SIZE OF HOLDING AND PRODUCTIVITY: A GEOGRAPHICAL ANALYSIS: CASE STUDY OF NOWGONG DISTRICT, ASSAM

HAREN SAIKIA

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF REQUIREMENT FOR THE DEGREE OF

MASTER OF PHILOSOPHY

DEPARTMENT OF GEOGRAPHY
SCHOOL OF ENVIRONMENTAL SCIENCES
NORTH-EASTERN HILL UNIVERSITY
SHILLONG

NOVEMBER 1987

PHONE :
GRAMS : NEHU

North-Eastern Hill University

Mayurbhanj Complex, Nongthymmai, Shillong-793014

Department of Geography

CERTIFICATE

This is to certify that the dissertation submitted by Sri Haren Saikia for the Degree of Master of Philosophy (M.Phil) at the Department of Geography, School of Environmental Sciences, North-Eastern Hill University, Shillong, entitled "Size of Holding and Productivity, A Geographical Analysis : Case Study of Nowgong District, Assam" is a bonafide study of the author to the best of my knowledge and belief. This study may now be placed before the examiner for evaluation.

R.K.Rai
(Prof. R.K. Rai)
Supervisor,
Dean
School of Environmental Sciences

Dated 15th December'87

CONTENTS

ACKNOWLEDGEMENTS

I owe my deep indebtness to my supervisor, Professor R.K. Rai, Dean, School of Environmental Sciences, North-Eastern Hill University, Shillong, for his valuable guidance and inspiring supervision of this work.

I express my gratitude to Dr. R. Gopalakrishnan, Head, Department of Geography, NEHU, and all the faculty members of the Department for their interest throughout the tenure of this study.

Special mention of thanks must be made to Agro-Economic Research Centre, Assam Agricultural University, Jorhat, for kind co-operation and for making research materials available to me.

I reveal my feeling of appreciation to a host of friends who proved to be very co-operative and helpful, but whom I am not able to acknowledge by name.

Date 15 th DECEMBER 1987
Place : Shillong

(HAREN SAIKIA)

List of Figures

List of Tables

CHAPTER-I

INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

Relationship between the size of holding and productivity has been a controversial issue in India. While some economists argue in favour of "inverse" relationship between the size of holdings and productivity, others attribute such a conclusion only to certain "statistical traps" and in turn suggest that, there exists no consistant relationship between productivity and size of agricultural holdings. There are still others who feel that the relationship tends to become positive, particularly in those areas receiving the impact of green revolution. Since the relationship between the size of holdings and productivity has an important bearing on various policies concerning agricultural planning adopted at the state or national level, it would be useful to utilize the latest data for testing various hypotheses.

Agriculture is the most extensive form of human occupation where half of the world's population earns its livelihood. Agricultural geography, dealing with the spatial organization of crops and their concentration, provides an interesting field in which geographer can play a vital role for the well-being of the society.

The present study attempts to understand the specific nature of the relationship existing between landholding and productivity in a backward agricultural setting of the Brahmaputra valley. In the course of the analysis the study will aim at examining the relationship in its multiferous facts ranging from size of farms, tenancy and fragmentation to broader aspects such as, land-utilization and cropping pattern etc. and avoid making a sweeping judgement arising out of a simple one to one relationship.

The process of economic development inevitably entails efforts to raise productivity in the agricultural sector so that not only a small working force can produce enough food for the rest of the society, but also to release a big chunk of its working hands to join the industrial sector. Thus raising agricultural productivity forms one of the most important tasks of most of the developing countries aiming at a quicker pace of economic development. In India, efforts had been made to raise agricultural production by raising more and more land under cultivation in its early decades of planned development. However, it was soon realized that emphasis has to be laid more on <u>productivity</u> than on <u>production</u>. All out-efforts were to made to increase productivity of land by way of

introducing improved varieties of seeds, mechanization and other modernized methods of cultivation popularly known as "Green Revolution" in the history of post independent India, contrary to the expectation, by the late seventies it was seen that the effects of green revolution were highly localized and in the larger part of the country its impact was minimal. Furthermore, it was also felt that the emphasis on mere productivity had introduced acute socio-economic disparities, particularly in terms of land distribution among various segments of the population and in terms of changes in the cropping pattern.

This led many to wonder the structural questions which were so far ignored. Social scientists began to question the very nature of the relationship that existed between productivity and size of holdings. A protracted debate continued to pour evidences contrary to each other as to whether the relationship is neutral, positive or inverse. The very debate has also raised doubts as to the ethical nature of economic development based on productivity ignoring the question of social justice. It has also marked a rethinking among planners and policy makers to incorporate the findings for better agricultural planning. But there appears to be no end to the debate.

The problem, perhaps, arises from the fundamental differences in the agricultural ecology of the sub-continent which allows differentials relationship between agricultural holdings and productivity. An attempt in this dissertation, therefore, has been made to understand the relationship in a green ecological mileu of Brahmaputra valley.

Assam has a strong agro-climatic base yet its economy in general and agriculture in particular is not showing satisfactory performance. A low level progress in the primary sectors of the region has resulted in many socio-economic problems. Agriculture is the principal source of livelihood for a majority of the people in the rural areas of Assam. The agricultural sector is so important to the state's total economy that it alone contributed 56 per cent to the state's total income at the current prices in 1975-76 as compared with 45 per cent for India as a whole. Agriculture has another most important role to play. It acts as the main absorber of the working population as it engages as high as 77 per cent of the total working population in the state. In fact, the average yield of cereal and non-cereal crops in Assam is much lower compared to that of other states; the technology deployed in agriculture is traditional and diffusion of innovations is insignificant. Although Assam ranks seventh

out of a total of twentyfive states in India in terms of per hectare productivity, it is not an impressive record considering the potentiality of its arable land and natural endowment. About half of the total districts (undivided), i.e. Darrang, Goalpara, Kamrup, Nowgong, Lakhimpur and Dibrugarh of Assam has very low agricultural productivity per hectare of land. It is obvious from the present agricultural situation that the agricultural potential of the state is highly under-utilized and much remains to be done.

1.2 OBJECTIVES

The studies on the size of holdings and productivity of agriculture in India are relatively less and there are extremely few studies which have been conducted on the North-Eastern region. This is understandable for the context and concepts of holdings in the region significantly differ from the rest of the country. In the light of new strategy adopted by the government of India during 1966-67 for agricultural development, the individual operational holdings assumed special significance in India as the unit of decision making. It became more important as the agricultural census centred around the operational holdings. The study, therefore, is undertaken with the following objectives:

i) to assess the nature and extent of inequality in the distribution of land holdings among various segments of the populations;

ii) to examine the specific nature of the relationship which exists between the pattern of land holding and agricultural productivity in the study area;

iii) to develop insights into various programmes on agricultural planning and policies and suggest necessary reformative measures aiming at better productivity of land.

1.3 SOURCE OF DATA AND METHODOLOGY

The data used for this study have mostly been obtained from the Farm Management Survey of India where 'the study in the economic of the Farm Management' was carried out in the year 1968 to 1971 in the district of Nowgong of Assam. The other sources of the data are the published and unpublished record of the state reports on agricultural census, Government of Assam. Apart from these sources, informations have been obtained from the Census of India and various periodicals and other sources.

Methodological idea adopted in this dissertation also centre around the study of the Economic of Farm Management as mentioned above. Therefore, the source of data and methodology at this study are the same as the findings of the

Farm Management Survey of India.

The whole district is divided into three agricultural zones according to the cropping pattern, rainfall and location etc. Altogether 150 farm families in 15 villages comprising of 3 zones, i.e. 80 households from Zone 'A', 30 from Zone 'B' and 40 from Zone 'C' has been taken up for investigation. To gather authentic information the structure of farms are divided into 4 sections, viz., 1) Farm size, tenancy and fragmentation, ii) Land utilization, cropping pattern, iii) Farm assets and iv) Cash receipts and cash expenses. The data has been analysed on cost accounting method.

1.4 AREA OF STUDY

The present study pertains to the Nowgong district of Assam, which is one of the agriculturally developed districts in the Brahmaputra valley. The district is situated on the south bank of the river Brahmaputra occupying a geographically central position in the state of Assam. The district lies between 25°45' and 26°45' North latitudes and 91°50' and 93°20' East longitudes. On the north it is bounded by the river Brahmaputra, on the east by the district of Sibsagar (undivided) and Karbi Anglong. The southern part is mainly bounded by the Karbi Anglong district and portions of the state of Meghalaya and North Cachar Hills. On the

west lies the district of Kamrup and part of Meghalaya plateau. The total geographical area of the district is 5,561 square kilometre.

According to the census of 1971, Nowgong district accounted for about 11.2 per cent of the total population of the state. The district was having 16,80,895 (8,84,938 males and 79,5957 females) in 1971 as against 12,10,761 persons (6,45,690 males and 5,67,071 females) in 1961, with an increase of nearly 39 per cent. The rural population of the district is about 1.6 million while the urban population is a little less than 1.2 lakhs. There were as many as 899 females per thousand of males. Among the district of Assam, Nowgong had the highest density (302 persons per square kilometre) of population far exceeding the state average of 221 per sq. km. However, in terms of absolute number Nowgong district has the lowest number of population compared to the other districts located in the plains.

The cultivated area of Nowgong district accounts for a little over half of the total geographical area of the district. The total cropped area and intensity of cropping has shown marginally increase over the period preceeding 1971. The porportion of current fallow has declined gradually probably as a result of better attention given to the farm practices.

Paddy is the major crop of the district. Different varieties of paddy occupy about 67 per cent of the gross cropped area in 1967-69 and 72 per cent in 1970-71. The second ranking crop of the district is jute. It is reported that, the area under jute shrinks from 16 per cent in 1967-68 to a meagre 12 per cent in 1970-71. The rabi season's crop viz., oil seed and pulses have occupied about 8 per cent and 4 per cent of the gross cropped area respectively.

1.4 SAMPLE VILLAGES

The villages chosen for the present study are those selected by Economics of Farm Management which carried out agricultural survey in the district during the period 1968-69 to 1970-71. The villages are well distributed throughout the district and hence the field data collected from these villages are proper indicative of the different aspects of agro-socio-economic life of rural areas in Assam, particularly of the Nowgong district.

The sample villages constitute 0.8 per cent of the total villages in the entire district. The population of sample villages are 23,446 according to the 1971 census. About 36.6 per cent of the total population in the villages is recorded as literate and 70 per cent of workers depend

on agriculture as their livelihood. The share of the workers in the total population of the sample villages is about 40 per cent. The livestock population consists of about 37 per cent draught animal, 23 per cent milch and 40 per cent other animals.

The average size of cultivated area is 2.07 hectare per household in the sample villages and per capita land available is 0.27 hectare. The intensity of cropping is low, the ratio of gross cropped area to the net cropped area being 1.28. Paddy is the pre-dominant crop of the sample villages covering about 74 per cent of total occupied area under principal crops. The next important crop grown by the villagers is jute. The rape and mustard, pulses and other miscellaneous vegetable crops are also raised in the villages.

The method of cultivation is still primitive. The traditional wooden plough and spade are commonly used as agricultural implements in the villages. A few cultivators, however, started using tractors for preparation of soil for the cultivation of jute, sugarcane and autumn paddy (Ahu) in the summer. The chemical fertilizers are used by almost all cultivators of the sample villages.

The crop rotation practised by the villages are as follows:

i) Autumn paddy (Ahu) followed by winter paddy (Sali)

ii) Jute followed by winter paddy (Sali) or mustard or pulses.

The cultivators of sample villages have grown winter paddy (Bao) and autumn paddy (Ahu) as mixture.

