large-sized villages are few, i.e., only 6 in number. In the remaining villages accounting for around three-fifths of the total number of villages, the population size of these settlements varies between 100-400 persons each.

#### 2.43. Sex Ratio :

The table - 2.3 reveals that the sex ratio of the villages in the study area is largely unfavourable to the female section of the population. In a majority of the villages located in the study area, the females are largely exceeded by the males.

Table- 2.3  
Study Area : Sex Ratio, 1981

Sex Ratio	Number of Villages
Below 70	1
70 - 80	3
80 - 100	26
100 - 120	11
120 - 140	1
Above 140	1

However, the females are in a numerically dominant position in about a third of all villages. At least one village has a very high sex-ratio, i.e., 1400 and above. The maximum number of villages have a sex-ratio ranging between 800-1200 females per thousand males. One village has the lowest ratio of 700 females per 1000 males. In another set of three villages, the sex-ratio ranges between 700-800 females per thousand males while one village has 1200-1400 females per thousand males.

#### 2.44. Proportion of Workers :

The table below shows that most of the villages have a very low percentage of working population i.e., below 50 per cent in 1981. However, the percentage of main workers in the total population varies significantly across the villages in the study area.

Table - 2.4  
Study Area : Proportion of Workers, 1981

Percentage of Workers to Total Population	No. of Villages
Below 40	10
40 - 45	4
45 - 50	9
50 - 55	7
55 - 60	7
Above 60	6

Only six villages have more than 60 per cent of their population returned as economically active. The proportion of workers in the total population ranges between 45 and 50 per cent in 9 villages and between 50 and 60 per cent in 14 villages.

In general, the low proportion of working population in many villages indicates a high proportion of non-working population. Large variation in the percentage of working population also indicates varying potential within the study area to absorb the labour-force.

#### 2.45. Proportion of Agricultural Workers :

The study area shows an overwhelming dependence on agriculture as indicated by the data on proportion of agricultural workers as a percentage of the total workers (table - 2.5) in 1981. This is not surprising considering the overall low level of diversification in the economy of the region.

Table - 2.5  
Study Area : Proportion of Agricultural Workers, 1981

Percentage of Agricultural Workers to Total Workers	No. of Villages
Below 80	1
80 - 85	3
85 - 90	3
90 - 95	5
95 - 100	12
Above 100	19

However, it is evident from the above table that the extent of agricultural dependence varies marginally across the villages, although it remains above 80 per cent in nearly all the villages included in the study area. It is significant that the entire working population is fully dependent on agricultural sector in as many as 19 out of 43 villages in the study area. In another set of 12 villages, agriculture absorbs 95 to 100 per cent of the total workforce. The proportion of agricultural workers ranges between 80 and 95 per cent in 11 villages. Only a single village shows a somewhat lesser dependence on agriculture (i.e., the agricultural workforce is less than 80 per cent).

#### 2.46. Proportion of Cultivators :

The cultivators dominate among the agricultural workers in the study area. Since the area of the study is located in a tribal setting, wage labour is yet to emerge in a big way as most families own and operate on whatever land available. It is, therefore, evident from the table - 2.6 that over 90 per

cent of all workers are owner- cultivators in a little over half of all villages located in the study area.

Table - 2.6  
Study Area : Proportion of Cultivators, 1981

Percentage of Cultivators to Total Workers	No. of Villages
Below 40	8
40 - 50	4
50 - 60	2
60 - 70	2
70 - 80	3
80 - 90	2
90 & Above	22

However, in the remaining villages, there is a considerable variation in the share of cultivators in total working force of these villages. For example, the cultivators are less than half of the workers in as many as 12 villages, while their proportion varies between 50 and 80 per cent in 7 more villages.

#### 2.47. Proportion of Agricultural Labourer :

Evidently, the study area shows a much lesser growth in agricultural wage-earning sector. However, this situation is not uniformly observed in all the villages spread over the study area.

Table - 2.7  
Study Area : Proportion of Agricultural Labourer, 1981

Percentage of agricultural labourers to total workers	No. of village
Below 10	26
10 - 20	1
20 - 30	1
30 - 40	2
40 - 50	4
50 - 60	1
Above 60	4

It is remarkable that the agricultural wage earning is highly insignificant in a majority (i.e., 26 out of 43) of the villages included in the study area. At the same time, it is interesting to note that this sector accounts for a majority of the workforce in atleast 5 villages, indicating social change and transformation of a very high order. However, it needs to be examined further with field level data. In the remaining villages, the proportion of agricultural workers varies significantly (i.e., between 10 and 50 per cent).

#### 2.48. Social Composition

The Social Composition in the study area shows a dominance of tribal ethos. In most of the villages, the tribes account for a major share of the population. The table - 2.8 shows that 13 out of 43 villages are fully tribal in their population composition. In other words, a little over 31 per cent villages have exclusively tribal character.

Table - 2.8  
Study Area : Proportion of Tribal Population, 1981

Percentage of S.T. population to Total	No of villages
Below 50	4
50 - 60	1
60 - 70	1
70 - 80	3
80 - 90	6
90 - 99	13
Fully Tribal	13

The lowest proportion (i.e. below 50 per cent) of scheduled tribe population is found only in four villages. Only one village each has scheduled tribe population ranging between 50-60 per cent and 60-70 per cent. Three more villages support 70 to 80 per cent tribal population and 80-90 per cent of the population consists of tribes in six more villages. Yet in thirteen more villages, the tribes have a share of 90-100 per cent.

#### 2.5. CONCLUDING REMARKS

This brief review of the physical setting, social, economic and demographic composition of the study area leads to the following broad conclusions :

Firstly, the study area is located in a region which is dominated by hilly topography and associated terrain conditions.

Secondly, the construction of the dam in Wah Umiam river at Barapani was primarily aimed at generating hydro-electric power and the consequent lake formation has promoted a tourist resort at Barapani. The intervention into the natural eco-system is small in its scale.

Thirdly, the village economy in the down-stream areas is dominated by agricultural economy with a very large proportion of the workforce engaged as owner-cultivators. However, some villages are showing a larger development of wage-labour market in the agricultural sector.

Fourthly, there is a larger concentration of settlements nearer the dam site and the settlements become sparser as one moves away from the dam.

Lastly, the study area has a dominantly tribal social ethos as indicated by a dominance of tribal population in most of the villages located in the study area.

CHAPTER - III

## DEMOGRAPHIC CHANGES

### 3.1. INTRODUCTORY STATEMENT

An attempt has been made in this chapter to examine the nature of demographic changes in the areas located in the downstream of Wah Umiam from the site of the dam. It is assumed here that the construction of the dam at Barapani with its consequent blocking of water and its diminished availability downwards is certain to affect the economic opportunity in the down-stream areas. Any changes - either positive or negative - is likely to affect the potential of the area in attracting the population into the area and thereby affect the demographic composition. Generally speaking a diminution in water availability should normally discourage large population concentration in the down-stream as it may reduce agricultural potential. However, such a situation may not arise in an area dominated by hilly terrain and subsistence agricultural practices by the the tribal population by and large unaffected by irrigational advantages. Moreover, the region receives adequate rainfall during major parts of the year. As a result, it would be extremely hazardous to assume a generally negative impact of the hydel project on the attractiveness of the areas located downstream.

It is therefore, proposed to examine the true nature of the impact of the dam by a reference to the demographic

changes after the construction of the dam. It would be possible, ceteris paribus, to indicate the positive or negative impact of the construction depending upon the situation that the area has either proved attractive to population or has proved to be repulsive. This dimension of demographic changes in the study area has been examined with the help of the following indicators:

- (1) Changes in the number and size of settlements.
- (2) Changes in the growth rate of the population.
- (3) Changes in the sex composition of the population.

These indicators have been chosen with the assumption that substantial increase in the number of settlements should reflect a positive change affecting the areas located in the down-stream. Any decrease in the number of settlements on the other hand would indicate that the area has proved repulsive from the point of view of human habitation after the construction of the dam.

Likewise, the change in the size of the settlements would reflect the attractiveness or repulsive character of the region as an indirect outcome of the diminution in water supply in the areas located down-stream.

Furthermore, the differential impact of the dam construction can be examined with a reference to the rate at which the population was grown before and after the construction of the dam. Any slowing down in the rate of

population growth would indicate falling economic viability of the area located in the downstream, whereas faster increase in the population would necessarily reflect the positive dimensions of change.

Lastly, a study of the sex composition of the population in the study area is likely to indicate the differential impact of the construction of the dam on the two sexes comprising the population. Sex ratio provides an indirect evidence of sex selective migration of the people. A higher sex-ratio would indicate male selective outmigration of people. All these variables are analysed with reference to changes taking place at the aggregate level, i.e., at the state level and in various distance zones in order to get an insight into the differentiated impact of the dam in areas closer and further renounced from the project site. It is assumed here that the greatest impact of the dam would be felt close to the dam site and its impacts would decrease with distance

### 3.2. CHANGES IN SETTLEMENT STRUCTURE

Available data indicate remarkable changes in the rural demographic composition of the study area. An important aspect of these changes are manifested in terms of a phenomenal increase in the number, size and growth of rural settlements located in the study area before and after the construction of the dam at Barapani.

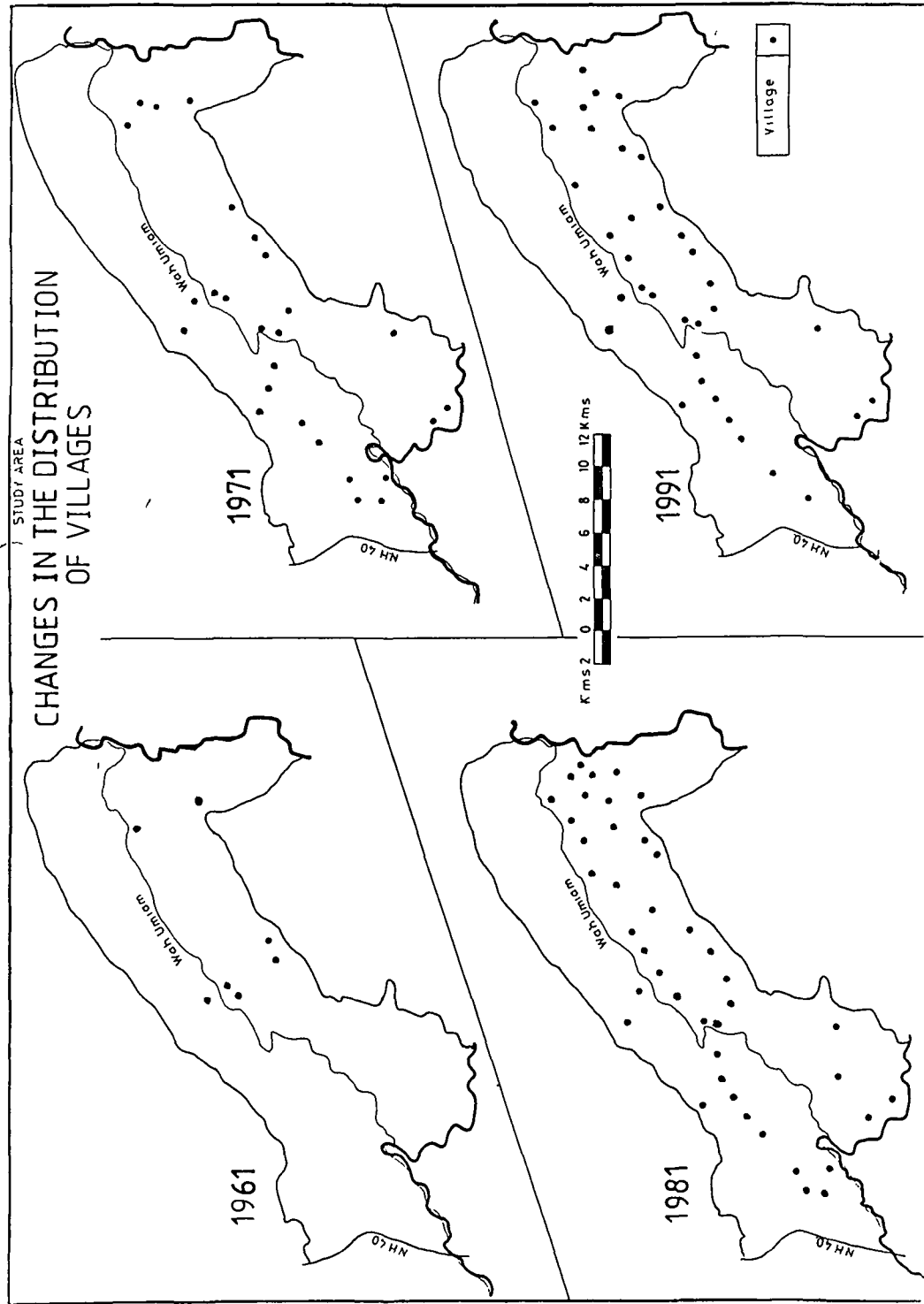


Fig 31

Table 3.1 shows a spectacular increase in the number of settlements in the study area after the construction of the dam.

Table - 3.1  
Study Area : Number of Settlements, 1961-91

Years	1961	1971	1981	1991
Study Area (Km)	7	31	50	39
Below 20	0	9	13	11
20 - 30	2	6	6	6
30 - 40	1	8	16	11
40 - 50	2	4	6	4
Above 50	2	4	9	7

It is evident from the above table that there was a spectacular increase in the number of settlements in the study area as a whole, from a meager 7 in 1961 to as many as 31 in 1971. The number of settlements increased to 50 in 1981. A marginal drop in the number of settlements in 1991 may be due to census enumeration which has clubbed a few settlement units under revenue villages.

An interesting feature of the changes in the number of settlements is that the bulk of increase has taken place in areas in proximity to the dam site particularly in the distance range of below 20 Km and between 20-40 Kms. It is this area which has experienced a great multiplicity in the number of settlements providing favourable sites for many new settlements to spring up. For example, the number of rural settlements have increased from nil in 1961 (i.e., prior to

the construction of the dam) to 9 in 1971 (i.e., immediately after the construction of the dam) in the distance zone of 0-20 Kms. Likewise the number of settlements increased from 3 in 1961 to 14 in 1971 in the distance zone of 20-40 Kms.

It is evident from the figure 3.1, that the number of settlements increased manifold immediately after the project was completed within a distance of 40 Km from the site of the dam.

### 3.3. GROWTH RATE IN THE NUMBER OF SETTLEMENTS

The multiplicity of settlements in the study area may also be examined with reference to the rate at which this grew.