1.4.1 Prices of agricultural commodities

The post harvest prices of all the commodities are considerably lower than that of pre-harvest prices. The differences of the village and market prices of all the commodities are not very much significant to note. The lowest price of paddy is recorded in the month of December and thereafter the prices gradually rise. In the case of jute, the lowest prices are recorded in September and October and continue to rise from the month of November. The variation of prices of pulses and mustard in different months are not worth noticing. The lowest price of sugarcane is recorded during the month of January to March and thereafter rise gradually.

1.4.2 Agricultural wages

The average daily wages (during the period of study) paid to the male, female and children are Rs.4.08,

Rs. 3.30 and Rs. 2.92 respectively. It appears that higher wages are received by the adult male and children in ploughing operation compared to other agricultural operations.

1.5 CHAPTER SCHEMES

The chapter schemes for the present study is as follows:

Chapter one discusses the problem, objectives of the study, sources of data and methodology, economy of the study are and existing literatures of the study.

Chapter two presents a brief geographical account of the study area.

Chapter three discusses the landholding and production pattern of the study area.

The fourth chapter pertains to the analysis of the various aspects of farm structure.

The last chapter is devoted to a summary and conclusions arrived at the earlier chapters and suggests recommendations for a better agricultural planning.

1.6 LITERATURE SURVEY

The relationship between the size of holdings and productivity has been a much debated issue. In the

early stages of the discussions, there was a near unanimity among most writers on an inverse relationship between the two variables. This conclusion, however, did not withstand rigorous empirical tests when the later investigators provided results contrary to it.

The focus of production response to price in the Indian literature has been nearly matched by the economic analysis, which was taken from the findings of the Farm Management Studies (for Uttar Pradesh, Madras, West Bengal, Bombay, Punjab, Madhya Pradesh and Andhra Pradesh during mid 50s) that an inverse relationship existed between farm sizes and productivity per acre. This relationship which has an obvious bearing upon the policy issues pertaining to land ceiling and land grouping under co-operative farming and other forms of agrarian organisations, has led to the explanations by Khusro, Majumder and Sen and further empirical work by Hanumantha Rao and A.P. Rao and the others.

We may note at the outset that much of the important statistical evidence that is available point rather strongly towards the existence of an inverse relationship between farm size and productivity. The Farm Management Studies have indeed, yielded this relationship, whether grouped by size classes or taken

on an individual farm basis as Hanumantha Rao has done from Bombay. Independent survey for Andhra Pradesh by Rao has also revealed similar results.

A.M. Khusro writes, 'of particular interest are some generalisation about the relationship between farm size and efficiency which are based upon a remarkable repetitiveness of some phenomena almost everywhere among the area studied', later mentioned as one of the generalization, 'as farm size expands gross output per acre declined'.[1]

Similarly, A.K. Sen listed three results found to be broadly valid in Indian agriculture. One of these was, 'by and large productivity per acre decreased with the size of holdings'.[2]

Dipok Majumder in his turn wrote, 'the data presented by the Farm Management Survey of India have added another example to a phenomena observed in many parts of the underdeveloped world, viz., that in peasant agriculture, as the farm size decreased the output per acre increased'.[3]

---

[1] Khusro, A.M., (ed.) Readings in Indian Agricultural Development, Allied Publishers, 1968.

[2] Sen, A.K., Economic Weekly, 14, June 26, 1963.

[3] Majumder, D., Economics, 32, May 1968.

Saini wrote, 'by and large the inverse relationship between farm size and productivity as a confirmed phenomena in Indian agriculture and statistical validity is adequately established by an analysis of the disaggregated data'.[4]

Hanumantha Rao made such a generalization not only for yield per acre but also some of the factors associated with it. Thus, 'in all the districts studied, the percentage of cultivated to uncultivated area, cropped more than once decreased sharply with increase in the size of holdings. This is because, among the factors the percentage of holdings irrigated invariably declines with increase in the size of holdings.'[5]

We may now turn to another side of the debate. A.P. Rao has fitted a logarithmic function to farm level data, all belonging to the same village. His conclusion was, 'contrary to the findings of the Farm Management Studies, according to which, the productivity remained constant over all holding sizes in all villages, which indicates that, holding size has no effect on productivity.'[6]

Rao's conclusions were confirmed by A. Rudra who also used disaggregated data referring to the farms within

---

[4]Saini, Economic and Political Weekly, 6, June 1976.

[5]Rao, Hanumantha, Indian Economic Review, 1, Oct. 1966.

[6]Rao, A.P., Economic and Political Weekly, 2, Nov. 1967.

the same village. He tested a large number of observations and statistical methods which he thought were superior to the regression method used by all others.

Usha Rani was more cautious and her conclusions were exemplified by the following statements:

a) "One can even conclude that yield per acre remains constant over different size groups of farms".

b) "No farm generalization can be made about the variation of intensity of cropping over different size group of farms".

c) "It can be said, there are no significant variations in the inputs per acre over the different size group of farm".[7]

The above survey only makes the complexities clear about the relationship between the two variables. It is clear from the survey that the received studies do not reach at any conclusive results and their findings are extremely divergent. Part of such divergent findings owe their origin to the varying ecological and social milieu, regionally differentiated over the broad spectrum of the Indian sub-continent. The size and diversity of the sub-continent defies predictably any ubiquitous experiance and this perhaps demands studies at a micro scale without aiming any generalized picture to be obtained.

---

[7] Rani, Usha, Economic and Political Weekly, 16, June 1971.

CHAPTER-II

PHYSICAL ENVIRONMENT OF THE STUDY REGION

2.1 INTRODUCTION

Agriculture is not only the growing of crops, it is also a form of applied ecology. Agriculture is directly dependent on the immediate natural environment which can be changed only at heavy cost. Initially, agricultural systems are imposed by the physical condition till the later are modified. Assam as a whole and Nowgong district particularly reveals regional contrasts in agriculture attributes, which is largely because of differences in environment.

Physical factors affecting agriculture may be divided into geology, physiography, location, soil, climate, hydrology, etc., although they are clearly interrelated. For instance, climate is influenced by altitude and slope aspects, soil by rainfall and evapo-transpiration etc. Therefore, the role of these factors in the areal agricultural complex is undeniable.

2.2 LOCATION

The state of Assam, situated in the North-Eastern corner of India is linked with the rest of the country by a narrow strip of sub-montane region in North-Bengal. It extends from 24°8' to 27°56' North latitudes and 89°42' to 96° East longitudes, surrounded by Bhutan and Arunachal

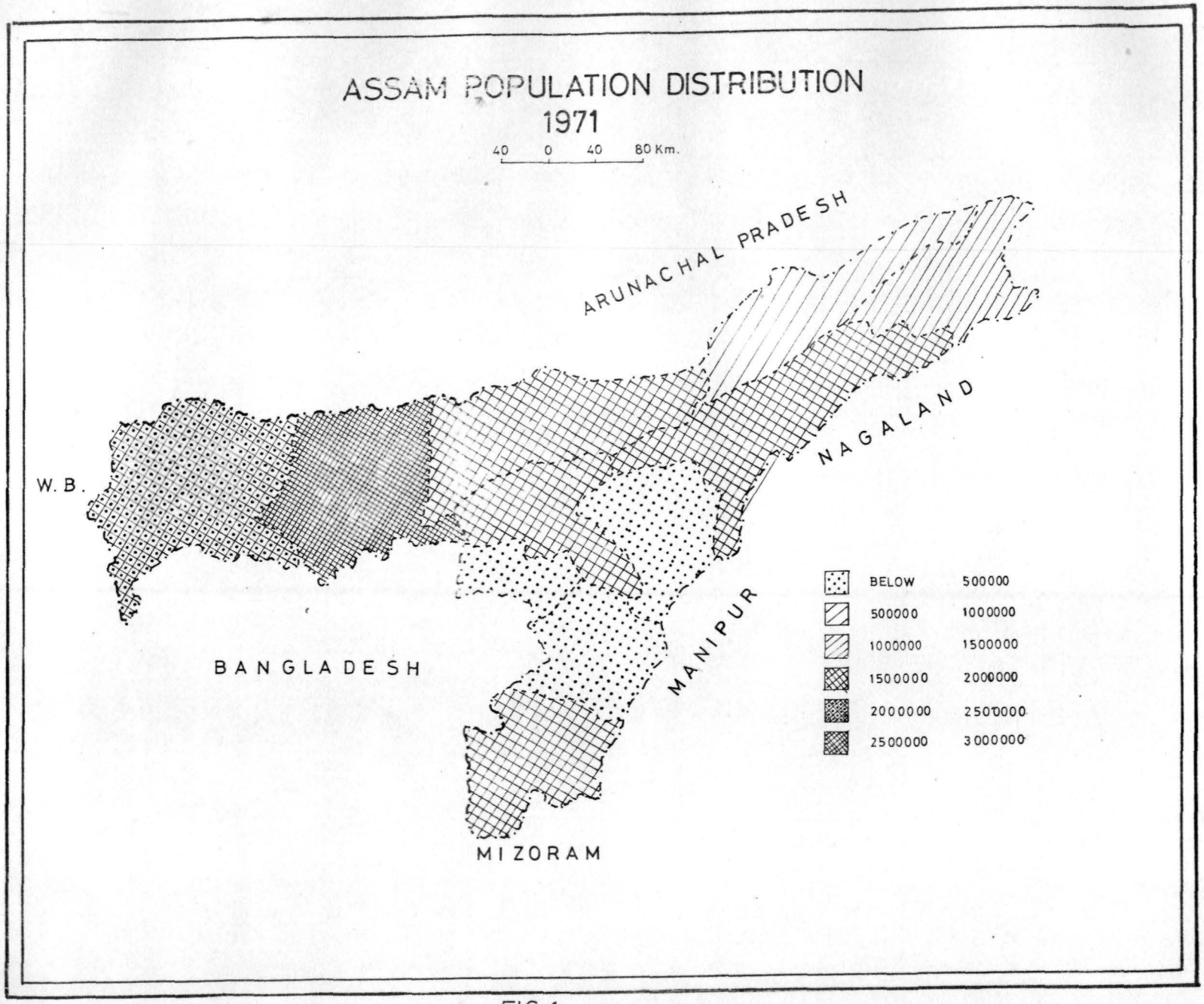
ASSAM POPULATION DISTRIBUTION
1971
40 0 40 80 Km.
ARUNACHAL PRADESH
NAGALAND
W. B.
BANGLADESH
MANIPUR
MIZORAM
BELOW 500000
500000 1000000
1000000 1500000
1500000 2000000
2000000 2500000
2500000 3000000

FIG.1

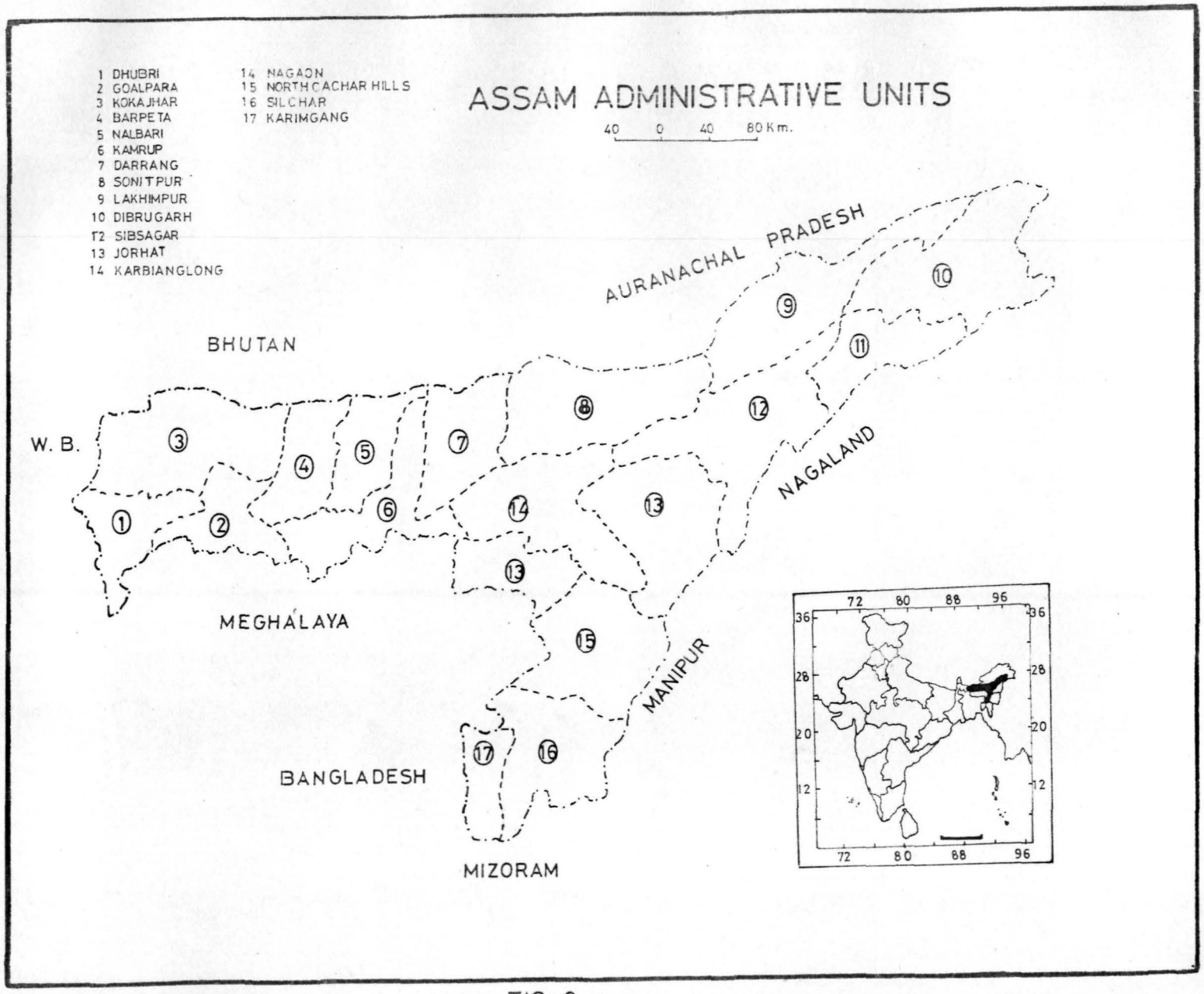
1 DHUBRI
2 GOALPARA
3 KOKAJHAR
4 BARPETA
5 NALBARI
6 KAMRUP
7 DARRANG
8 SONITPUR
9 LAKHIMPUR
10 DIBRUGARH
12 SIBSAGAR
13 JORHAT
14 KARBIANGLONG
14 NAGAON
15 NORTH CACHAR HILLS
16 SILCHAR
17 KARIMGANG
ASSAM ADMINISTRATIVE UNITS
40 0 40 80 Km.
AURANACHAL PRADESH
BHUTAN
W. B.
NAGALAND
MEGHALAYA
MANIPUR
BANGLADESH
MIZORAM
72 80 88 96
36
28
20
12

FIG. 2

Pradesh and Nagaland in the east and south-east, Nagaland, Manipur, Mizoram and Meghalaya in the south, in the west and south-west bordered by Bangladesh and to the west by West Bengal. The geographical area of Assam is 78,532 km^2 and the projected population for 1981 is 19,897,000. It comprises of 16 administrative districts, viz., Dibrugarh, Lakhimpur, Sibsagar, Jorhat, Nowgong, Karbi Anglong, Sonitpur, Darrang, Kamrup, Barpeta, Dhuburi, Goalpara, Kokrajhar, North Cachar Hills, Karimganj and Silchar (Fig.1B2).

The study region Nowgong district is located on the south bank of river Brahmaputra occupying the central portion of the state of Assam. It belongs to lower Assam part, bordering between lower and upper Assam (Fig. 3).

2.3 GEOLOGY AND SOIL

The geological history of Assam goes back to the period of formation of some of the most ancient rock masses on the crust of the earth. These rocks, grouped as the Archaeans, from the main body of the Indian Peninsular shield. The Karbi plateau (Mikir Hills) was originally a geologic and physiographic continuation of this peninsular shield.

Perhaps the most ancient rocks of Assam are a

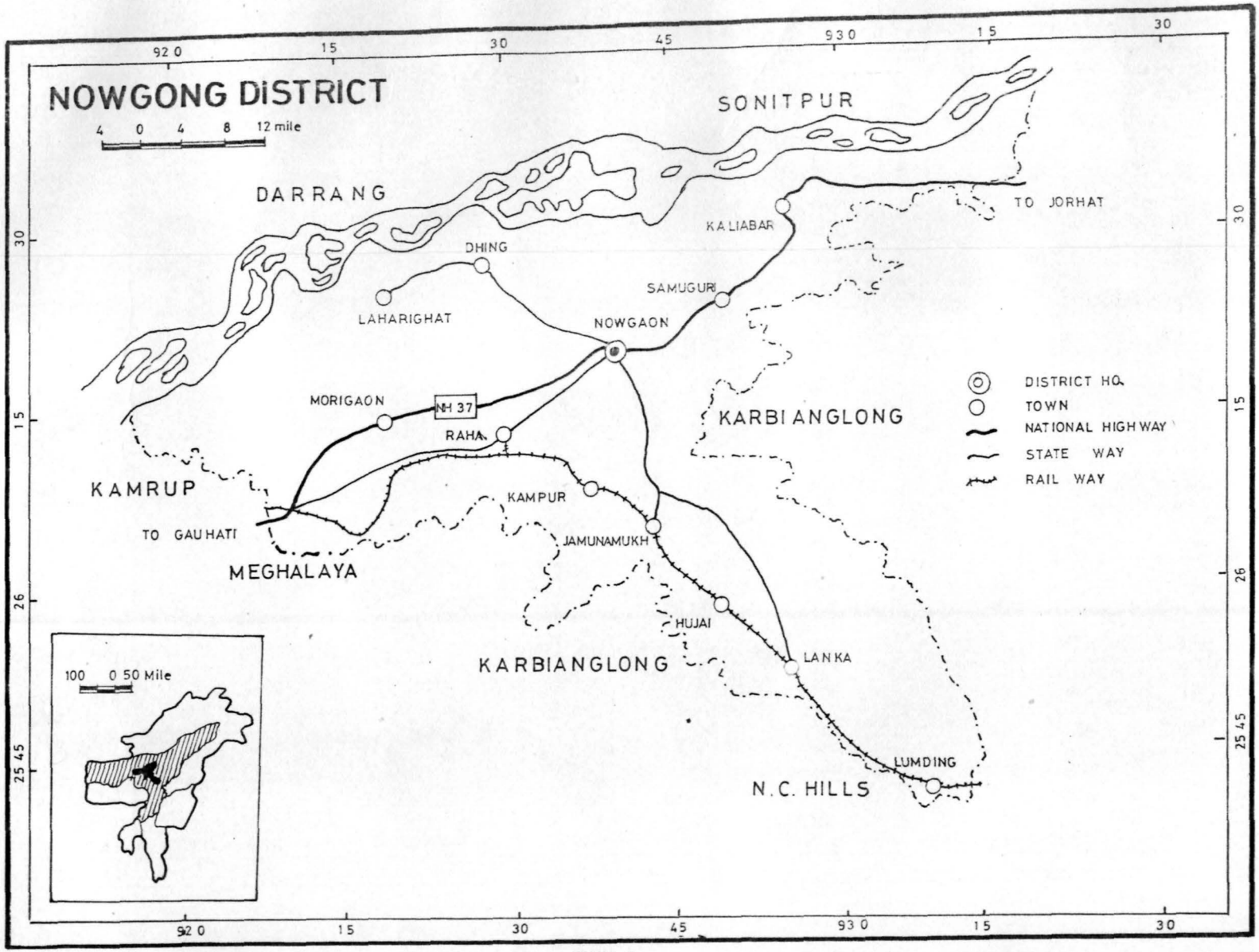
NOWGONG DISTRICT
4 0 4 8 12 mile
SONITPUR
DARRANG
TO JORHAT
KALIABAR
DHING
SAMUGURI
LAHARIGHAT
NOWGAON
MORIGAON
NH 37
RAHA
KARBIANGLONG
DISTRICT HQ.
TOWN
NATIONAL HIGHWAY
STATE WAY
RAIL WAY
KAMRUP
KAMPUR
TO GAUHATI
JAMUNAMUKH
MEGHALAYA
HUJAI
LANKA
KARBIANGLONG
LUMDING
N.C. HILLS
100 0 50 Mile
92 0
15
30
45
93 0
25 45
26

FIG. 3

group of gneisses and granulites which are more than 2450 million years old. On the eroded surface of these ancient rocks were deposited the Shillong series (Meghalaya plateau) some 2450 million years ago.

The geological history of Assam between the Cambrian and the Jurassic - a period of about 400 million years - is missing due to the absence of any rock belonging to this period. It was only towards the end of the Jurassic period that some volcanic rocks were formed in this region.

It is generally knwon that during the Upper Carboniferous period, a great orogenic disturbance known as the 'Hereynian revolution' took place. As a result of this, a great mediterranean sea came into existence along the north of the then existing Indian continent (Gondwanaland), from the region of Atlas through the Alps, Asia Minor and the Himalayas, further east into the Burmese Arakan-Andamans. In geological literature, this sea is known as the 'Tethys'.

Sometime during the Upper Jurassic period, deep fissures developed along the southern flank of the Meghalaya plateau and a great volume of lava erupted along these fissures. During the Cretaceous times, i.e. about 90 to 100 million years ago, a sea extended from the south

and covered the areas that are now the Nagaland, the Mizo Hills, and part of the Meghalaya plateau. After some time the sea regressed from the plateau area and again transgressed in the Eocene period. During Eocene, there was an area of shallow water over the site of the present Meghalaya plateau, the Karbi Hills and the Upper Assam valley. It was a slowly and intermittently sinking 'foreland'.

About the end of the Eocene, mountain-building movement raised the central part of the big basin from the sea level, separating it into a Assam basin gradually caught up with subsidence of the sea bed and some part of the basin became favourable for the deposition of coal beds. About the end of the Oligocene period there was a widespread fall in sea level and deposition gave away to erosion. But in early Miocen, renewed submergence began. This time the area south-east of Karbi Hills was the deepest part of the region. By the time sedimentation had reached the northern part of Assam, a stupendous earth movement took place. This was some 18 million years ago. This movement of the Middle Miocene period forced the sediments of the Tethys, north of Assam, to their maximum heights, and thus gave rise to the mountain system of the Himalayas.

Broadly, the soil in Assam may be classified into three types viz., alluvial, laterite and hill soil (Fig. 4).

The alluvial soil is extensively distributed throughout the Brahmaputra valley. The new alluvial which is deficient in nitrogen and humus is found in the middle plains both in the north and the south banks of the river Brahmaputra. The old alluvium which is more clayey and dark in colour can be found along the northern margin of the north bank of Brahmaputra, middle plain of the district of Goalpara, Kamrup and Darrang.

Laterite soil, which is generally deficient in in nitrogen, potash, phosphoric acid and lime is found in the hill slopes of the Barak valley, south-eastern of Nowgong and Sibsagar district.

Hill soils which is generally in dark colour and fertile loams are found in the slopes and ridges of the hills of Karbi Anglong and North Cachar district.