It is interesting to note that the state as a whole experience only 4 per cent increase in the number of settlements during 1961-71 period (Table-3.2). This is in sharp contrast to a 343 per cent increase in the number of settlements in the study area. The largest increase in the number of settlements has taken place between 30-40 Km distance where the increase is as high as the number of settlements is somewhat less beyond 40 Km distance where the increase is as high as 700 per cent. The settlements increased four times within a distance of 20-30 Km during 1961-71 period. The growth rate in the number of settlements is somewhat less beyond 40 Km.

Table - 3.2  
Growth Rate of Settlements (%)

	1961-71	1971-81	1981-91
State	4.00	6.96	11.87
Study Area	343.00	61.29	-22.00
Below 20 Km	-	44.44	-15.38
20 - 30	200.00	0.00	0.00
30 - 40	700	100.00	-31.25
40 - 50	100	50.00	-33.33
50 and Above	100	125.00	-22.22

During the period 1971-81, the growth rate in settlements in the state as a whole increased marginally to 6.96 per cent. On the other hand, the study area continued to experience a much higher growth rate (i.e., 61.29 per cent). However, the increase in the number of settlements was largely confined to the immediate vicinity of the project site (i.e., 44.44 per cent) and beyond 40 Km (i.e., over 50 per cent).

In the period 1981-91, while the rural settlements in the state as a whole increased at a rate of 11.87 per cent, the study area, however, experienced a negative growth rate in all distance zone. The maximum decrease took place beyond 30 Km (i.e., above 30 per cent).

#### 3.4. CHANGES IN POPULATION SIZE

There was a significant change in the size of population of the settlements located in the study area.

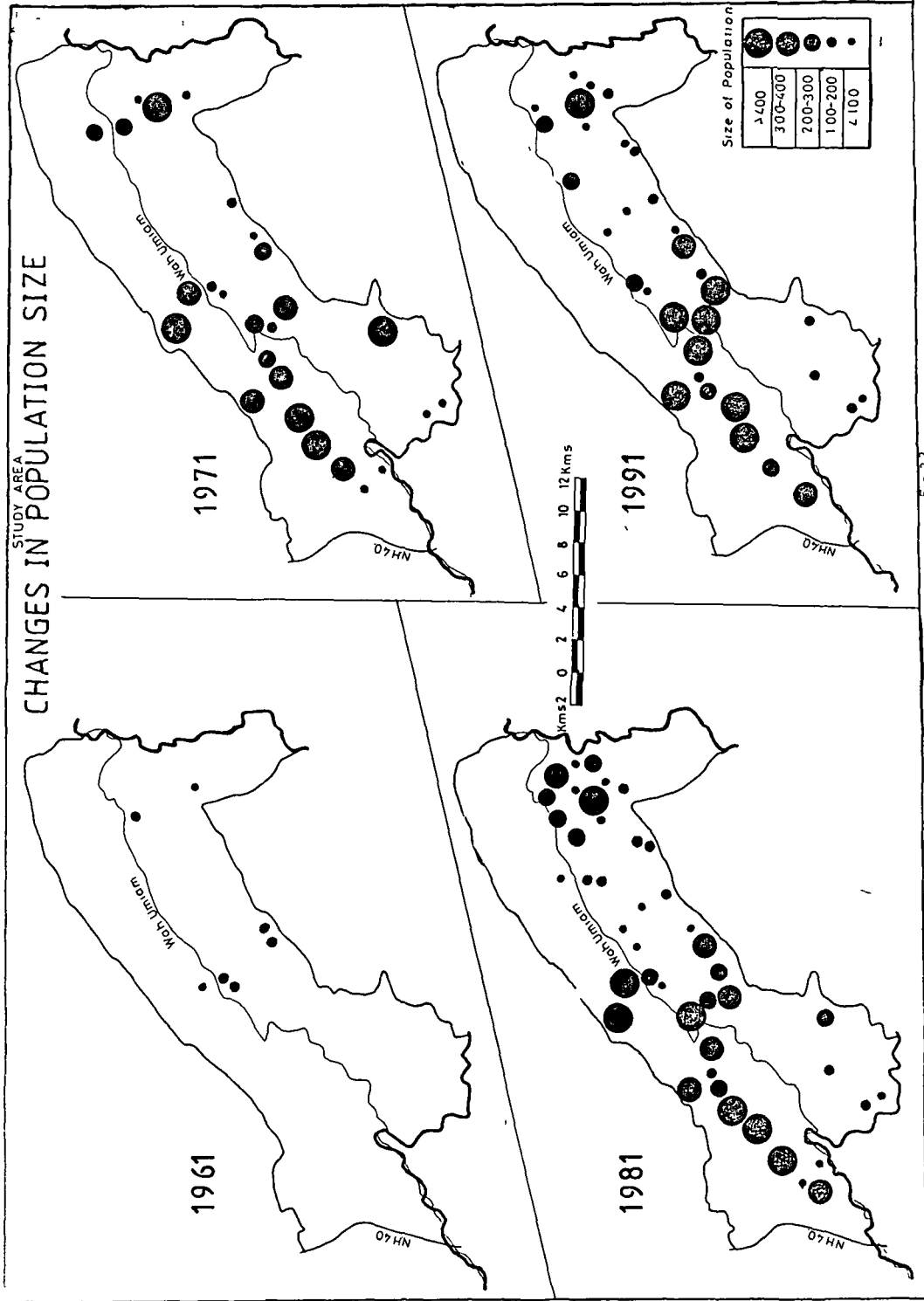


FIG 32

**Table 3.3**  
**Study Area : Changes in Population Size**

Population Size Classes (Persons)	Year	Number of Settlements					
		Study Area	< 20 Km	20-30 Km	30-40 Km	40-50 Km	>50 Km
Below 100	1961	2	0	0	0	1	1
	1971	9	3	1	3	1	1
	1981	14	5	1	3	0	2
	1991	11	2	1	4	0	3
100 - 200	1961	4	0	2	1	1	0
	1971	6	1	2	1	0	2
	1981	8	1	1	5	0	
	1991	8	2	1	4	0	1
200 - 300	1961	1	0	0	0	0	1
	1971	6	1	1	1	2	1
	1981	12	2	2	3	2	3
	1991	7	3	2	1	0	1
300 - 400	1961	0	0	0	0	0	0
	1971	5	1	2	1	1	0
	1981	8	2	1	2	2	1
	1991	2	1	0	0	1	0
400 & Above	1961	0	0	0	0	0	0
	1971	5	3	0	1	0	1
	1981	8	3	1	1	2	1
	1991	9	3	2	2	1	1

It is evident from the table 3.3 that the population size of the settlements was small in 1961. Nearly the settlements had a population size of below 200 persons.

In the year 1971, however, as many as 10 settlements had more than 300 persons each out of a total of 31. Smaller sized settlements too got multiplied. As many as 9 settlements had less than 100 persons each whereas 6 settlements supported 100

to 200 persons each. Another set of 6 villages contained a population size of 200-300 persons each in the study area.

Most of the tiny settlements had come up closer to the dam site, i.e., within 40 kilometers from the site of the project. On the other hand, the size also contained most of the large sized (i.e., above 400 persons) villages too. It is quite likely that the existing villages in this zone added tremendously to their population while the new ones were generally of small size.

There was a great acceleration in the number of settlements in each population size classes in the year 1981. The number of villages with a population size of 200-300 persons doubled within 1971-81 decade. This increase in the number of settlements was well spread out over the study area as a whole.

The situation changed drastically in the year 1991 as the number of settlements declined in the down-stream areas compared to the 1981 situation. However, the decline in the number of settlements was not uniform across the population size classes nor in different distance zones. The decline was far more pronounced in the population size classes of 300-400 persons. On the other hand, the number of settlements remained unaltered in the population size class of 100-200 persons and actually increased in the size class of 400 persons and above.

Small sized settlements (below 100 persons) decreased in their number in areas close to the site of the dam whereas their numbers increased farther away. On the contrary, the number of relatively large-sized settlements (above 200 persons) increased in the areas in close proximity of the site of the project while their numbers showed a decline farther away.

### 3.5. CHANGES IN THE GROWTH RATE OF POPULATION

A remarkable aspect of the demographic composition of the study area reveals itself in terms of a phenomenal growth in population. Table-3.4 depicts the extent of population growth in the state as a whole, in the area of the study and in different distance zones for three decades beginning from 1961.

Table - 3.4  
Growth Rate of Population

Decade	1961-71	1971-81	1981-91
State	31.80	32.04	32.86
Study Area	105.32	41.95	12.15
Below 20 Km	Infinite	9.89	37.88
20 - 30	100.00	1.36	20.63
30 - 40	108	16.14	- 1.00
40 - 50	168.6	36.77	50.49
Above 50 Km	124	-22.80	2.53

It is clear from the above table that the down-stream areas experienced a phenomenal rise in the population after the construction of the dam. For example, the state as a whole witnessed 31.5 per cent rise in its population during 1961-71

decade. On the other hand, the down-stream areas witnessed a precipitous rise in its population with a rate of growth as high as 105.32 per cent. It may be safely inferred from this data that contrary to expectation the construction of the dam at Barapani made the down-stream areas far more attractive than ever before.

However, the rate of increase in the population during this decade does not show uniformity in different distance zones within the study area. The largest increase in population is noticed in the immediate vicinity of the dam, i.e., within 20 Km from the site of the dam. Interestingly, the areas situated beyond 40 kilometers have experienced the largest increase in population with the maximum increase having taken place within a distance of 40 to kilometers. The rate of increase in the distance range of 20 to 40 kilometers is almost identical to the increase in the study area as a whole.

In the following decade, i.e., 1971-81, the study area continued to increase its population, but at a much lesser rate. However, it remained much above the state average of 32.05 per cent. The population grew at the rate of nearly 42 per cent in the study area. Interestingly, however, there was a net decline in the population beyond 50 kilometers from the project site. The largest growth of the population in this decade was confined to a zone of 40-50 kilometers while areas

close to the project site added marginally to their population.

A completely reversal is observed in the decade 1981-91 as regards the rate of population growth. While the state as a whole recorded an increase in the population at the rate of 32.86 per cent, the areas in the down-stream experienced only 12.15 per cent increase in its population. However, areas close to the site of the dam continued to add to their population at an accelerated rate. Even the villages located at a distance of 40 to 50 kilometers too significantly (i.e., above 50 per cent) increased their population. The other villages, however, either did not add much to their population or experienced a decline in the decade.

It is clearly evident from the above pattern in the population growth rate that the construction of the dam only resulted in an acceleration in population in areas located down-stream. This acceleration was, however, far more pronounced in the period immediately after the construction of the dam and in areas in close proximity to the site of the dam (Fig. 3.2).

### 3.6. CHANGES IN SEX-RATIO

It is expected that the sex composition of the population in the down-stream areas would through some light on the quality of changes that took place after the construction of the dam. The census data on the sex composition of population

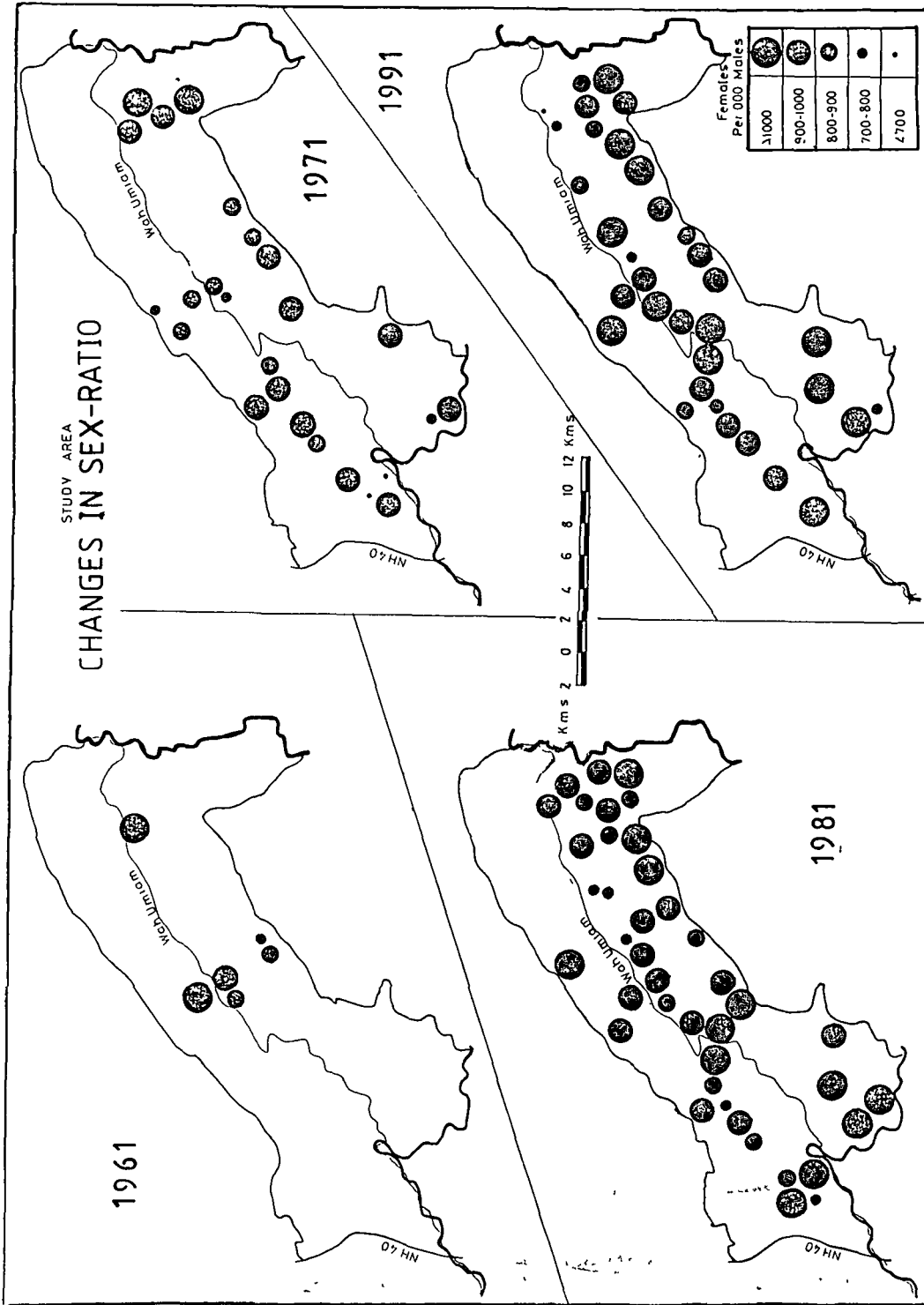


FIG 23

at the aggregate level reveals that the study area as a whole had a sex-ratio by and large unfavourable to women as compared to the state average (table 3.5) in 1961. The state as a whole recorded 936 females per thousand males while the study area had only 902 females per thousand males.

The following table presents the data on sex-ratio for the state as a whole as well as in the study area for the period between 1961 and 1991.

Table - 3.5  
Sex-Ratio

Years	1961	1971	1981	1991
State	936	942	954	955
Study Area	902	920	948	983
Below 20 Km	-	863	946	976
20 - 30	897	898	915	1014
30 - 40	797	889	903	975
40 - 50	875	971	1640	952
Above 50 Km	971	978	934	1002

It is important to note that the deficit of women in the villages located in the down-stream revealed wide variations (Fig. 3.3). The men largely outnumbered women in areas close to the site of the dam. This situation was far more pronounced in the distance zone of 20-30 kilometers as well as in the zone located at a distance of 40-50 kilometers. The zone lying at a distance of over 50 kilometers, however, is much favourable to women with a sex-ratio of 971 females per thousand males.

In the following decade which incidentally represents the situation immediately after the construction of the dam. The state as well as the study area experienced some increase in the proportion of female population. However, the deficit of females in the area of the study continued to lag behind in its share of female population compared to the state as a whole. Significantly the areas in close proximity to the dam site (i.e., within 20 kilometers) had a much larger shortage of females per thousand males. In the next distance zone, i.e., 20-30 kilometers with the down-stream areas the sex-ratio remained unchanged. Between 30-40 kilometers there was much improvement in the sex-ratio in 1971. But the zone lying between 40-50 kilometers experienced a maximal decrease in the share of female population compared to 1961 situation. The villages located at a distance of over 50 kilometers experienced a marginal increase in sex-ratio.

The sex-ratio increased to 954 in the state as a whole in the year 1981. Significantly, however, the study area recorded a higher sex-ratio (i.e., 978 females per thousand males) than the state average indicating considerable increase in the share of female population. This increase was largely a result of substantial gain in the female population in the villages located at a distance of 40-50 kilometers within the down-stream areas. There was a surplus of females in this zone. Another interesting change that overtook the demographic situation in the study area is a relatively larger increase in

the female segment of the population in the villages located closer to the site of the dam. This zone had a great deficit of women in the previous decade.

While the sex-ratio remained by and large unchanged in 1991 at the state level, the study area experienced further increase in the share of female segment of the population. This improvement improvement of the population was experienced in nearly whole of the study area excepting the zone located at a distance of 40-50 kilometers from the project site. The females outnumbered the males in villages located within 20-30 kilometers and over 50 kilometers in the study area. The villages in close proximity to the site of the dam further increased its female component to record a sex-ratio of 971 females per thousand males.

It may be concluded from the above analysis that the area seems to have attracted more population in the post-dam period. In its early phase, it appears that more males have come to live in the down-stream areas. Considerable increase in female segment of the population in the later phase indicates a greater stability and socio-economic viability of the rural economy.

### 3.7. CONCLUDING STATEMENT

The preceding analysis of the demographic attributions of the population in the down-stream areas leads to the following broad conclusions :

Firstly, the study area has experienced phenomenal increase in the number of settlements and their size. Though the degree of such changes vary in different distance zones within the study area, it is the zone in close proximity to the down-stream, which seem to have provided many favourable sites for the growth of settlements.

Secondly, the rate of growth of population too indicate a similar trend suggesting that the down-stream areas, particularly nearer to the dam site have provided adequate social and economic base for increased population concentration in the post-dam period.

Thirdly, the pattern of sex-composition indicates more male selective inmigration into the area of the study in the initial phase and a greater social stability later.

Overall, it may be safely concluded that the analysis of demographic situation indicates favourable changes in the down-stream areas after the construction of the dam.

## CHAPTER - IV

## SOCIO-ECONOMIC CHANGES

### 4.1. INTRODUCTORY STATEMENT

The preceding chapter highlighted the changes in demographic characteristics of the people living in villages located in the down-stream of Wah Umiam. An attempt is made in this chapter to evaluate the impact of the construction of the dam on the rural population residing down-stream as reflected in the changes introduced to their economy and society. The underlying assumption of examining the social and economic changes is that the blocking of the flowing water at Barapani would directly affect the economy of the people living in the down-stream areas. The analysis is restricted to a few indicators of the social and economic characteristics of the people. These are as follows :

- (i) Percentage of workers to total population classified into aggregate, male and female segments of the population.
- (ii) Ratio of non-workers and the workers
- (iii) Percentage of agricultural workers to total, disaggregated into male and female segments
- (iv) Percentage of cultivators to total disaggregated, into male and female segments

(v) Percentage of agricultural labourers to total, disaggregated into male and female segments

(vi) Percentage of scheduled tribes to total population

Besides, an attempt has also been made to examine the relationship between relative distance of the villages from the project site and the demographic, social and economic indicators for four points of time viz 1961, 1971, 1981, and 1991.

#### 4.2. CHANGES IN WORKING POPULATION

The proportion of working population as shown in table 4.1 and figure, 4.1 reveals that the study area, in general, has a larger share of workers in its population compared to the state as a whole, the only exception being the year 1961 representing the pre-dam economic situation. In the post-dam period, however, the study area shows a consistent rise in the proportion of workers in successive census periods and remains much above the state average. This is indicative of the fact that the economic base of the study area became far more supportive and could absorb a larger proportion of the labour-force after the construction of the dam.

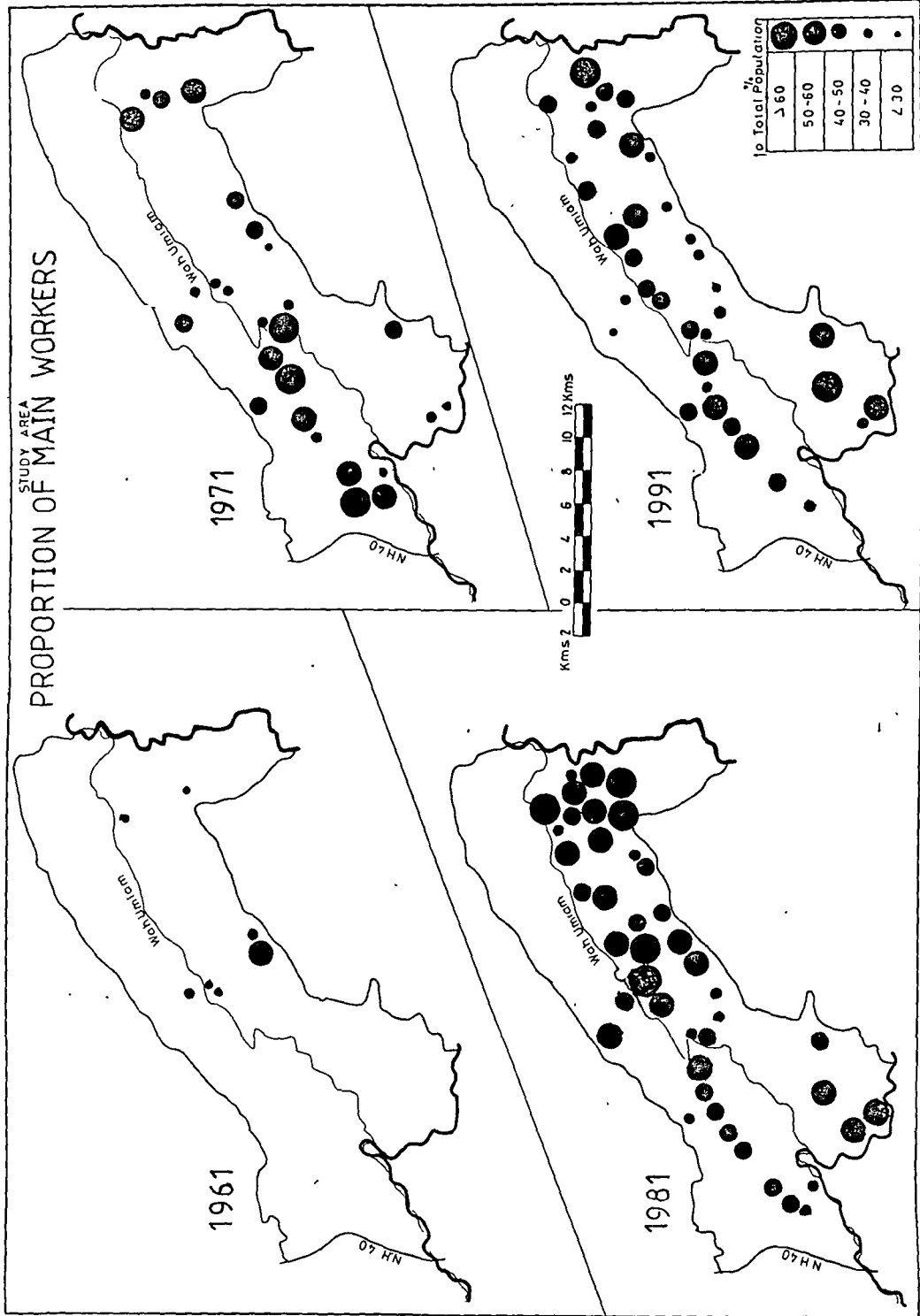


Fig. 4.1

Table - 4.1  
Study area : Percentage of Workers to Total Population

	1961	1971	1981	1991
State	52.31	44.16	43.43	40.32
Study Area	35.14	46.00	50.00	42.70
Below 20 Km	-	47.00	47.47	49.77
20 - 30	15.00	51.10	41.36	41.73
30 - 40	38.26	40.88	51.16	39.60
40 - 50	45.80	40.69	48.26	39.90
Above 50	22.91	51.19	55.50	43.00

However, the favourable economic conditions seem not to have been equally distributed over the entire down-stream area. For example, the area lying at a distance of 30-50 kilometers in 1971 had only around 40 per cent of the population returned as economically active as against the state and regional average of 44.16 and 46 per cent respectively.

However, in the following decade (i.e., 1981) the proportion of working population was lower than the regional average in areas below 40 kilometers while the villages lying at far off distances showed a larger proportion of working population in the total.

In the year 1991, the state as a whole showed an overall decline in the proportion of working population. The share of workers in the total population in the down-stream areas too experienced a similar trend but remained above the state average. However, the villages in close proximity to the site of the dam absorbed a much higher proportion of the population

STUDY AREA  
**PROPORTION OF MALE MAIN  
 WORKERS**

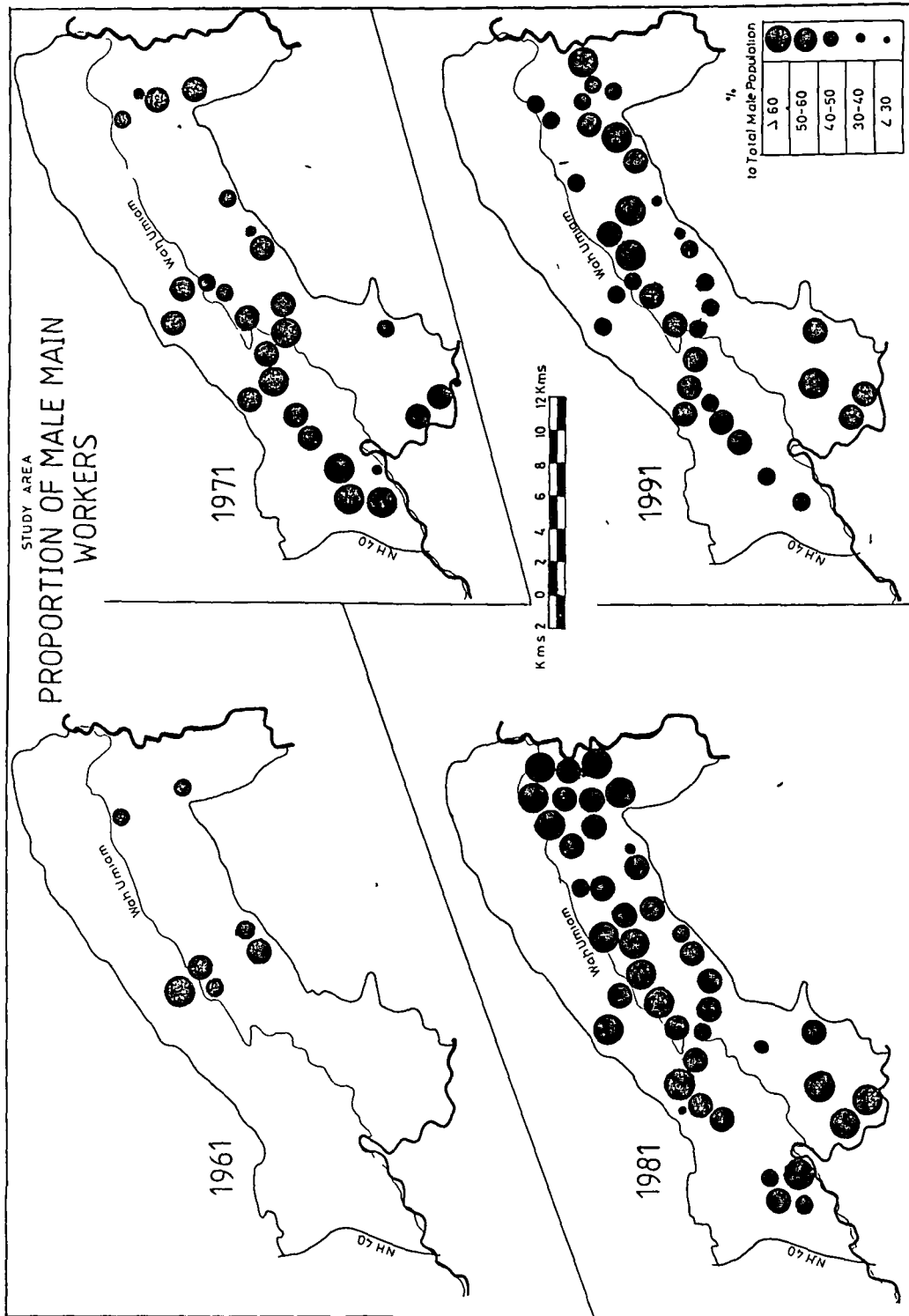


Fig. 42

in economic activities compared to either the regional or the state average. The capacity of the economy to absorb the labour-force declined as one moved away from the site of the dam.

The changes in the male work-force too presented a more or less identical pattern (Table - 4.2 and Fig. - 4.2).