The geological formation of the Nowgong district as seen from the outcropping rocks are confined mainly to three geological period, viz., Pre-Cambrian, Tertiary and Quanternary ages. The areas at the north mostly covered by recent alluvium formed by the Brahmaputra river and

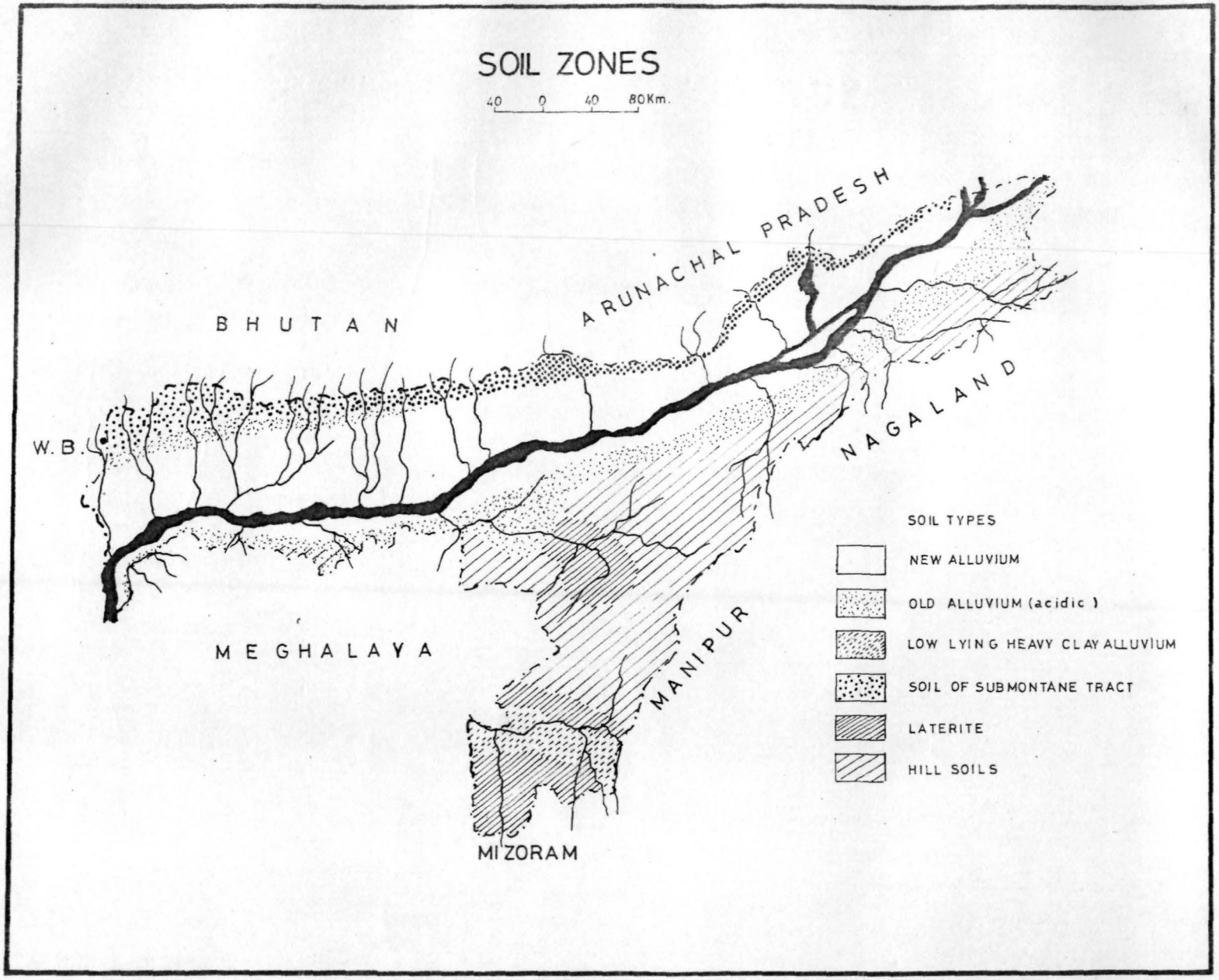
SOIL ZONES
40 0 40 80Km.
BHUTAN
ARUNACHAL PRADESH
W.B.
NAGALAND
MEGHALAYA
MANIPUR
MIZORAM
SOIL TYPES
NEW ALLUVIUM
OLD ALLUVIUM (acidic)
LOW LYING HEAVY CLAY ALLUVIUM
SOIL OF SUBMONTANE TRACT
LATERITE
HILL SOILS

FIG.4

its tributaries. The alluvial soil is mostly loamy and consists of a mixture of clay and sand in varying proportions, ranging from pure sand on the bank of the Brahmaputra to a stiff clay which is quite unfit for cultivation. Marshy soil is chiefly found in the low-lying water-logged areas. These are black in colour. The red soil generally occupies the hill slopes and foot-hills formed by the weathering of the pre-cambrian rocks. In a few cases lateritic soil of recent age is also found near about Lumding. The areas near the Sibsagar district, geophysical exploration has revealed that rocks of the Tertiary age occur at a depth ranging from six to seven thousand feet below the alluvium. It is not yet known whether the large alluvial tract of the district is also underlain at depth by the Tertiary group of rocks.

The geological succession exposed in the district is as follows:

Recent: Alluvium of the Brahmaputra and its tributaries (.01 million years)

Pleistocene: Dihing series (unconformity) (1 million years)

Miocene: Barail series (unconformity) (32 million years)

Tertiary: Oligocene: Barail series (unconformity)
(40 million years)
Pre-Cambrian (Gneisses)
(500 million years)

The pre-cambrian rocks are exposed in the hilly areas to the west, south-west and north-east parts of the district. These are constitutions of the Shillong plateau. The pre-cambrian group of rocks are mainly consist of gneisses and granites. In the granites, older rocks, such as biotite, schist, quartzite, hornblende, and granite are found to occur as xenoliths.

Younger rocks belonging to the Tertiary age are seen only near Lumding. East and north-east of Lumding, the Barails become more and more disturbed, and the outcrops are split up into long narrow strips or small inliners by a system of strike faults. In the rocks of the series, massive current bedded sandstones predominale argillaceous beds form only a small portion.

A large area near Lumding is occupied by the transgressive Surma series, which dip at very low but variable angles. These are probably not more than about 2,500 to 3,000 feet in thickness. The rest of the series is made up of very well bedded rocks. They include very

fine sands or silt, sandyshale, shale, clay and alternation of their liminae of soft, fine sand and soft clay.

The rocks of the Surman series lie in a gentle syncline overlapping the Barail series. The unique feature of the geology of the Lumding are is the occurrance of widespread clay. They seem to overlie the shale of the Surma series unconformably. These mantle of clay is well over fifty feet, and possibly belongs to the Dihing series.[8]

2.4 RELIEF

Assam is more or less a hilly state in between parallel ranges of hills. Due to the presence of hills, plains and river valley, the general appearance of the country is very picturesque (Fig. 5).

The physiography of Assam amay be divided into the following physical units:

a) The Brahmaputra valley or Assam valley
b) The Barak valley or Surma valley and
c) The Hill Region.

---

[8] Geographical report submitted by the Director of Geology and Mining Department, Assam, Shillong.

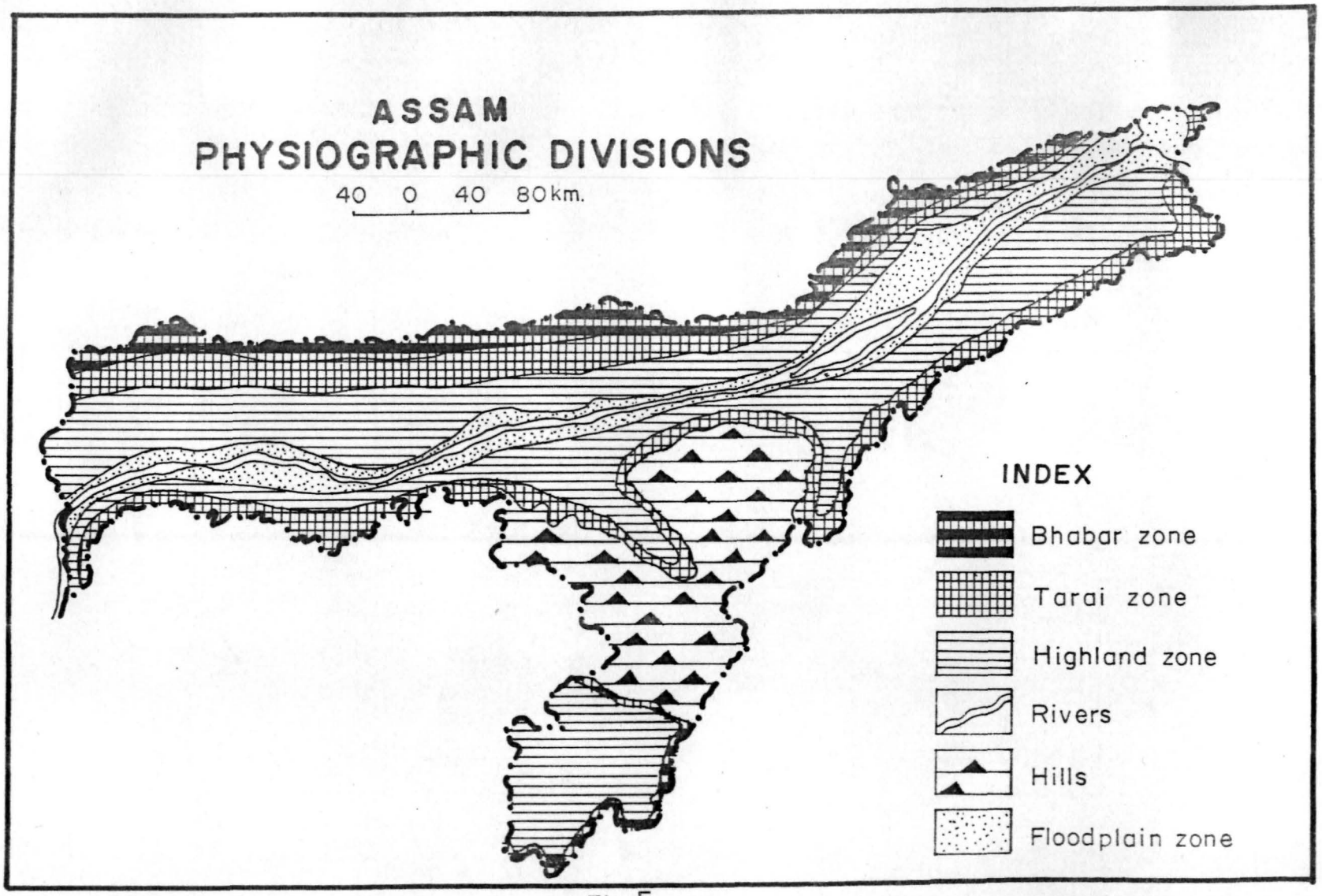
ASSAM
PHYSIOGRAPHIC DIVISIONS
40 0 40 80km.
INDEX
Bhabar zone
Tarai zone
Highland zone
Rivers
Hills
Floodplain zone

Fig. 5.

The Brahmaputra Valley

The Brahmaputra valley consists of an area of 56,339 km^2 representing 72 per cent of the total geographical area of the state. It is an alluvial plain due to the deposition of the Brahmaputra river and its innumerable tributories. The length of the valley is 725 km from Sadiya to Dhuburi with an average width of 80 km. The general gradient of the valley is from north-east to south-west from Sadiya to Dhubmri with an average east-west slope of 12.5 cm per km. As the river is sluggish with a low gradient, innumerable almond-shaped river islands called 'Chaporis' or 'Chars' are formed by the deposition of sediments in the middle of the river course. Most of these 'Chaporis' are washed away by flood during rainy season while new 'Chaporis' are formed. Another notable feature of the valley is hillock and 'beel' which are scattered in large numbers.