Table - 4.2  
Study Area : Percentage of Male Work-Force to Male Population

	1961	1971	1981	1991
State	58.32	53.21	53.12	49.53
Study Area	48.00	56.45	56.80	51.95
Below 20	-	57.09	54.49	56.10
20 - 30	48.22	59.10	52.83	57.00
30 - 40	78.44	52.97	55.71	49.00
40 - 50	58.44	57.09	56.39	54.58
Above 50	45.41	56.08	64.83	49.10

While the proportion of male working force showed a decline in the period immediately after the construction of the dam, the area of the study on the other hand, revealed a greater absorption of the males in gainful economic activity. The areas closer to the site of the dam (i.e., within a distance of 30 kilometers) absorbed a very large proportion (i.e., between 55 and 60 per cent) of the males in gainful economic activity in 1971. However, the year 1981 and 1991 reveal a much more confused pattern as regards the male working force in different distance zones.

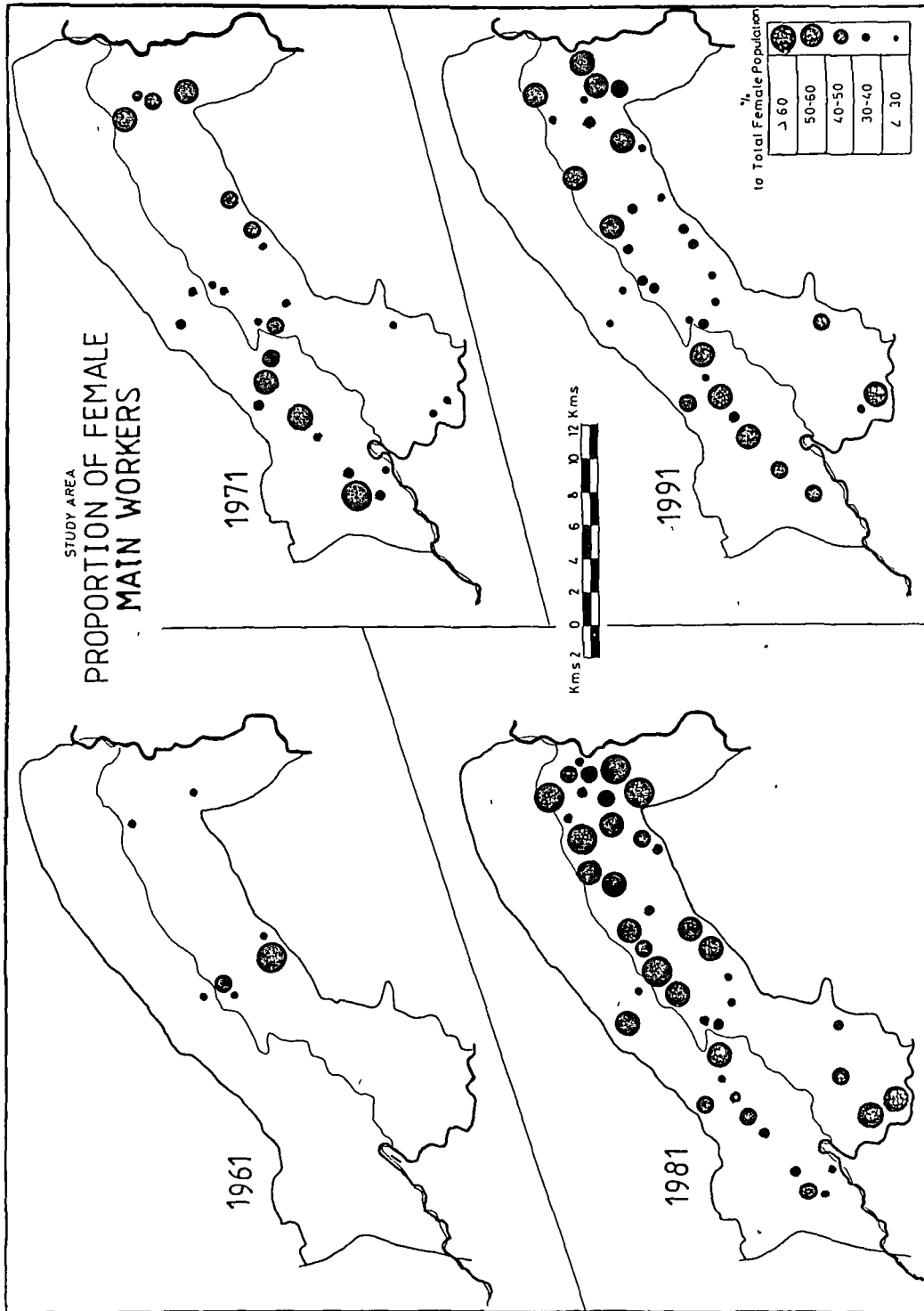


Fig 4.3

With regards to the changes in the proportion of female workers, it is interesting to observe that their proportion remained lower in the study area than the state average before and immediately after the construction of the dam. However, in the subsequent period, a greater proportion of the female population was absorbed by the regional economy compared to the state as a whole (Table - 4.3).

Table - 4.3  
Study Area : Percentage of Female Work-Force  
to Female Population

	1961	1971	1981	1991
State	45.88	34.15	33.29	30.67
Study Area	20.98	33.31	43.10	37.04
Below 20	-	35.92	38.16	43.41
20 - 30	25.16	34.45	41.72	33.10
30 - 40	25.49	27.76	47.15	31.00
40 - 50	33.33	22.60	40.50	25.42
Above 50	00.00	45.80	47.75	37.27

Figure 4.3 reveals that the proportion of female workers increased gradually with distance in 1961. But in the year 1971, the share of female workers was the lowest at a distance between 30 and 50 kilometers. In the year 1981, however, the share of female main workers shows an increase not only at the aggregate level, but also in each distance zone. The largest increase in the share of female main workers took place in the zone at a distance between 30 and 50 kilometers away from the site of the dam indicating a better economic opportunity available to women.

In 1991, however, there was a marginal decrease in the proportion of female main workers in the study area as a whole. It is interesting to note that while most areas in the down-stream indicated a shrinking of economic opportunity for women as evident from a fall in the proportion of female workers; the areas very close to the site of the dam revealed an enlarged scope for gainful economic activities for women. The percentage of female workers in the total female population in villages within 20 kilometers from the site of the dam was 43.41 per cent as against the regional average of 37.04 per cent and 38.16 per cent in the previous decade.

#### 4.3. CHANGES IN NON-WORKER - WORKER RATIO

A perusal of the data on worker non-worker ratio (Table 4.4, Fig. - 4.4) shows that the area of the study had a much larger dependency than the state as a whole in the pre-dam period (i.e., 1961). In the state as a whole, there were only 900 non-workers per thousand workers. On the other hand, 1000 workers had to support as large as 1840 non-workers. In the post dam period, however, the down-stream areas reveal a much lesser dependence of non-working population compared to the state average. In fact, in the year 1971, i.e., immediately after the construction of the dam, the study area had a ratio of 1290 non-workers per 1000 workers as against 1260 non-workers per thousand workers in the state as a whole.

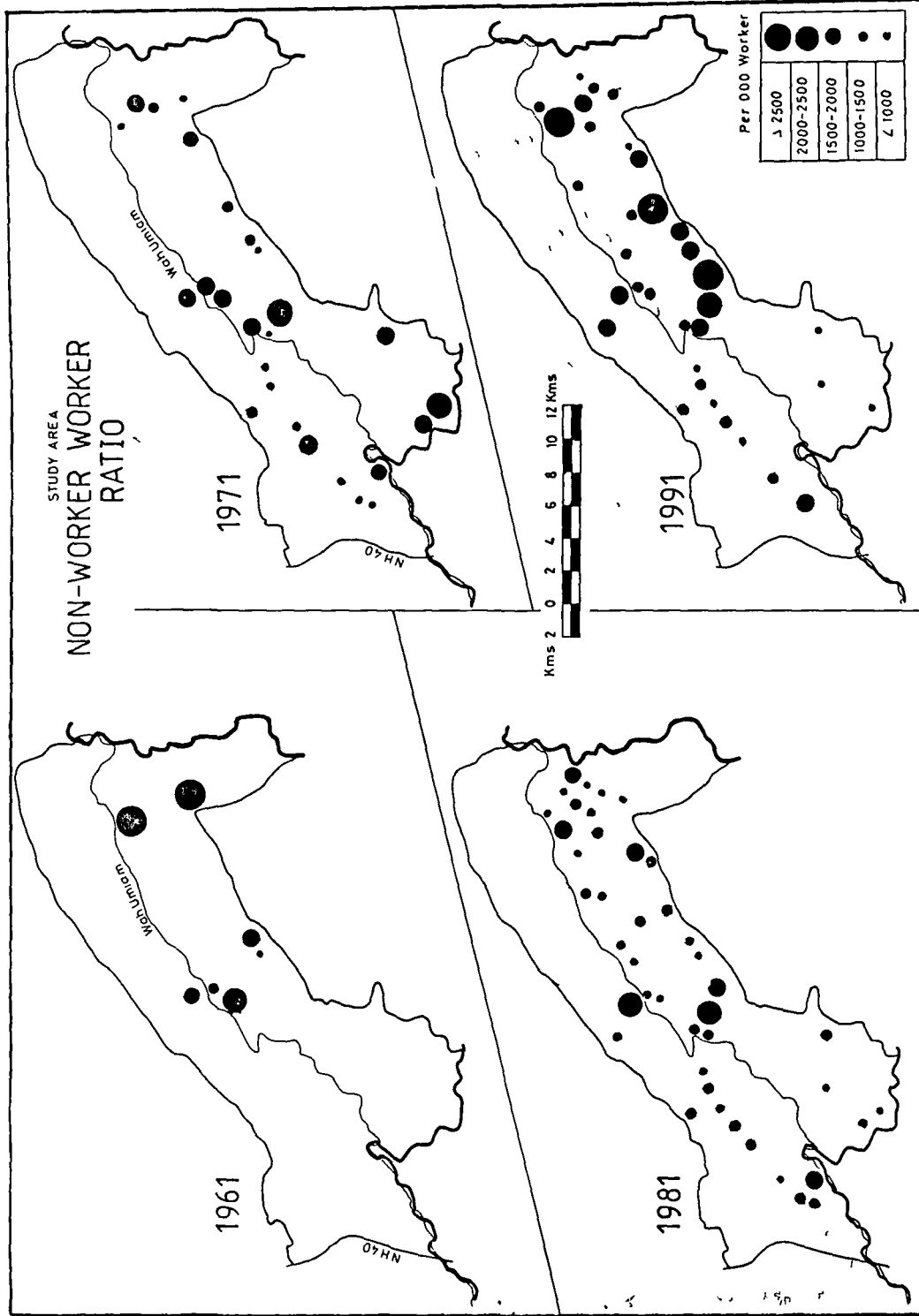


Fig 4.4

Table - 4.4  
Study Area : Non-Workers per 1000 Workers

	1961	1971	1981	1991
State	900	1260	1290	1480
Study Area	1840	1290	1090	1470
Below 20	-	1200	1110	1050
20 - 30	1750	1230	1090	1400
30 - 40	1600	1900	620	1800
40 - 50	700	1320	1170	1790
Above 50	3490	950	1010	1040

In the following decade, the ratio of non-workers decreased to 1090 in the study area while it showed an increase to 1290 in the state as a whole. The non-worker worker ratio was nearly identical both at the regional and state level after showing an unprecedented rise in the proportion of non-workers.

This generalized pattern, however, shows wide variation within the down-stream areas. It is worth mentioning that there has been a continuous fall in the proportion of non-workers in areas close to (i.e., below 20 kilometers) the site of the dam. There were 1200 non-workers per thousand workers in this zone in 1971 which fell to 1110 in 1981 and to 1050 only in 1991. This decline is indicative of greater work opportunities available in the areas in close proximity of the dam after its construction.

In the next zone (i.e., 20-30 kilometers) however, the trend is uneven. In the pre-dam period, this zone experienced a very large dependence of 1750 non-workers per thousand

workers. But in the next Census, i.e., in 1971, the proportion of non-workers fell sharply to 1230 per thousand workers indicating greater absorption of the population in gainful economic work. It further fell down to a ratio of 1090 in 1981 but increased sharply to 1400 non-workers per thousand workers in 1991.

In the distance zone of 30-40 kilometers, the period after the construction of the dam resulted in a greater proportion of dependent population. But the ratio of non-workers fell precipitously in 1981 to show an equally sharp rise in 1991.

The proportion of non-workers in villages located above 40 kilometers away from the project site shows far greater fluctuations over time indicating either a rise or fall in the availability of gainful economic activity as well as differential capacity of these areas in absorbing the workforce.