The hillocks are mostly scattered in the middle portion of the valley and they geologically form a part of the Meghalaya plateau. The middle portion of such bank is generally narrow and uneven in its outline. Due to the existence of the Mikir Hills the continuity of the middle plain is interrupted. To the west of Nowgong district it is again a narrow lateral strip due to the jutting out of Meghalaya plateau which is very near to the bank of river

Brahmaputra.

The Barak Valley

The Barak valley or the Cachar plain is the result of both aggradational and degradational activities of river Barak and its tributories. The main part of the valley consists of swampy flates broken by numerous low isolated hills and ridges. The Meghalaya plateau mark the limit of the valley abruptly in the north and to the sounth-east long spurs of highland gets projected from Tripura and Mizo Hills and between them one broad valleys umusually diversified with many low isoalated hills. The valley is about 100 km long from east to west and 70 km wide from north to south and covers an area of 6962 km^2.

The valley is closed on three sides by ranges of hills and only towards the west it is open to the Sylhet district of Bangladesh.

The gradient of the valley is very low with large number of hillocks which are locally known as 'Tilas'. The central and western part of the valley is very fertile which is formed by the alluvial deposits.

The Hills

The hill regions of Assam consists mainly of two hill districts viz., Karbi Anglong and North Cachar covering an area of 15,222 km^2. Again, this region may be subdivided into three physiographic units - the Karbi Hills, the Humren Hills and the North-Cachar Hills.

Karbi and Hamren Hills are both geologically part of Meghalaya plateau projected into the Brahmaputra valley, which is detached from the main mass of the Meghalaya plateau due to the headward erosion of the river Dhansiri and Kopili. The average height of the plateau is 1200 metres to the west, the plateau almost merge with the Brahmaputra valley due to the erosional works of river Dikharu and Jamuna which are tributaries of river Kopili.

The hills of Hamren are highly dissected by the river Barapani which is an individual part of the Meghalaya plateau. The average height of the Hamren Hills is 900 m.

The Hills of North-Cachar district which are composed of tertiary rocks located to the north of Karbi Hills and north-east of the Hamren Hills. Here the most important range is Barail with steep southern face. The northern face is relatively gentle.

The greater part of the Nowgong district is alluvial plain criss-crossed with numerous rivers and waterways and dotted over with 'bils' and marshes. In places like the bank of Kolong it is densely populated. But the areas fringing the south bank of river Brahmaputra which is liable to deep floods is nothing but wide stretches of wastelands usually covered with tall grasses. On the north-east of Mikir Hills, impinge upon the plain and on the south east, there is the fertile valley of the Kopili. On the west the outlying spours of the Khasi and Jaintia Hills projected into the plain. The district may be raughly described 'as a tract of level country bounded on the north by the Brahmaputra and surrounded on the three remaining sides by Hills.'[9] (Fig. 6).

Across the centre of the plain there are wide fields of cultivated land extending from Silghat on the north-east to Jogi on the south-east. But on either sides of this plain the cultivation falls off and there are wide expanses of grassland on the north-west and old forest and hills on the south and east. To the south and east lie range upon range of lower hills whose sides are clutched with the luxuriant vegetation of a tropical forest.[10]

---

[9] Gazetteer of India, Assam State, Nowgong District.

[10] Ibid.

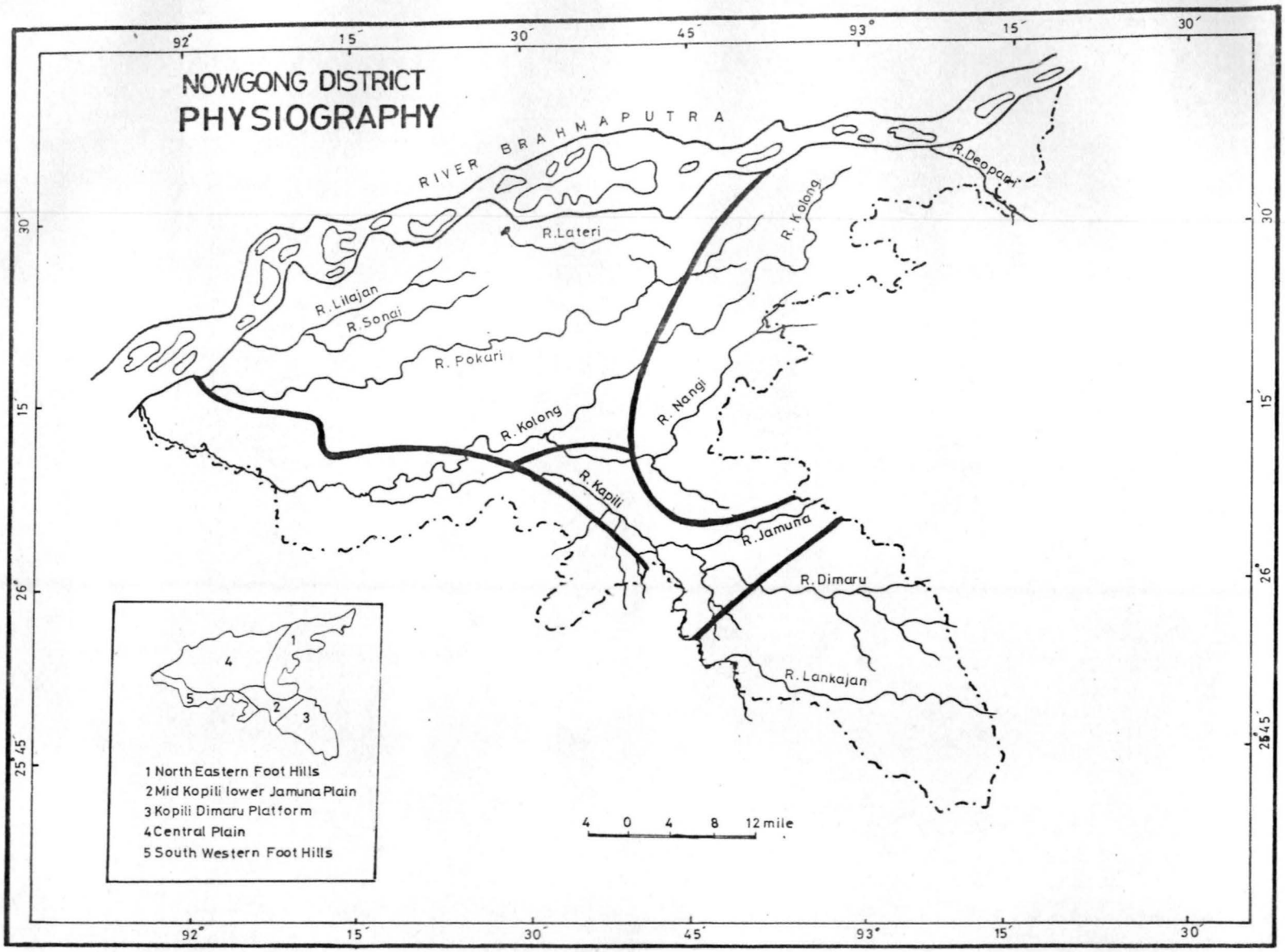
NOWGONG DISTRICT
PHYSIOGRAPHY
RIVER BRAHMAPUTRA
R. Deopani
R. Kolong
R. Lateri
R. Lilajan
R. Sonai
R. Pokari
R. Kolong
R. Nangi
R. Kapili
R. Jamuna
R. Dimaru
R. Lankajan
92° 15' 30' 45' 93° 15' 30'
30' 15' 26° 25° 45'
4 0 4 8 12 mile
1 North Eastern Foot Hills
2 Mid Kopili lower Jamuna Plain
3 Kopili Dimaru Platform
4 Central Plain
5 South Western Foot Hills

FIG. 6

The plains bordering the south bank of the Brahmaputra is low-lying area and is deeply flooded in the rainy seasons. For the greater part of the year it is covered with grasses and reeds which grow from three to six metres high. The greater part of this tract is too low-lying for the growth of any tree. The higher land produces many kinds of shorter grass used for thatching.[11]

The country of Kopili between Dharamtul and the hills is also low-lying. It is also subject to floods and is covered with high grass interspread with marshes. These marshes grow the most luxurious fodder grass where cattle graze knee-deep in water.

The Kopili valley beyond Jamunamukh is getting gradually filled up though it is mostly covered with marshes and savannah which support rich growth of thatching grass but is destitute of trees.

The elevated tracts consist of a range of low hills. The district has two main mountain system one of which is the Mikir Hills on the north-east while the other consists of the outlying spours projecting from the Assam range into Brahmaputra valley on the south and west. The

---

[11] Ibid.

major proportion of Mikir Hills lies within the erstwhile Mikir and North Cachar Hills district but the western spours from Kuthuri to Debaka lie in the Nowgong district. The hills, south of Mohandijua and Jamuna river rise steeply from narrow valleys with which the hills are intersected. The hills are covered with dense forests. The outlying spours projected from the Assam range are lower in appearance and the general characteristic do not differ much from the Mikir Hills. Over and above these hills, there are many other hills or hillocks. The height of the hills and hillocks of the district vary from about 270 metres to 850 metres. The highest peak in the district is Barkandali which is situated at a distance of 19.2 km south of Nowgong town and which rises to a height of 853 metres.

2.5 CLIMATE

The climate of Assam is quite distinct from that of the rest of the country. According to Koppen the pioneer climatologist, the climate of Assam is Humid Mesothermal Gangetic type (C_{wg}). But the climate of Assam highly differ from C_{wg}, because of the development of an orographic low, a spectacular but complex Thermodynamic phenomenon.[12]

---

[12] Das, M.M., Peasant Agriculture in Assam, p.17.

Therefore instead of C_{wg} the climate of Assam may be defined as C_{wa}.

Generally the climate of Assam is characterised by the heavy summer rainfall and dry winter, relative coolness and extreme humidity. During the period of 1971-75 the annual mean temperature was 23.65°C, the mean relative humidity was 82.5 per cent and average annual rainfall was 2208 m.

Except the southern part of the Nowgong District, which fall in a rainshadow belt of Meghalaya plateau, rainfall is uniform in all the plain districts of Assam. Comparatively the lower part of the Brahmaputra valley and Goalpara and Cachar of lower part receive heavy rainfall than the lower part of the state.

About 70 percent of the total rainfall are experienced during the period of June to August, whereas December, January and February are almost rainless (Fig. 7).

There are four distinct seasons in Assam, viz., (i) Pre-monsoon, (ii) Monsoon, (iii) Retreating monsoon and (iv) Dry winter.