#### 4.4. CHANGES IN THE AGRICULTURAL WORKFORCE

It has already been noted that the state as a whole as well as the study area are characterized by subsistence agricultural economy. It is therefore natural that a very large proportion of the working force is engaged in agricultural activity. Under such conditions, it would be necessary to examine the trends in the proportion of agricultural workforce within the study area and may be

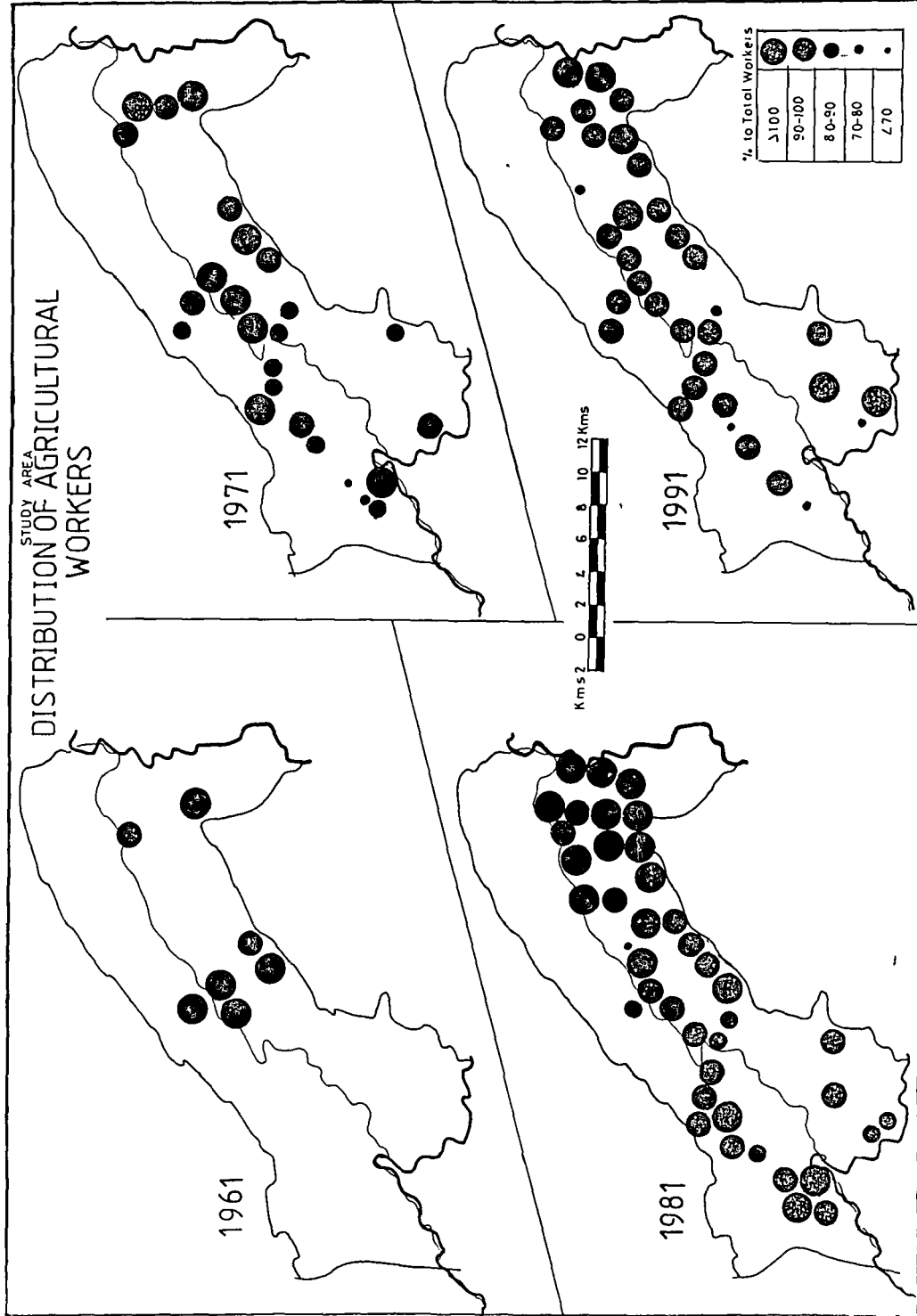


Fig 4.5

compared with the situation prevailing at the state level. The comparison can be made between the pre and post-dam period with a view to getting some insight.

**Table - 4.5**  
**Study Area : Percentage of Agricultural Workers**  
**to Total workers**

Year	1961	1971	1981	1991
State	71.54	79.02	72.54	67.82
Study area	98.53	94.00	96.04	93.37
Below 20	-	85.53	96.08	91.47
20 - 30	100.00	95.00	96.45	95.40
30 - 40	93.18	95.34	94.00	88.11
40 - 50	100.00	94.77	93.78	94.81
Above 50	98.84	99.42	99.89	97.08

It is evident from the table 4.5 that the area of study had a larger proportion of its working population engaged in agricultural activities compared to the situation in the state as a whole. This is true in all the four points of time. Moreover, there is a progressive decline in the share of agricultural workers in the state during 1961-91 period. The only exception is the year 1971, when the proportion of workforce engaged in any type of agricultural activity increased substantially. On the other hand the areas located in the down-stream do not show much variation in the proportion of agricultural workers which remains above 93 per cent throughout the period of investigation. It is significant to note that the period immediately after the construction of the dam showed a marginal decrease in the proportion of agricultural workers at a time when the state experienced a

large increase in the proportion of agricultural workers. In the following decade however, the agricultural workforce showed a marginal increase in its proportion, but again fell to its 1971 position in 1991. Overall, it may be said that the villages located in the study area have a greater dependence on agriculture than the state as a whole at any given time. The marginal decrease in the share of agricultural workforce in the period following the construction of the dam may be attributed to the proliferation of new settlements in the study area, yet to settle down for permanent cultivation.

The agricultural dependence in different zones within the study area however, shows large variation (Fig. 4.5). In the pre-dam period, the entire area, excepting the zone lying at 30-40 kilometers had a working force almost exclusively engaged in agriculture. The construction of the dam however, resulted in a marginal fall in the share of agricultural workforce in most distance zones excepting the villages located in close proximity of the dam. All these villages were new settlements and had only a little over 85 per cent of its workforce engaged in agricultural activity.

In the later period, however, the agricultural dependence in this zone comes much closer to that of other zones.

An analysis of the data on male agricultural workforce reveals a more or less identical pattern with that of the aggregate level (Table 4.6 and Fig. 4.6).

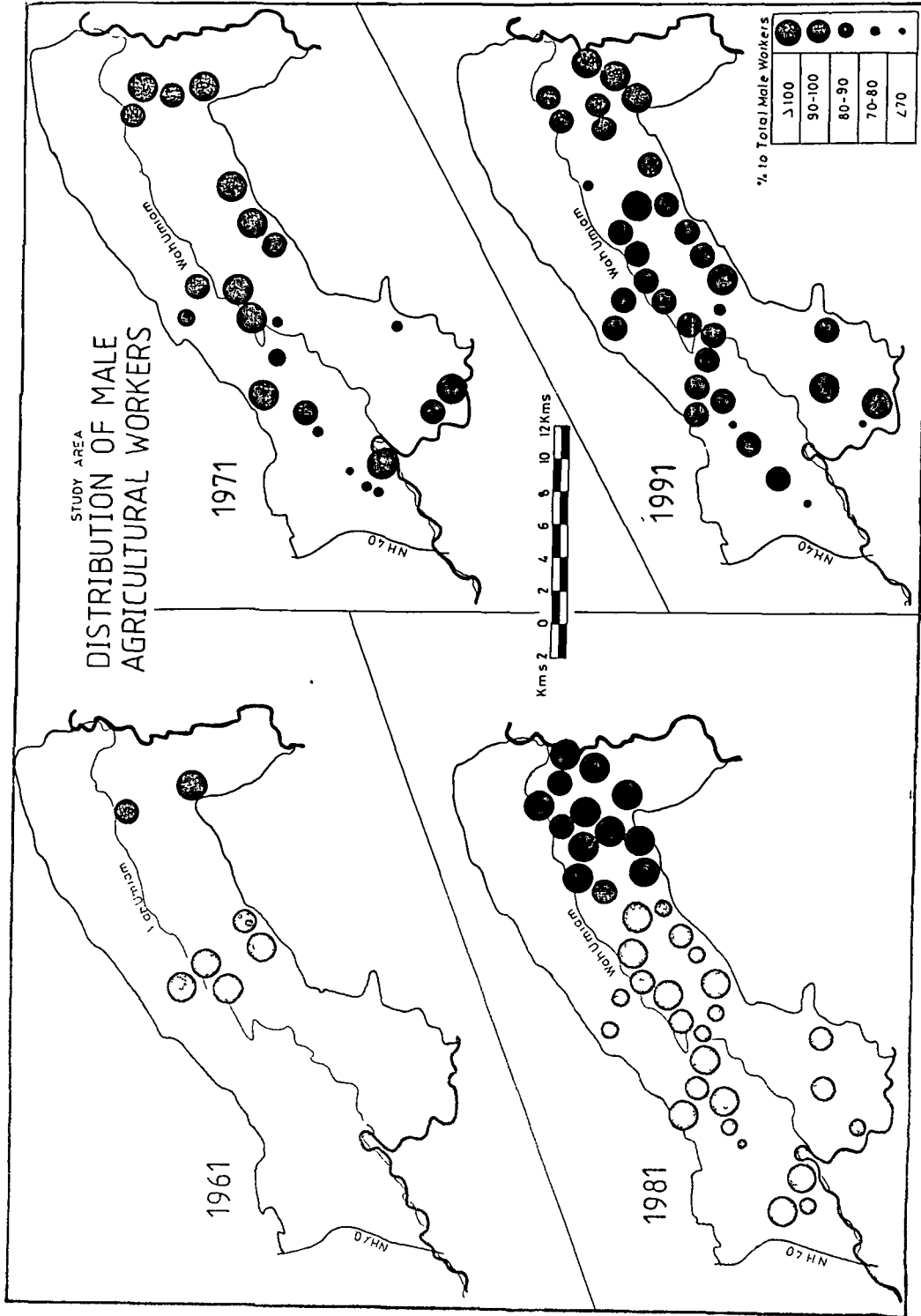


Fig 4.5

**Table - 4.6**  
**Study Area : Percentage of Male Agricultural Workers**  
**to Total Male Workers**

Year	1961	1971	1981	1991
State	70.60	72.88	67.25	62.35
Study area	98.46	92.16	95.27	92.30
Below 20	-	79.84	94.98	89.82
20 - 30	100.00	92.01	96.24	94.56
30 - 40	93.55	94.89	91.97	87.00
40 - 50	100.00	95.17	93.32	93.45
Above 50	98.84	98.93	99.85	96.75

It is also evident from the above table that the areas in close proximity to the site of the dam experienced a smaller proportion of male agricultural workforce compared to other areas in the down-stream. Excepting this, one observes a much less zone-wise variation in the proportion of male agricultural workforce (Fig. 4.6). Over 90 per cent of the male workforce is absorbed by the agrarian sector in most cases. The extent of variation is slightly more pronounced in the year 1991.

As far as the female workforce is concerned, one notices a relatively larger dependence of women on agrarian sector in the state as a whole. But this dependence is even more in the area of the present study. However, as the table 4.7 and figure 4.7 reveal, the female workforce shows much more consistency in their dependence on agriculture. The only exception is in the year 1991.

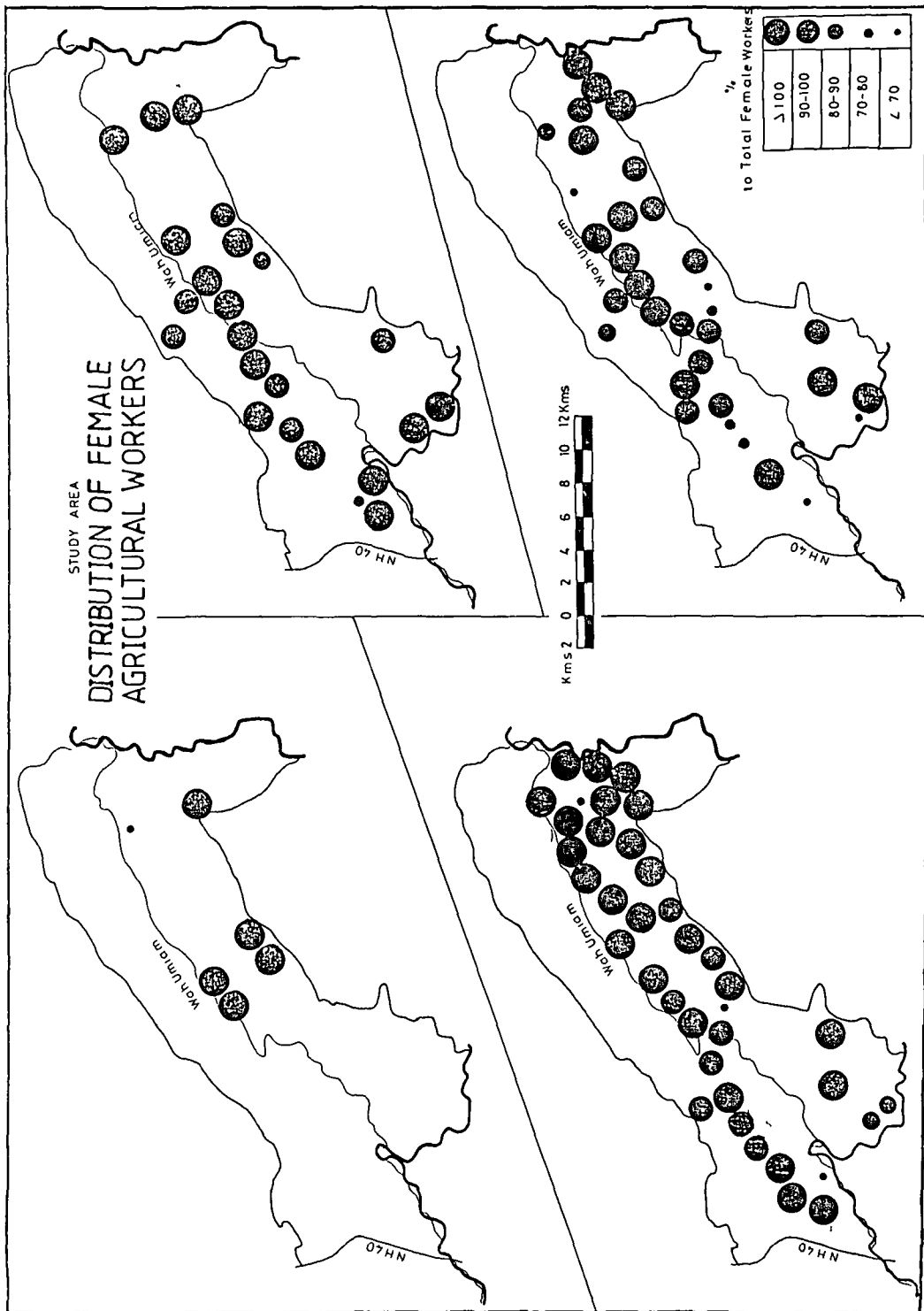


Fig 47

**Table - 4.7**  
**Study Area : Percentage of Female Agricultural Workers**  
**to Total Female Workers**

Year	1961	1971	1981	1991
State	86.95	89.05	81.39	85.97
Study area	98.70	96.27	94.91	93.30
Below 20	-	96.41	90.53	84.23
20 - 30	100.00	99.19	97.26	96.89
30 - 40	92.31	93.58	91.34	80.80
40 - 50	100.00	92.19	95.41	97.89
Above 50	100.00	100.00	100.00	96.56

The most remarkable fact about female involvement in agricultural work pertains to the zone in close proximity to the site of the dam. It is interesting to note that the proportion of female workforce engaged in agricultural work remains quite high (i.e., over 96 per cent) in this zone in 1971. This is in sharp contrast to the overall and male segment of the population which showed a smaller proportion of their population engaged in agricultural work. It is quite probable that a section of the male population belonging to this zone probably could find employment outside agriculture while such opportunities were few for the female segment.