The pre-monsoon starts by early March along with the gradual rise of temperature. The early part of this season upto mid-April is affected by very strong storm

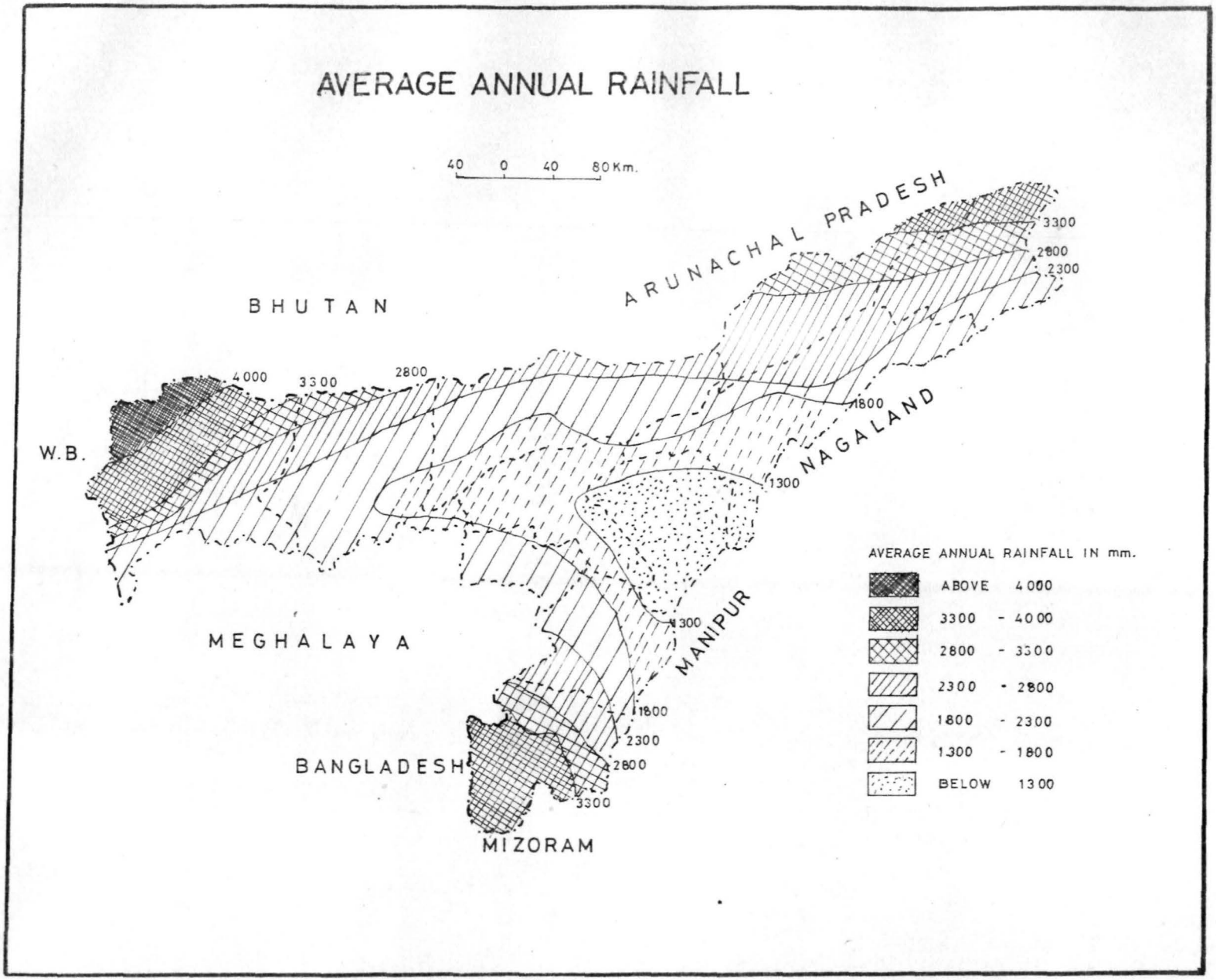
AVERAGE ANNUAL RAINFALL
40 0 40 80 Km.
ARUNACHAL PRADESH
BHUTAN
W.B.
MEGHALAYA
BANGLADESH
MIZORAM
MANIPUR
NAGALAND
4000
3300
2800
2300
1800
1300
AVERAGE ANNUAL RAINFALL IN mm.
ABOVE 4000
3300 - 4000
2800 - 3300
2300 - 2800
1800 - 2300
1300 - 1800
BELOW 1300

FIG.7

which turns into dust-storms a peculiar climatic phenomena mostly in the lower Brahmaputra valley.

The south-west monsoon enters Assam by the middle of June and continues upto September. This season is mainly characterised by cloudy sky, high humidity, high temperature and heavy rainfall. Rainfall is so frequent that about 18 to 20 days in a month are normally recorded to be rainy.

By the middle of September, south-west monsoon starts to retreat and is followed by fair weather and morning fogs towards the end of November.

The winter season starts at the end of November and continues upto the end of February. The main characteristic of this season is absence of rainfall, cool and dry weather, low temperature and frequent morning fogs. This is the season for pleasant weather for Assam.

The climate of the Nowgong district is characterised by a highly humid atmosphere all through the year, the absence of dry hot summer season and plentiful rainfall. The cool season is from December to February. This followed by the pre-monson season of thunderstorms from March to May. The period from June to about the beginning of October is the south-west monsoon season. October and November

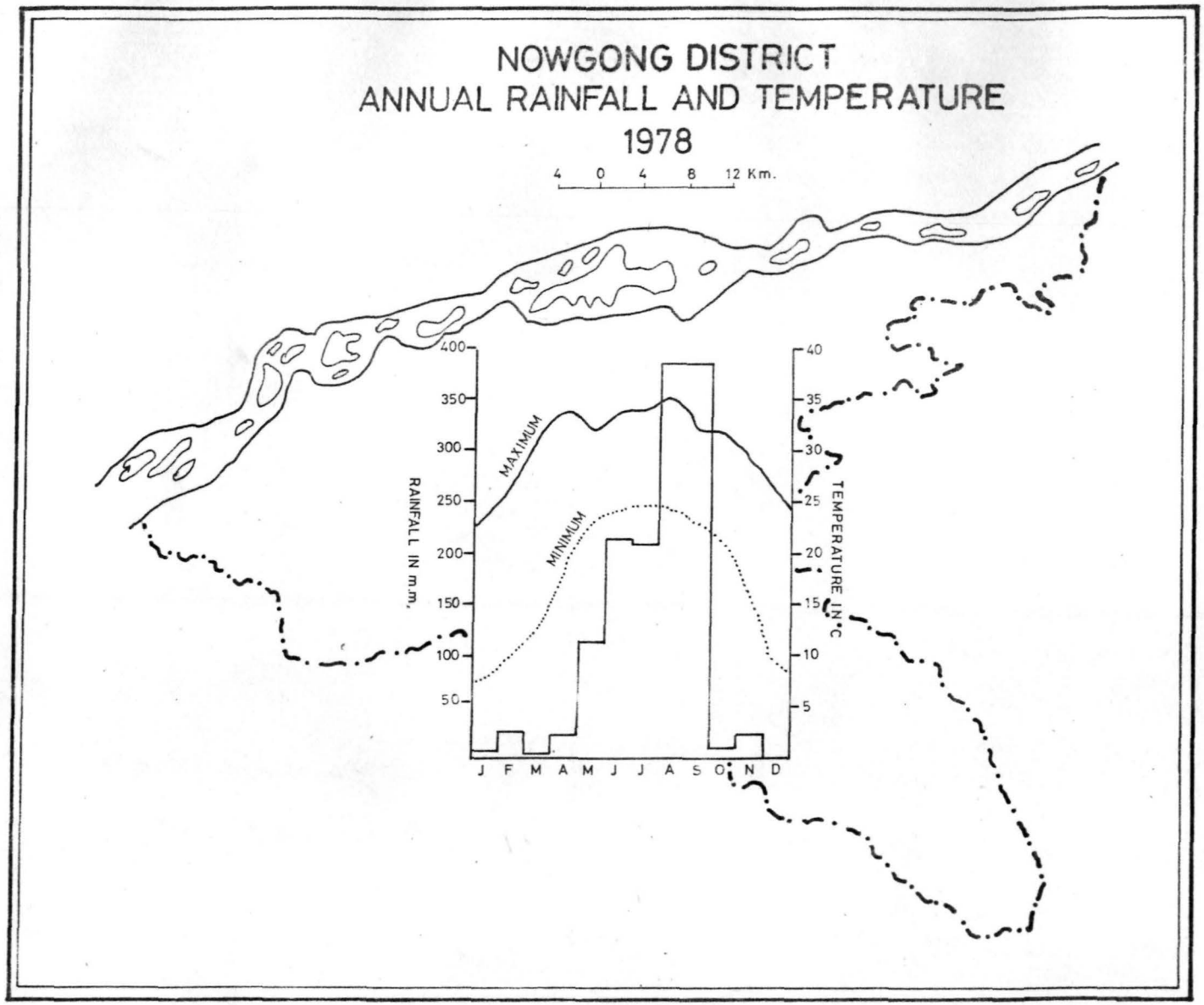
NOWGONG DISTRICT
ANNUAL RAINFALL AND TEMPERATURE
1978
4 0 4 8 12 Km.
MAXIMUM
MINIMUM
RAINFALL IN m.m.
TEMPERATURE IN °C
400
350
300
250
200
150
100
50
40
35
30
25
20
15
10
5
J F M A M J J A S O N D

FIG.8

constitute the post-monsoon season.

The average annual rainfall in the district is 1753.4 mm. The rainfall in the district generally increases from the south towards the north. About 60 percent of the annual fainfall is received during the period June to September, July being the rainest month of the year. Rainfall mostly as thundershowers occurs in the pre-monsoon months of April and May and in October (Fig. 8).

On an average there are ninety eight rainy days in a year in the district. The heaviest rainfall in twenty-four hours recorded at any station in the district was 471.9 mm, at Lanka on October 6, in the year 1916.

2.6 DRAINAGE SYSTEM

The drainage system of Assam is dominated by the two main rivers, Brahmaputra and Barak. Both the rivers control the drainage system in their respective valleys. It is estimated that 1/15 of the total geographical area of Assam is under water bodies, swamps and marshes which are ubiquitous along the course of the Brahmaputra and the Barak river and their tributaries (Fig. 9).

There are 150 principal tributaries of the Brahmaputra and Barak altogether. All the major north bank