#### 4.5. Cultivators

In a tribal setting where the problems of landlessness or land alienation have not taken an ugly shape, it is expected that most of the agricultural workforce shall be engaged as owner-cultivators. Table 4.8 presents the data on the percentage of cultivators to total workers for the state,

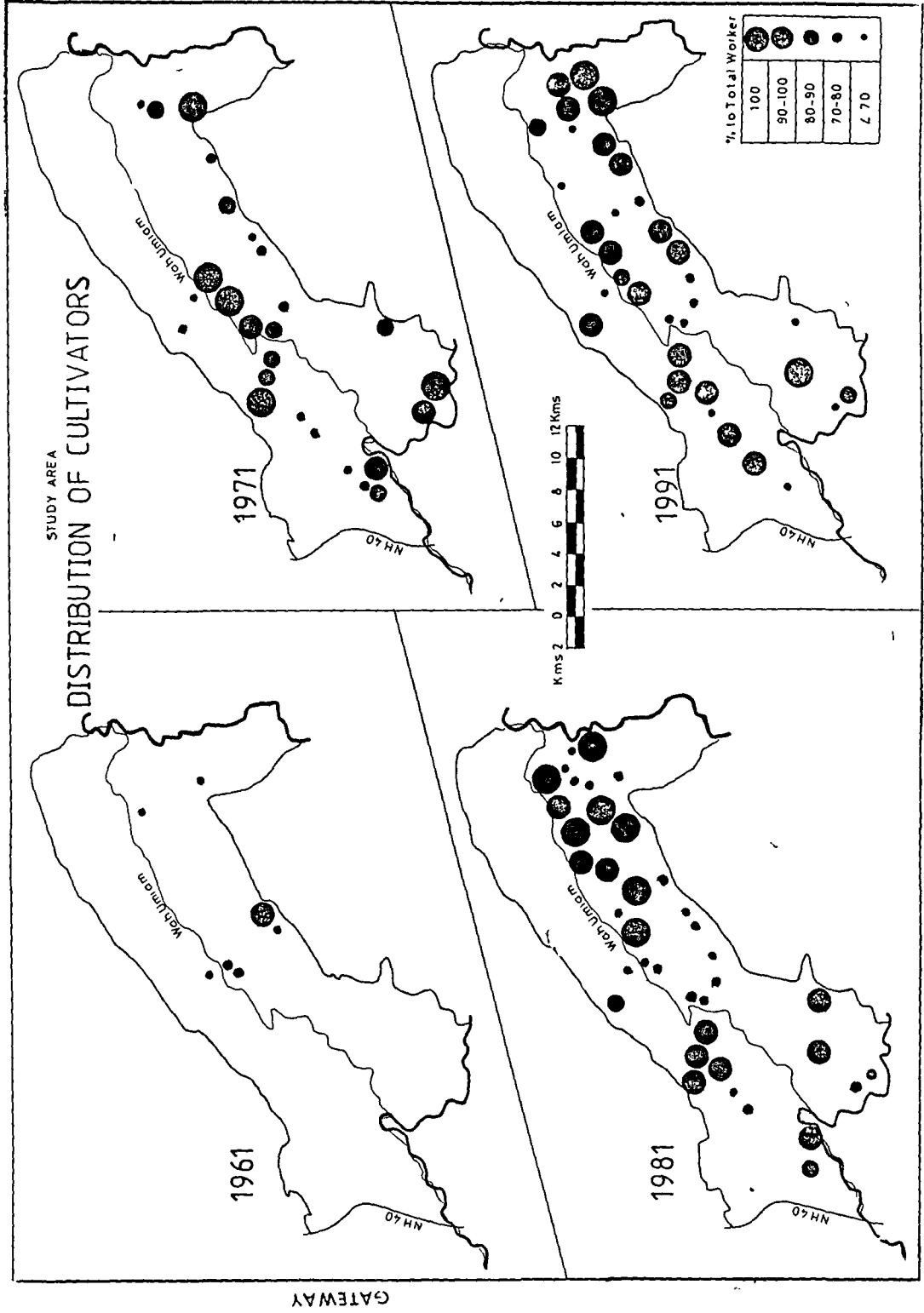


Fig 4.8

region as well as in different distance zone within the study area.

Table - 4.8  
Study Area : Percentage of Cultivators to Total Workers

Year	1961	1971	1981	1991
State	73.28	69.14	62.56	55.31
Study area	66.54	83.28	77.13	77.82
Below 20	-	75.63	87.42	73.31
20 - 30	66.33	92.98	65.93	74.12
30 - 40	93.18	74.72	79.95	65.24
40 - 50	61.00	78.89	77.45	81.33
Above 50	53.34	94.51	74.34	95.08

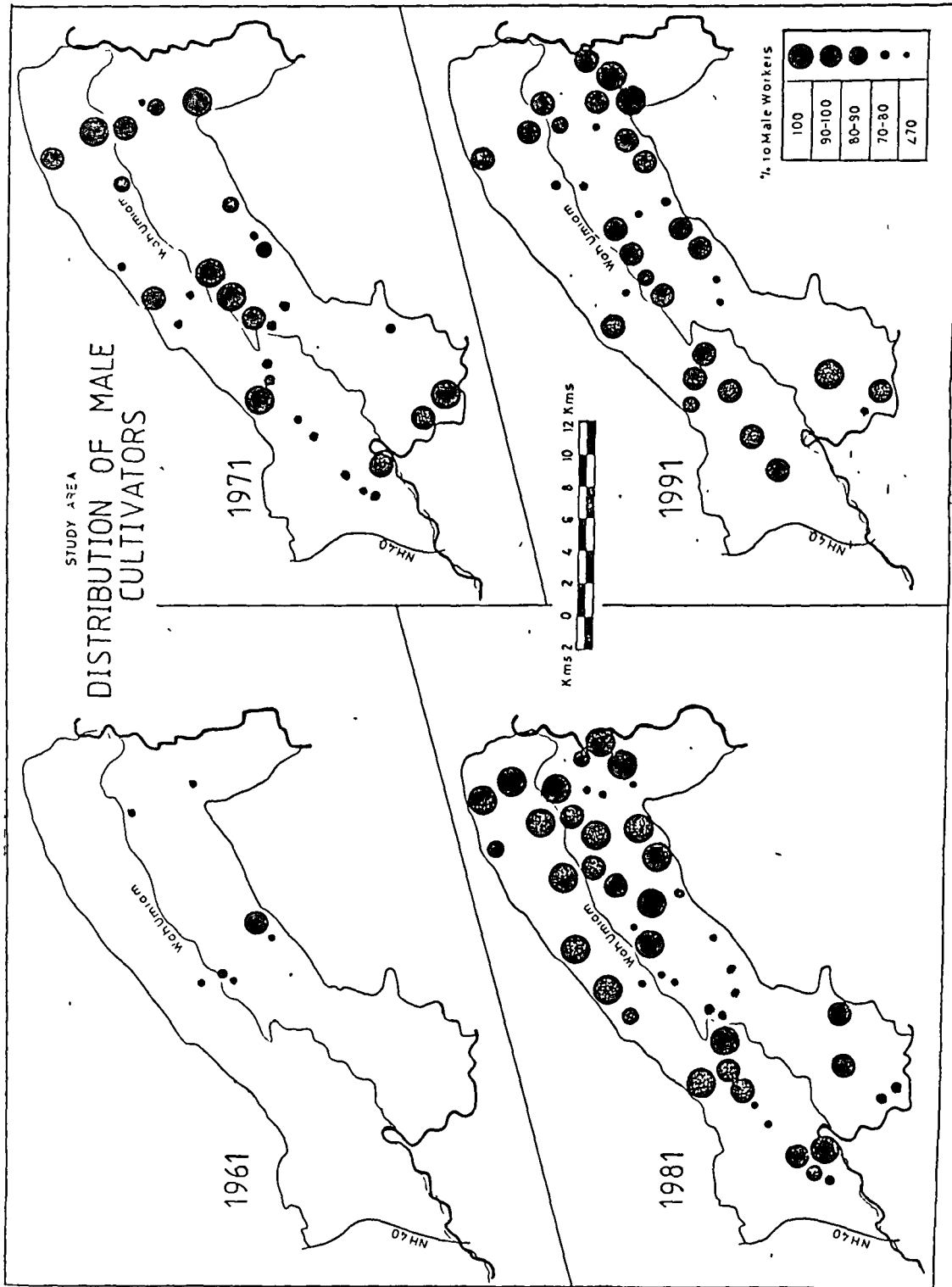
It is evident from the above table that there is a gradual decline in the proportion of cultivators in the total workers in the state as a whole, i.e., from 73.28 per cent in 1961 to only 55.31 per cent in 1991. On the other hand the study area shows an increase in the proportion of cultivators in the total workers. This increase is striking between 1961 and 1971, representing the situation prior to after the construction of the dam respectively. The percentage of cultivators in the study area increased from 66.54 per cent in 1961 to as high as 83.28 per cent in <sup>1971</sup>1981. Their share, however, fell marginally in the successive census counts but remained around 77 per cent - much above the state average.

The most striking change evident in the down-stream areas after the construction of the dam is a phenomenal rise in the proportion of cultivators in the area of the study. Fig. 4.3 shows that the cultivators accounted for a relatively smaller

proportion (i.e., ranging between 53 and 67 per cent) of the work-force in most villages located in the down-stream in the year 1961. The only exception is observed in the distance range of 30-40 kilometers where over 93 per cent of the workforce is returned as cultivators. This situation indicates dependence of the available workforce in wage-earning sector or other sectors of the economy in the study area prior to the construction of the dam.

However, the period after the construction of the dam reveals a sea change in the structure of the workforce as a very large proportion of the working population seems to have transformed itself into owner cultivators. The increase is phenomenal in the distances over 50 kilometers and between 20-30 kilometers. However, there is a drop in the share of cultivators in the total workforce in the area lying between 30 and 40 kilometers. Most other villages show an increase in the proportion of cultivators.

In the year 1981, the region as a whole experienced a drastic fall in the share of cultivators in its workforce, bulk of which was confined to a zone lying at a distance of 20-30 kilometers away from the project site. On the other hand, the villages very close to the project site showed a rapid rise in the proportion of cultivators. The proportion of cultivators remained more or less unchanged in the distance zone of 30-40 kilometers away from the site of the dam. The



villages lying at the distance of over 50 kilometers in the down-stream however, showed a decline in the proportion of cultivators.

But in the year 1991, the share of cultivators showed a marginal decline in villages lying at a distance of less than 40 kilometers whereas areas located farther away recorded an increase in their proportion.

Broadly speaking, the down-stream areas showed an increase in the proportion of cultivators after the construction of the dam indicating larger agricultural opportunities. However, the trend and the pattern of such increases were highly fluctuating over years and uneven over different distance zones within the down-stream locations.

A perusal of the data on the proportion of male cultivators during the period of the study as well as in different distance zones reveals by and large an identical pattern (Table 4.9, Fig. 4.9).

Table - 4.9  
Study Area : Percentage of Male Cultivators to Male Workers

Year	1961	1971	1981	1991
State	66.02	83.55	57.83	50.75
Study area	67.69	81.84	77.75	76.96
Below 20	-	70.54	85.93	72.57
20 - 30	70.76	81.91	65.87	70.14
30 - 40	93.55	73.83	79.48	65.60
40 - 50	66.20	78.43	79.25	81.89
Above 50	57.82	96.44	78.21	94.60

Much like the aggregate pattern, the male cultivators far exceed in their proportion compared to that of the state as a whole in the period after the construction of the dam. In the villages in close proximity to the dam, the proportion of male cultivators exceeds that of the state and regional average after 1981. But the villages lying at a distance of 20-30 kilometers away from the project site show a reversal in the period after the construction of the dam. In the distance zone of 30-40 kilometers, the proportion of male cultivators remains much higher in the pre-construction period, but shows a decline after the construction. Cultivators among the male workers constitute an overwhelming proportion in villages located in a distance of 40-50 kilometers and their proportion increased rapidly after the construction of the dam. Nearly the entire workforce got engaged as cultivators in villages lying at a distance of over 50 kilometers after the construction of the dam.

As far as the female workforce is concerned, the proportion of cultivators remains lower than the state average in 1961 and 1971. However, in the subsequent period, there is a rapid increase in their proportion (Table 4.10 and Fig. 4.10).

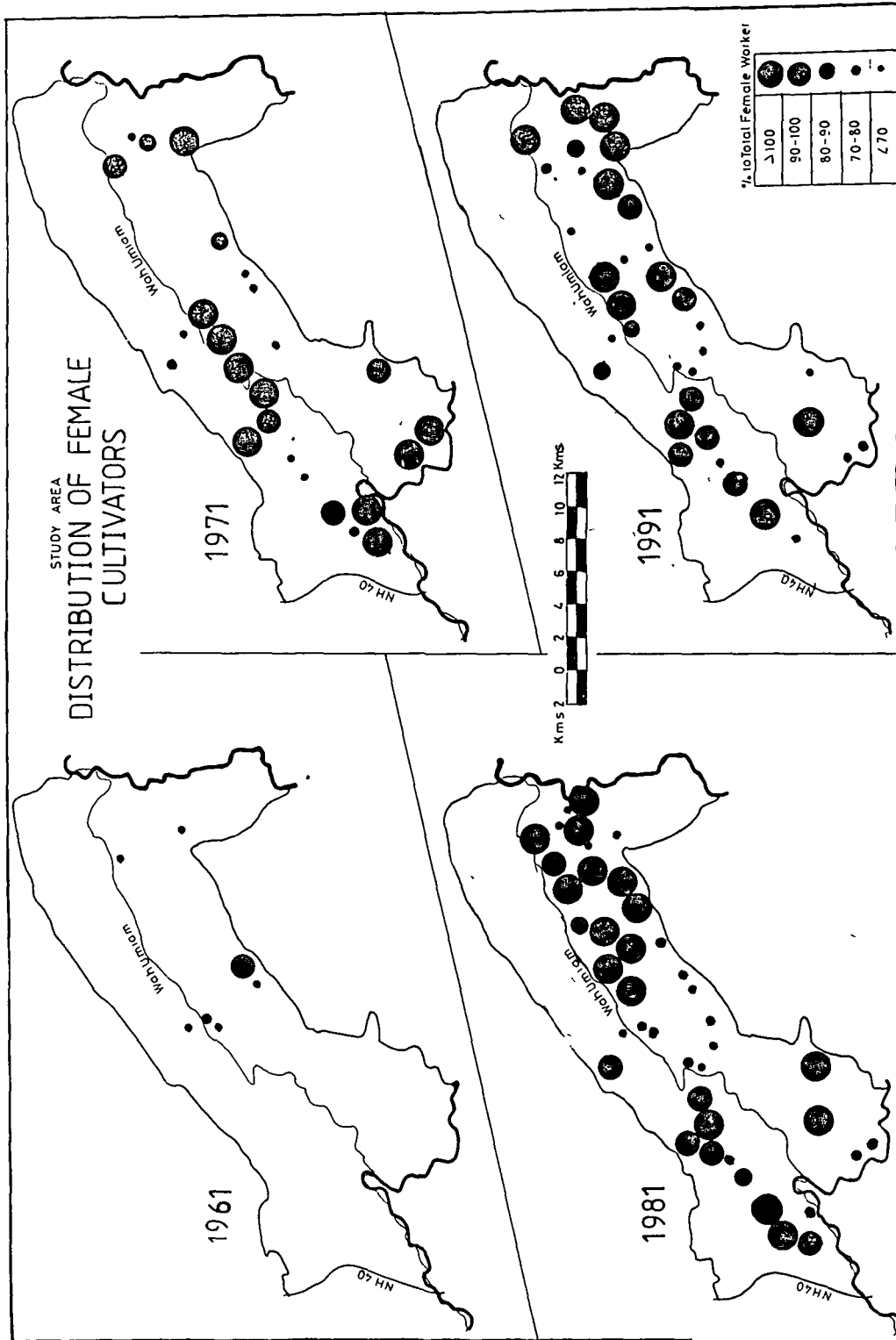


Fig 4.10

Table - 4.10  
Study Area : Percentage of Female Cultivators  
to Female Workers

Year	1961	1971	1981	1991
State	82.34	78.30	70.49	45.79
Study area	63.63	71.65	73.39	77.22
Below 20	-	85.42	83.56	74.68
20 - 30	36.36	98.45	66.25	74.99
30 - 40	53.84	59.79	79.41	63.00
40 - 50	53.34	91.06	71.66	78.82
Above 50	00.00	94.51	66.11	94.73