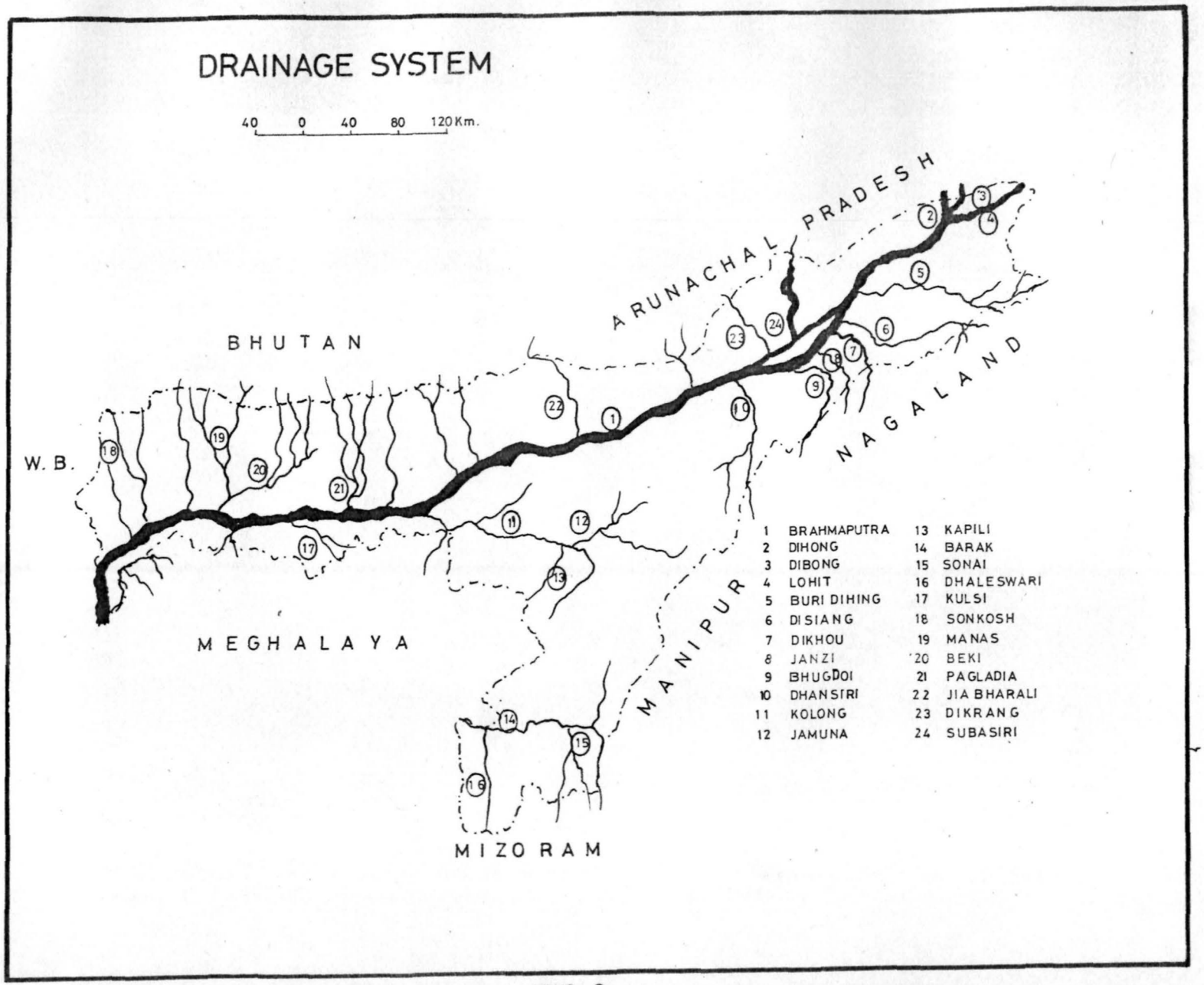
DRAINAGE SYSTEM
40 0 40 80 120 Km.
ARUNACHAL PRADESH
BHUTAN
W. B.
NAGALAND
MANIPUR
MEGHALAYA
MIZORAM
1 BRAHMAPUTRA
2 DIHONG
3 DIBONG
4 LOHIT
5 BURI DIHING
6 DISIANG
7 DIKHOU
8 JANZI
9 BHUGDOI
10 DHANSIRI
11 KOLONG
12 JAMUNA
13 KAPILI
14 BARAK
15 SONAI
16 DHALESWARI
17 KULSI
18 SONKOSH
19 MANAS
20 BEKI
21 PAGLADIA
22 JIA BHARALI
23 DIKRANG
24 SUBASIRI

FIG. 9

tributaries of the Brahmaputra river originate in the Himalaya where the south bank tributaries are originated from the Meghalaya plateau and Naga Hills. The Barak river originates from Barail range from the south of Japro Peak. Its tributaries are originated in the hills where rainfall is very high. During the rainy season both valleys are liable to floode

The Brahmaputra, the principal river of the Nowgong district which flows along the entire northern boundary of the district and the whole drainage of the district ultimately finds its way to it. The rocks and hills at Silghat give permanence to the channel of the Brahmaputra but lower down the river spreads itself d during the rainy season over the marshy land on either side and when flooded, the distance between one bank to the other is very great. There is a wide sandy stretch between its main banks in which the river constantly oscillates from side to side for breadth, about 10 kilo- metres on either side. Divergent channels are thrown out here and there, which after a time rejoin the main stream or get silted up. A huge quantity of suspended matters and sediments is carried by the river. Any obstruction to the current gives rise to an almond shaped 'Chapari' or sandbank. Floods may wash off this 'Chapari' or may increase its size by fresh deposit of sand. These

operations of alluvium and diluvium are continually carried on in a massive scale by the Brahmaputra. Its main tributaries in the district are the Kalang, Kopili, Diphlu, Sonai, Leteri and Pakaria. The total length of the river within Nowgong district is about 175 kms.

The Kalang takes off from the Brahmaputra about thirteen kilometers north-east of Silghat and after flowing a tortuous course through the middle of the district passes Koliabor, Nowgong, Raha and Jagi. In its upper reaches it is joined by the Diju and the Missa which collect the drainage of the north-western slopes of Mikir hills. Further south, the drainage of Mikir hills is collected in the Nanoi or Haria which flows from the same distance parallel to the Kalang river and finally falls into it at Raha. Here the Kalang river is joined by a channel with the Kopili which brings the drainage of North-Cachar Hills and the eastern slopes of the Jaintia Hills. But the main stream of Kopili after receiving the waters of the Barapani and Umiam falls into the Kalang river at Jagi. A little to the west of Jagi, the Kalang forms the boundary between Nowgong and Kamrup district, and not far from its junction with the parent stream, it receive the Digaru on its left bank.

The Kopili river which rises in the Jaintia Hills (Meghalaya) flows north and northeast winding through the

Jaintia Hills and North-Cachar Hills. At Jamunamukh in Nowgong district it is met by its eastern tributary the Jamuna and flows past Raha after taking a western turn. Here it is joined by a branch channel with Kalang river and at Jagi it finally meets the main stream of the Kalang after a course of 262 kms. Only 102.5 kms of its course are within Nowgong district. The combined channel after flowing north-west finds its way into the mighty Brahmaputra near Kajalimukh in Nowgong district.

The Barapani rises in the Shillong hills and enters the district of Mikir hills just below its confluence with the Umlew. After flowing through the Mikir Hills district upto Amtreng it forms the western boundary of the district with Nowgong district. It continues to run down the boundary till Lutumari Reserve Forest where it enters the plains of Nowgong. Ultimately joining the Kopili near Chaparmukh.

The Nanoi river originates from the Chapanalla Hills and flows through the plains of Nowgong district. After a course in the plains the river flows parallel to the Kalang river for some distance and ultimately falls into the river Haria at Doorigaon at which place both the rivers combine together and flow to meet the Kalang near Raha.

The river Umiam originates from a high altitude of Shillong hills and flows from south to north. In the hilly region the river is stable and carries practically no silt as the bed of the river consists of boulders and gravels. It meets the Kopili river at Naldhara Noa 'bil'.

In addition to the rivers mentioned above, there are other important tributaries, numerous streams and streamlets locally called 'Jan' and 'Juri'. These carry off the drainage of the hills into the large rivers which finally fall into the river Brahmaputra. The area in between the Brahmaputra and the Kalang is drained by the Leteri and Sonai which fall into the Brahmaputra.

CHPATER - III

LAND HOLDING AND PRODUCTIVITY

3.1 INTRODUCTION

In the light of the new strategy adopted by the Government of India during 1966-76 for agricultural development, the individual operational holdings assumed special significance in India as units of decision making. It became more important on account of changed socio-economic conditions. The conduct of agricultural census centred around the operational holdings.

An operational holding for the purpose of agricultural Census is defined as the land which is used wholly or partly for agricultural production and is operated as a single technical unit by one person alone or with others, without regard to title, legal form and size. An operational holding managed by the person of the same household is considered as an individual holding and the member of the household, who is mainly responsible for management of the holding is considered as the holder. When two or more persons jointly share the economic and technical responsibility for the operation of an agricultural holding, each of them is treated as the holder if they belonged to different household and the holding is considered as a joint holding.

3.2 SIZE OF OPERATIONAL HOLDING

Assam is one of those states where a comprehensive system for maintenance of land records has been in vogue for a long time. Except for two districts, i.e., Karbi Anglong and North Cachar Hills, essential information for each survey number is available in the land records. In Karbi anglong and North-Cachar Hills districts data have been collected through sample survey.

The rural settlements in Assam are surrounded by innumerable operational holdings of different shapes and size. According to 1976-77 Census, there were 22.5 lakhs operational holdings accounting for 30.8 lakhs hectares of operational area in Assam. The number of operational holdings in 1976-77 as compared to 1970-71 has gone up by 2.9 lakhs and the percentage increase is to the tune of 14.7 per cent. The operational area has increased by 2 lakh hectares (i.e. 6.8 percent). The average size of an operational holding in Assam is as small as 1.47 hectares, much below the all-India average of 2.71 hectares. Moreover, there are more than 752 tea gardens in Assam which are included in operational holdings area. Therefore, the actual average size of holding in peasant agricultural sector may be much smaller than what is stated above (Fig.[10]).

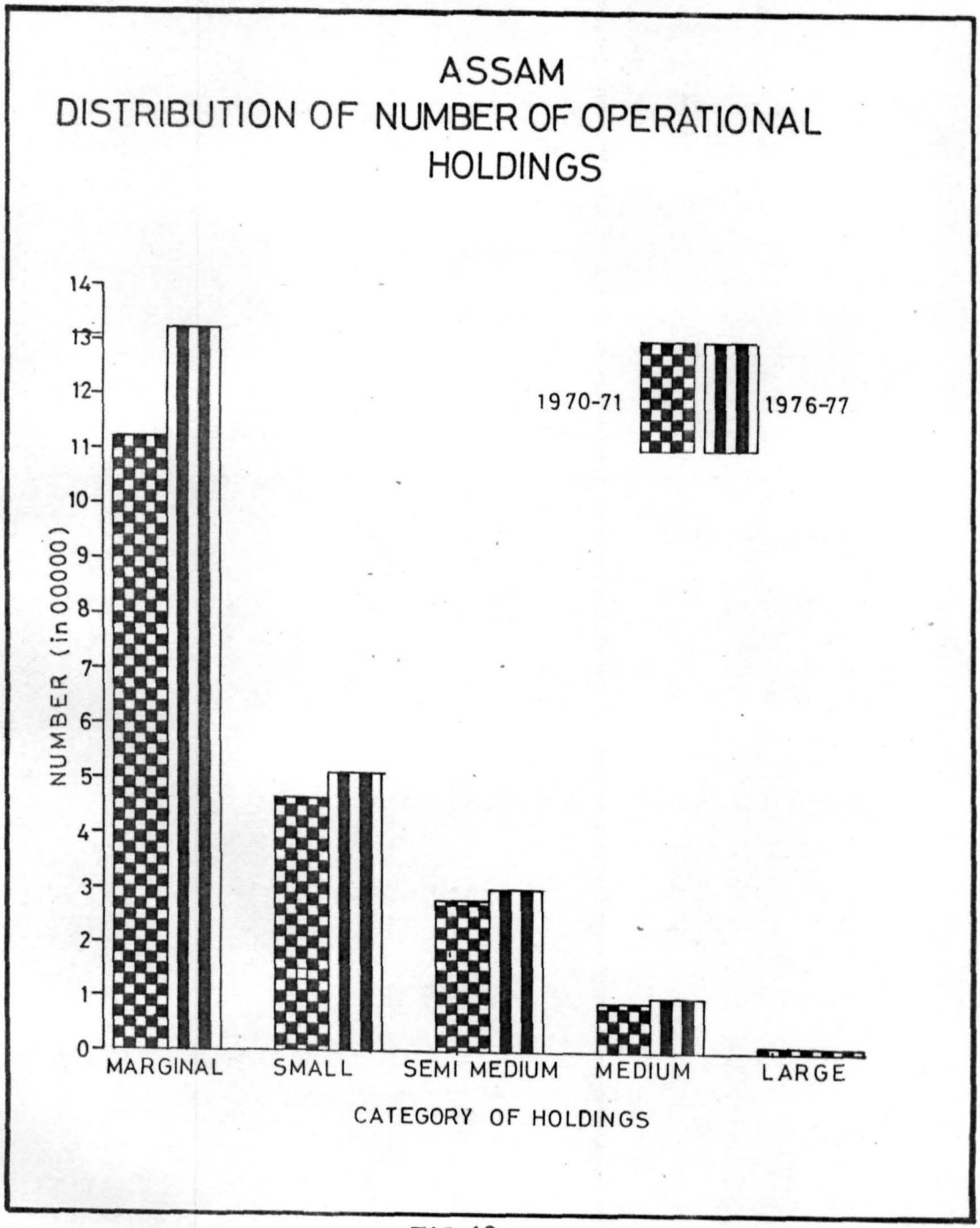
ASSAM
DISTRIBUTION OF NUMBER OF OPERATIONAL HOLDINGS
1970-71
1976-77
NUMBER (in 00000)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
MARGINAL
SMALL
SEMI MEDIUM
MEDIUM
LARGE
CATEGORY OF HOLDINGS

FIG. 10

The distribution of total number of holdings and operated area in the five categories of holdings is given below.