In the period before the construction of the dam, the female cultivators constituted only 63.63 per cent of their total workforce in the study area as a whole. This was in sharp contrast to the state average of 82.34 per cent. Significantly, the proportion of female cultivators was only 36.36 per cent in 20-30 kilometers zone in the down-stream locations. But in the post-dam period, almost the entire female working population was cultivating in their own fields in this zone. In the subsequent periods, however, the share of the female cultivators fell to 66.25 per cent and 74.99 per cent in 1981 and 1991 respectively.

In the areas in close proximity to the site of the dam, the proportion of female cultivators during the period after the construction of the dam remained more or less static, though there was a marginal decline in the proportion of female cultivators in the remaining areas during 1961-91 period. But, the female cultivators show a rise in their proportion after the construction of the dam.

## AGRICULTURAL LABOURERS

As has been pointed out earlier, this tribal dominated region has not developed a very large wage-labour market within the agrarian sector. However, the table 4.11 shows a consistent rise in the ratio of agricultural labourers from year to year. As for instance, there were only 60 agricultural labourers per 1000 cultivators in the state in the year 1961. However, the ratio increased to 140 in 1971 and to 160 and 200 in the year 1981 and 1991 respectively.

**Table - 4.11**  
**Study Area : Ratio of Agricultural Labourers Per Thousand Cultivators**

Year	1961	1971	1981	1991
State	60	140	160	200
Study area	480	200	410	590
Below 20	-	200	210	240
20 - 30	640	80	710	470
30 - 40	400	330	270	1030
40 - 50	660	260	400	190
Above 50	960	210	710	20

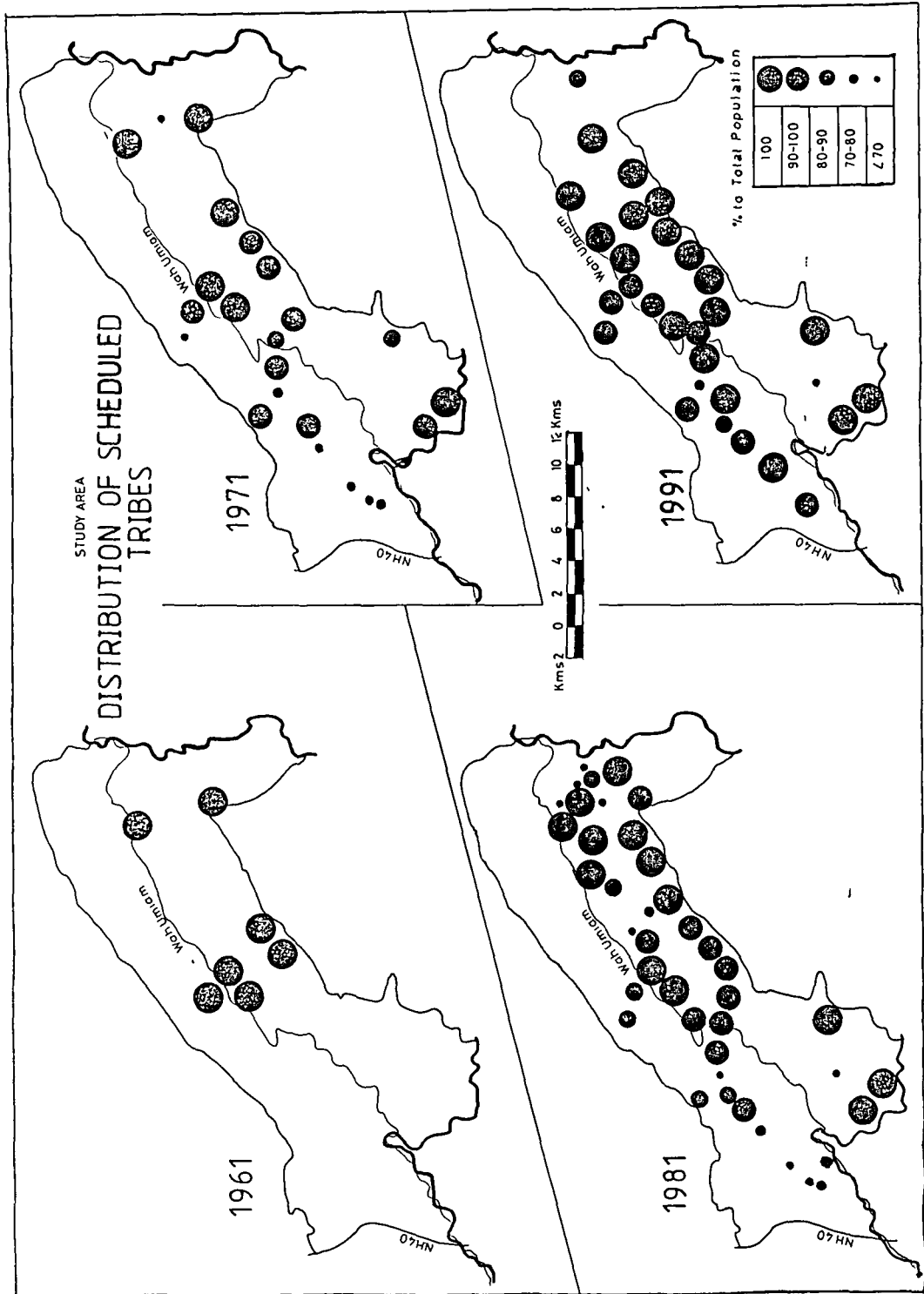
In the study area as a whole, the proportion of agricultural labourers remains much higher than the state average in all the census years indicating a much larger dependence on wage labour market. Moreover, with the exception of the year 1971, the region as a whole shows a rapid rise in the ratio of agricultural labourers from year to year. There were 480 agricultural labourers per thousand cultivators in the study area in the year 1961 representing the period before

the construction of the dam. This ratio decreased to only 200 in 1971 - immediately after the construction of the dam showing an increase in the proportion of cultivators. However, in the next period of time, i.e., in 1981, the ratio increased to 460 and further increased to 590 in 1991.

Significantly however, the wage-dependence of the workforce showed a significant decline after the construction of the dam. Within the region however, the village located within 20 kilometers distance show a much smaller ratio of agricultural labourers to cultivators, the ratio rarely exceeding 240 per thousand cultivators. In the next distance zone, (i.e., 20-30 kilometers), the ratio fell sharply in the post-dam period in 1971, but increased equally drastically to a high of 710 in 1981 to fall again to a low of 470 agricultural labourers per 1000 cultivators in 1991.

The proportion of agricultural labourers as evident from the ratio showed a decline in 30-40 kilometers zone in the post-dam period till 1981. But the year 1991 showed an excess of agricultural labourers compared to the cultivators. Barring the situation in 1981, the ratio of agricultural labourers to cultivators show a declining trend in the distance zone of over 40 kilometers.

In summary, it may be concluded that barring a few notable exceptions, the ratio of agricultural labourers show a



drastic decline in the post-dam period in most of the distance zones.

#### 4.7. PROPORTION OF SCHEDULED TRIBES

The proportion of scheduled tribes in the total population of the villages located in the down-stream areas is analysed here with a view to examining the nature of changes in the social composition of the population in the study area. As has been already pointed out, the study area is located in the tribal heartland of Meghalaya and therefore shows an overwhelming dominance of tribal ethos.

Table - 4.12  
Study Area : Percentage of Scheduled Tribe  
to Total Population

Year	1961	1971	1981	1991
State	83.07	80.48	80.58	85.53
Study area	100.00	86.07	80.64	97.06
Below 20	-	79.45	70.83	94.92
20 - 30	100.00	74.90	82.22	94.80
30 - 40	100.00	89.66	90.43	98.60
40 - 50	100.00	98.17	97.68	97.43
Above 50	100.00	90.17	62.08	99.58

It is evident from the table 4.12 that the state as a whole supported over 83 per cent of scheduled tribe population in the year 1961. The study area on the other hand, had villages which were exclusively tribal in their social composition though there was a slight decline in the proportion in the scheduled tribes in the state in the following two decades. The tribal proportion in the total

population again increased in the year 1991. In the study area, however, the proportion of the tribal population always remained above the state average. But the period after the construction of the dam showed a decrease in the proportion of tribes in the down-stream areas indicating an incursion of some non-tribal population into the area resulting in the breaking the absolute control of the tribes in the settlements. The year 1981, saw a further decrease in the proportion of tribal population in the study area. However, the tribal dominance reasserted itself in 1991.

Within the study area, however, the distribution of tribal population showed divergent trends and patterns. It is interesting that the areas in close proximity (i.e., within 30 kilometers) of the site of the dam showed a much greater infiltration of the non-tribal segment of the population in the period after the construction of the dam (Fig. 4.11). It may be recalled that it is these areas which witnessed a large increase in the number of settlements, particularly newly established ones. The sex-ratio in these villages were largely in favour of males. All these indicate that the areas in the vicinity of the dam showed a relatively more male-selective non-tribal incursion.

Table - 4.13  
Study Area : Co-efficient of Correlation

Indicators	1961	1971	1981	1991
Sex-Ratio	0.47	0.43	0.32	0.06
Dependency Rate	0.36	0.26	-0.08	0.28
Percentage of Workers to Total Population	0.29	0.29	0.23	-0.29
Percentage of Male workers to Total Male Population	0.04	0.49	0.24	-0.37
Percentage of Female workers to Total Female Population	-0.31	-0.63	0.21	-0.77
Percentage of Agricultural workers to Total Workers	0.03	0.09	0.005	0.15
Percentage of Male Agricultural Workers to Total Male Workers	0.23	0.43	0.02	0.17
Percentage of Female Agricultural Workers to Total Female Workers	-0.42	0.002	0.12	-0.02
Percentage of Cultivators to Total Workers	-0.13	0.20	-0.30	0.13
Percentage of Male Cultivators to Total Male Workers	0.22	-0.37	0.23	0.15
Percentage of Female Cultivators to Total Female Workers	-0.39	-0.15	-0.26	0.07
Ratio of Agricultural Labourers to Cultivators	-0.87	0.12	0.30	0.02
Percentage of Scheduled Tribes to Total Population	—	-0.07	-0.01	0.27

However, in the subsequent period, the proportion of tribal population showed an upward trend in these areas, indicating a gradual withdrawal of the non-tribal population from these areas and an increasing replacement by the tribal segment of the population in the newly emerging settlements in close proximity of the dam.

#### 4.8. RELATIONSHIP BETWEEN DISTANCE AND SOCIO-ECONOMIC CHANGES

An attempt has been made to examine the effect of distance on the nature of economic indicators. This has been

done with the help of a correlational exercise between distance of each village from the project site and the changes in the demographic, social and economic composition of the people living down-stream. Table 4.13 presents the coefficient of correlation between distance and socio-economic indicators for the year 1961, 1971, 1981 and 1991.

It is evident from the table of coefficient of correlation that the distance of each village from the project site in most cases show a weak relationship with the chosen indicators. Broadly, therefore, one may postulate an independent relationship between distance and the changes in the rural economy, demography and society.

Such a relationship is in sharp contrast to the zone-wise analysis of the changes which showed uneven nature of these changes in different distance zones. The weak correlation, ironically, leads to a significant conclusion that the construction of the dam, atleast, has not meant any serious negative impact on the demographic, economic and social life of the people in the down-stream areas irrespective of the distance at which the villages are located. 9

#### 4.9. CONCLUDING STATEMENT

The above analysis leads to the following broad conclusions:

Firstly, the region in the down-stream has provided a better economic condition to the people after the construction of the dam as evident from an increase in the proportion of workers in the total population.

Secondly, the areas located in the down-stream provided better agricultural work opportunities to the people as indicated by a higher proportion of cultivators in the working force.

Thirdly, there is little to suggest that the construction of the dam has resulted in any gender<sup>o</sup> disparities in work or within the agricultural sector.

Fourthly, the areas located in close proximity to the dam site seem to have received much of the positive effects accruing from the construction of the dam.

Fifthly, the social composition in the down-stream areas shows a greater diversity in the post-dam period inviting non-tribal segment of the population. But after 1981, there seems to be a gradual displacement of the non-tribal population by the tribal segment.

Lastly, the correlational exercise reveals very little impact of distance on the changes in the economy and society of the people living in the down-stream.

## CHAPTER - V

## A SUMMARY OF CONCLUSIONS AND IMPLICATIONS

5.1. The present study aimed at evaluating the social ; economic, and demographic impacts of the Umiam hydel project on the people living close to the river in the downstream areas from the dam site. The study is confined to an analysis of these impacts on the villages spread along the river course roughly for distance of over 60 kilometers within Meghalaya plateau. The primary aim of the research is to assess the impacts on the village economy and society and come to a conclusion as to the viability and effectiveness of such small scale developmental interventions in tribal areas of Meghalaya in particular and in the country in general by way of inference and generalization.

The significance of the study is related to the present day concern of the consequences on tribal ecosystems in the name of development of people with scant regard to the differential nature of the gains in diverse geographical conditions. The social scientists are engaged in a fierce debate as to the efficacy of large scale multipurpose projects in the context of its negative consequences on environment, economy and society of people affected by such interventions and the positive benefits accruing to people who may not be sacrificing anything for these developments. There are enough evidences to suggest that these projects have had quite

contradictory consequences for people located in the upstream and down-stream areas as well as for the people who are to be displaced from areas submerged after the completion of the project. It is often pointed out that the development gains reach to those people who live far away from the immediate vicinity of the project site, at the cost of those who are directly affected owing to either a rise or diminution in water supply. The impacts in short, assume different characteristics in different geographical areas which are vastly different, implying diverse capacity to internalize both the positive and negative gains.

While studies abound with regard to the impacts of multipurpose and river valley projects on the people displaced or are threatened with such a fate, very little attention has been paid to the consequences of small projects on the people living in areas down-stream who may be directly affected due to these constructions. The present effort is made towards an understanding in this direction.

Based on data mostly collected from successive Indian censuses from 1961 onwards, the study attempts to fulfill these objectives. The choice of 1961 census as a starting point has a vintage value as it reflects the condition prior to the construction of the dam at Barapani. The year 1971 records data immediately after

the construction. The informations after this year provides valuable insights into the process of stabilization and adjustment achieved after the period of relative turmoil owing to the construction of the dam.

5.2. An evaluation of the impacts of small-scale intervention into the natural eco-system in hilly and tribal areas on the society and economy of the people living in areas located in the down-stream can be attempted in many ways. The present study however, examines the viability or otherwise of these interventions by a reference to the spatio-temporal changes in the rural economy with reference to a select number of variables classified into demographic, economic and social in nature. The underlying assumption is that the changes in these spheres of rural society would indicate the positive and negative dimensions of change and it would be possible to make some value judgements with regard to the implication of such small-scale interventions.

It may be argued that any of the changes noted in the rural demography, social and economic conditions may be the result of overall changes taking place in the regional economy and it may be, therefore, not very safe to assume that the changes in the down-stream areas are a direct result of the construction of the dam. While it may be true, attempts have been made to minimize such a possibility by a careful selection of the study area and

to compare the changes taking place therein to those overtaking the region as a whole. If the gap in the quantum and the quality of the change observed in the study area and the region as a whole is substantial, the study assumes these changes as generally, if not fully, a result of the intervention into the natural eco-system by way of constructing a dam.

5.3. The analysis of the available data on changes in demographic composition, economic structure and social composition reveals interesting patterns of manifestations of the changes within the study area with reference to the period of investigation.

The most remarkable impacts of the construction of the dam on the down stream area is visible in terms of spectacular changes in the demographic situation. While the state as a whole experienced a growth rate of 4 per cent in the number of its rural settlements during 61-71 period, the study area witnessed a phenomenal growth of settlements of over 342 per cent during the same period. The largest increase took place within a distance of 30 Kilometers from the site of the dam. A similar trend was observed in the following decade, i.e during 1971-81 period.

Likewise, the study area experienced phenomenal growth rate in its population particularly in areas in

close proximity of the dam, i.e., within 20 Kms from the site of the dam. The increase in population farther away did take place but not as spectacularly as it took place near the dam. In the successive period however, there was a considerable slowing down in the population compared to the state average. However, the population increase continued unabated in the areas close to dam site during 71-81 period while the areas away from the dam only marginally added to their population.

The study area as a whole had a sex-ratio, by and large unfavourable to woman as compared to the state average. The area close to the dam site experienced a far greater shortage in female population after the construction of the dam. However, the sex-ratio was more balanced in the succeeding period and during 1981 and 1991 the sex-ratio in the region was higher than the state average.

In the economic sphere it is interesting to note that the ratio of the working population was much higher in the study area compared to the state average. The construction of the dam has very little impact on worker non-worker ratio as evident from data available in 1971, 1981 and 1991.

As far as the share of working population is concerned it is evident from the available data that the

study area had a much lower working population in the pre-dam period. However, it is interesting to note that after the construction of the dam, one notices a large increase in the share of main workers in the total population which is marginally higher than that of the state average. The increase in the proportion of main workers in the zone adjacent to the dam is far greater indicating better economic opportunities for the inhabitants after the construction of the dam than the situation before. The pattern is almost identical in the case of both males and females.

It is evident from the data on industrial distribution of work-force that the construction of the dam results in a marginal shift from a complete dependence on agriculture to some non-agricultural activity. This shift is far more evident in areas in close proximity to the site of the dam. There is hardly any difference among the two sexes in this kind of a shift.

A striking feature of the change in the occupational pattern is a phenomenal increase in the proportion of cultivators in the study area in the pre construction and post construction phase. This is true for both male and female segment of the population. This situation is matched by a corresponding decline in the proportion of workers engaged in agricultural wage earning.

The changes in the economic sphere suggest positive changes in the economic life of the people as indicated by greater absorption of the labour-force and increased agricultural activity in the downstream areas.

Significantly, the downstream areas experienced a decline in the tribal population immediately after the construction of the dam indicating incursion of non-tribal population causing phenomenal increase in the number of settlements and population. However this situation is reversed in the succeeding census counts recording larger proportion of tribal population which was possibly caused by increasing displacement of the non-tribal segment by the tribes.

5.6. An analysis of the co-efficient of correlation between distance of the villages and the indicators chosen reveals the lack of any strong association. In most cases the co-efficients indicate indeterminate relationships. Ironically, lack of strong association as revealed from the co-efficient of correlation data suggests that the changes are at least not negative in the down-stream areas in relation to distance.

5.7. The analysis of the data reveals that the construction of the dam at Barapani has had little negative impacts on the social, economic or demographic composition of the people living in the down-stream areas.

The areas in close proximity to the site of the dam have proved far more attractive from the demographic and economic point of view after the construction of the dam and it appears therefore that such small-scale developmental interventions are welcome as processes of regional development in hilly and tribal areas.

However, the research has its own limitations of a near exclusive dependence on census data. The conclusions arrived in this study need to be probed further with the help of primary data generated through field investigations. Until such an effort is made, the findings of this research may be treated as provisional and need to be treated with caution.

## BIBLIOGRAPHY

## SELECT BIBLIOGRAPHY

- Agarwal, Mundira, (1989) : Geomorphological Studies Around Umiam Lake, (unpub) M.Phil. Dissertation, NEHU, Shillong.
- Agarwal, P.N. & Kumar, A. (1982) : "Micro-Earthquake Recording for Engineering Applications", Engineering Geoscience, Prof. R.S. Mittal Commemorative Volume, (ed.) B.B.S. Singhal, Sarita Prakashan, New Delhi.
- Ahmad, A. (1984) : " Socio - Cultural Change in a Developing Society - The Case Study of India", (Mimeo).
- Ahmad, A. (1985) : Presidential Address, Geography Section, 10th Congress of the Indian Academy of Social Science, (Mimeo).
- Alvares, C. and Billorey, R., (1987) : "The Damned", The Illustrated Weekly of India.
- Bana, S. (1987) : Major Irrigation Projects Non-Viable?, Financial express.
- Barkataki, S., (1969) : India - The land and People, Assam, National Book Trust, New Delhi.
- Basu, N.G. (1989) : Ecology and development, Mainstream, Vol. 37, No. 40.
- Basu, Swapana (1994) : "Problems of Siltation in Panchet Reservoir", Indian Journal of Landscape Systems and Ecological Studies, Institute of Landscape, Ecology and Esketics, Vol. 17, No. 1.
- Burton, I., (1963) : "The Quantitative Revolution and Theoretical Geography", Canadian Geographer, 7.
- Census of India, (1961) : Assam, General tables.
- (1971): Meghalaya, District Census Handbook, United Khasi & Jaintia Hills, Series 13, Part 10 A & B.
- (1981) : Meghalaya, District Census Handbook, East Khasi Hills District, Series 14, Part 13 A & B.

- Census of India, (1991) : Meghalaya, National Informatics Centre (Uncompiled)
- Chatterjee, S.P. (1968) : India - A Physical Geography, Publication Division, New delhi.
- Chaudhury, A., (1987) : "The Life-line of Gujarat Sardar Sarovar Project", The Hindu.
- Dhawan, B.D., (1993) : "Coping with Flood in Himalayaan Rivers", Economic and Political Weekly, Vol. 28, No. 18.
- Dogra, Bharat, (1993) : "Urgent Needs to Review Sardar Sarovar Project", Mainstream, Vol. 31, No. 31.
- D.V.C., (1985) : "Sedimentation Survey of Panchet Reservoir", (Fifth Survey), Maithon.
- Ghosh, R.N. and Sen Sharma, S.B., (1984) : Surface Water Resource Development and Dams of India, Arnold, Heinemann, New Delhi.
- Gopalakrishnan, R., (1989) : Geography of Meghalaya, Rajesh Publications Ltd., New Delhi.
- Irrigation Commission Report (1972) : Vol. III, Part I, Ministry of Irrigation and Power, New Delhi.
- Kothari, A. and Bhartari, R., (1984) : "Narmada Valley Project - Development or Destruction", Economic and Political Weekly, Vol. 19, No. 22 & 23.
- Kothari, Rajni, (1988) : "Rethinking Developemnt - Development Viewed Internationally in Search of Humane Alternatives", Mainstream, Vol. 21, No.17.
- Kothari, A., (1992) : "Tehri Dam -Memorable Fast", Mainstream, Vol. 30, No. 26.
- Kurien, J.C.T. (1987): "Development-Where Do We Go From Here", Development and Social Change Lecture Series, North-Eastern Regional Centre, Indian Council of Social Science Research. (Mimeo).
- Lawrence, S.,(1992): "Environmental Implications", A Symposium on Sector Neglected by The New Economic Policy, Seminar, 395.

- Majumdar, S.K., (1986) : "The pre-Cambrian Framework of Part of the Khasi Hills, Meghalaya", Rec. Geol. Survey of India, Vol. 117, Pt. 2.
- Mathur, Nita, (1992) : "Evolving Strategies for tribal Development", Mainstream, Vol. 30, No. 20.
- Meghalaya Guardian, (1994) : "Tribal Around Subarnarekha, Project Languishing".
- Misra, Sri Kumar, (1994) : "The First Hydel Power Station in India", Indian Journal of Landscape Systems and Ecological Studies, Institute of Landscape, Ecology and Esketics, Vol. 17, No. 1.
- Mithal, R.S. (1981) : "The Physical Impact of Ram Ganga Dam Project on its Drainage Basin and Catchment Areas", Interim Report II, Submitted to CSIR, (unpublished).
- Mithal, R.S. (1982) : "The Physical Impact of Ram Ganga Dam project on its Drainage Basin and Catchment Areas", Interim Report III, (Unpub).
- Mithal, R. S., Gohain, K. and Joshi, B. C. (1982) : " Geomorphic Analysis of Part of the Ramganga catchment Basin", Himalaya Landform and Process, (ed.) V.K. Varma and P.S. Saklani, Today's and Tomorrows Publishers, New Delhi.
- Mithal, R.S., Joshi, B.C. & Gohain, K., (1984): "Environmental Impacts of the Ram Ganga Dam Project", The National Geographical Journal of India, Vol. 30, Pt. 2, pp. 81-91.
- Nag, D.S., (1988) : Resettling Displaced - need for Promptness, Free Press Journal.
- Narayan, S. and Kumar, Binod, (1983) : "Obstacles to tribal Development", Mainstream, Vol. 32, No. 1.
- Nayak, D.K., (1990) : "Geography, Environment and Social Concern", Trans. Inst. Indian Geographers, Vol. 12, No. 2.
- Pal, T. K. and Nath, P. (1984) : " Ranganadi Hydel Project - Its Necessity, Environmental Aspects and Prospects in Fisheries". Indian Journal of Landscape Systems and Ecological Studies, Institute of Landscape and Esketics, Vol. 13, No. 2.

- Ramganga Project Report (1963) : No. 5, (Unpub.).
- Ramganga Project (1978) : History and Completion Report, No.I, (Unpub).
- Rashtriya Barh Ayog Report (1980) : Ministry of Energy and Irrigation, Department of Irrigation, Govt. of India.
- Raza, Moonis etal. (1977) : ".The Tribal Population of India Spatial Patterns of Clustering and Concentration", Centre for the Study of Regional Development Occasional paper No. 5, Jawaharlal Nehru University, New Delhi.
- Raza, M., (1980) : "Reflections on Geographical View of Man in the Eco-systems", Transactions of Institute of Indian Geographers, Vol. 2, No. 2.
- Reddy, U. B., (1991) : "The Implications of Large dams in India A Case of Narmada Valley project", Geographical Review of India, Vol. 53, No. 3, Geographical Society of India, Calcutta.
- Rego, Stephen, (1994) : "Destructive Development and People's Strategy in Bastar", Economic and Political Weekly.
- Roy Burman, B.K., (1971) : "Distribution of Scheduled Tribes of India - An Explanatory Geo-cultural Appraisal", Socio-Cultural and Economic Dimensions of Regionalisation in India, Census Centenary Monograph, No. 7, New Delhi.
- Scope Report, 5, (1975) : Environmental Impact Assessment, Principles and Procedures (ed) R.E. Munn, Toronto.
- Singh, R.L. (1971) : India - A Regional Geography, National Geographical Society of India, Varanasi.
- Singh, S., Agarwal, P. N. and Arya, A.S., (1975) : "Microearthquake studies at Ramganga Project, Kalagarh, U.P., India" Bull. Indian Society of Earthquake Technology, Vol. 12.

- Singh, K., (1989) : Narmada Issue - An Overview, Mainstream, Vol. 26, No. 23.
- Singh, N.K., (1987) : Narmada Project - Churning Controversy, India Today.
- Singh, R.P., (1968) : Geomorphology of Shillong Plateau of Assam, Proc., pre-cong. Sym. on Meghalaya II, (I.G.U., Guwhati).
- Spate, O.H.K. etal., (1967) : India, Pakistan and Ceylon, The Regions, Methuen & Co. Ltd, London, B. I. Publications.
- Sten, H.W., (1970) : "Meghalaya - 100 Years War of Independence", The Assam Tribune.

LIBRARY  
 Acc. No. 103022  
 Date Recd. 27.2.98  
 Date Recd. by  
 Date Recd. by  
 Date Recd. by