Table No.1

Distribution of Number and Area of Operational Holdings in Different Categories

Category	No. of Holdings (00)		P.C. Variation	Operated area (00 ha)		P.C. Variation
	I 1970-71	I 1976-77		I 1970-71	I 1976-77	
Marginal (below 1 ha.)	11,204 (57.04)	13,437 (59.62)	19.9	5,093 (17.67)	5,936 (10.27)	16.6
Small (1-2 ha.)	4,667 (23.04)	5,098 (22.62)	9.2	6,615 (22.95)	7,181 (23.32)	8.5
Semi-medium (2-4 ha.)	2,758 (14.04)	2,959 (22.62)	7.3	7,572 (26.72)	8,084 (26.25)	6.8
Medium (4-10ha.)	939 (4.78)	964 (4.28)	2.6	5,204 (18.05)	5,272 (26.25)	1.3
Large (above 10 ha.)	76 (0.38)	78 (0.34)	2.8	4,342 (15.06)	4,323 (14.04)	0.4
All	19,644 (100.00)	22,536 (100.00)		28,826 (100.00)	30,796 (100.00)	6.8

Nearly 60 per cent of the holdings in Assam are marginal holding, i.e., holdings below 1 hectare. But it covers only a little more than 20 per cent of total operated area of the state. The number of large holdings have gone up by 2.8 per cent and area operated has decreased by 0.4 per cent in 1976-77 as compared to 1970-71 (Fig. [11]).

Nearly 23 per cent of the state's total holdings are small holdings which covers about 23 per cent of the total operated are of the state. Semi-medium holdings accounted for 13 per cent of total holdings occupying 26 per cent of total operated area. Medium holding covers only 4 per cent of total holdings and area operated is 17 per cent. In the overall distribution, the share of marginal holdings both in terms of number and area has increased in 1976-77. But the average size of holdings in the state has gone down from 1.47 hectare in 1970-71 to 1.37 hectare in 1976-77. The average size of holdings has decreased in all size classes in the state during 1976-77.

It may be mentioned that, 80 per cent of the total land holdings in Assam are below 2 hectares, which is under estimation of the most important consideration of economic variability or non-variability of farm size.

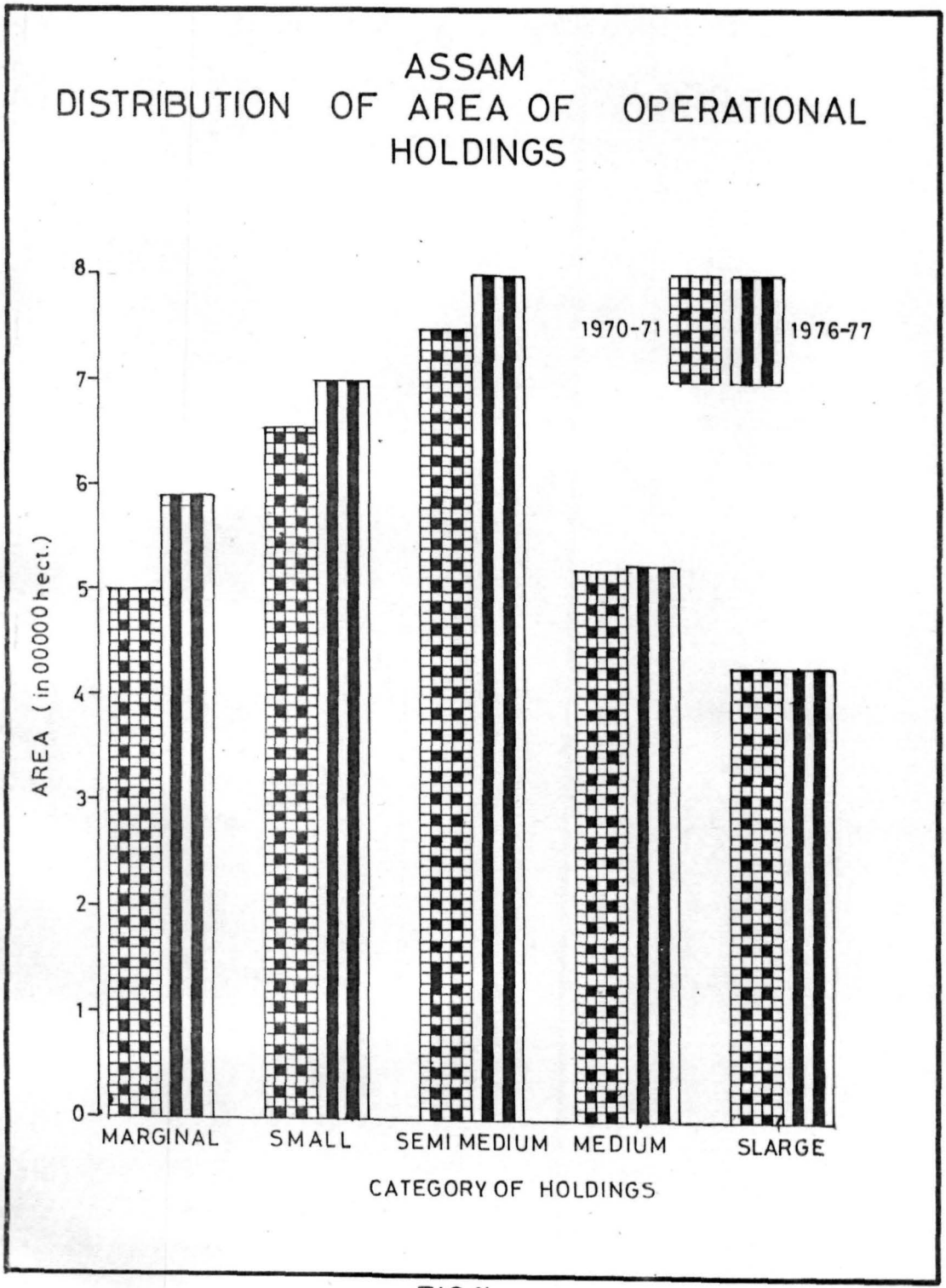
ASSAM
DISTRIBUTION OF AREA OF OPERATIONAL HOLDINGS
1970-71
1976-77
AREA (in 00000 hect.)
0
1
2
3
4
5
6
7
8
MARGINAL
SMALL
SEMI MEDIUM
MEDIUM
SLARGE
CATEGORY OF HOLDINGS

FIG.11

Khusro has pointed out that, from the economic point of view 2 hectares size of holding is floor level.[13] Such a small size of holding suffers from various problems like size-disability, tennurial uncertainty and available human and animal labour.

Another notable feature is that, in Assam the land holding pattern is not equally distributed. In 1970-71 it was found that 57 per cent of holding contains only 17 per cent of the total cultivated area. On the other extreme, 43 per cent of holding contains the rest 83 per cent of the total cultivated area. In 1976-77, it is found that 60 per cent of holding contains 19 per cent of the total cultivated area. So the disparities remained more or less unaltered. Figure clearly brings out the extent of disparities in the land distribution in Assam.

The two lorenz curves so obtained reveal that the distribution of holdings for both the years, i.e., 1970-71 and 1976-77, are more or less similar and show highly concentrated nature of landholding pattern. From the above situation it may be concluded that, by and large land holding system is dominated by small size holdings in Assam. The number of large farms or large holdings are comparatively less (Fig. 12).

---

13 Das, M.M. (1984), Peasant Agriculture in Assam

LORENZ CURVE

DISTRIBUTION OF LANDHOLDINGS

ASSAM

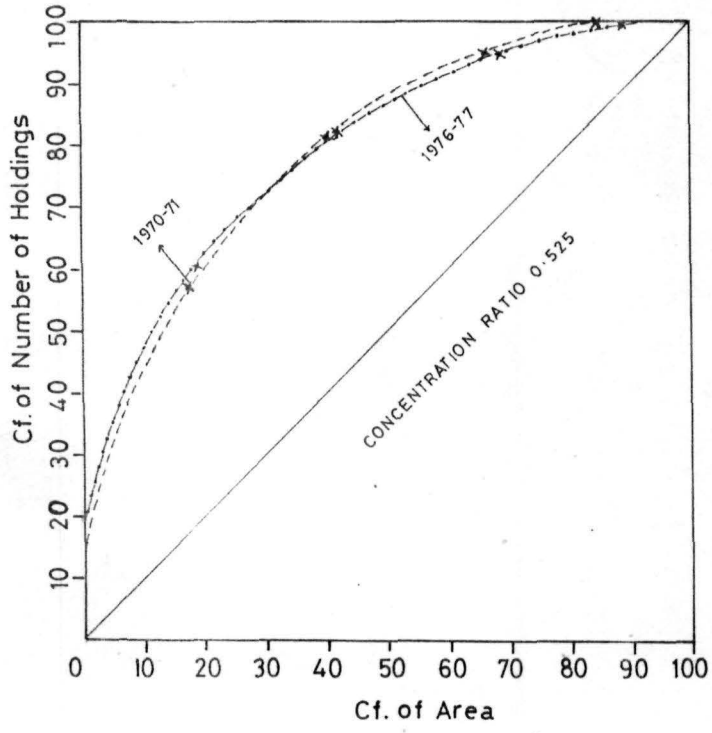

FIG.12

Table No.2

Percentage Distribution of number, area of operational holdings in 1970-71 and 1976-77, Assam

Sl. No.	Size Class	P.C. No. of operational holdings				P.C. area of operational holdings			
		1970-71	Cf	1976-77	Cf	1970-71	Cf	1976-77	Cf
1	Marginal (below 1 ha)	57.2	57.2	59.6	59.6	17.7	17.7	19.3	19.3
2	Small (1-2 ha)	23.7	80.9	22.6	82.2	22.9	40.6	23.3	42.6
3	Semi-Medium (2-4 ha)	14.0	94.9	13.1	95.3	26.3	66.9	26.2	68.8
4	Medium (4-10 ha)	4.7	99.6	4.3	99.6	18.0	84.9	17.1	85.9
5	Large (above 10 ha)	0.4	100.0	0.4	100.0	15.1	100.0	14.1	100.0
		100.00		100.00		100.00		100.00	

The overall concentration found in Lorenz Curve may also be measured numerically with the help of the Gini's Co-efficient. The Gini's co-efficient can be numerically worked out by the help of following formula:

$$G = \frac{1}{100 \times 100} \left| X_i Y_{i+1} - (X_{i+1} Y_i) \right|$$

		$X_i Y_{i+1}$	$X_{i+1} Y_i$
1	Marginal	2538.96	1586.46
2	Small	5655.36	4059.78
3	Semi-medium	8186.27	6852.48
4	Medium	9960.00	8590.00
5	Large		
		26340.59	21088.72

$$G = \frac{1}{10000} \times 5251.87$$

$$G = \frac{5251.87}{10000}$$

$$G = 0.525$$

If the holdings are uniformly distributed in relation to area, the ratio in this case will be zero. The ratio varies between zero to one.

The above value regarding distribution of holdings in relation to area of Assam shows a relatively higher concentration. That is a large number of holdings are concentrated within a less amount of area operated.

It is very interesting to notice that, the higher average size of holding in Dibrugarh, Cachar, Sibsagar and Lakhimpur district is mainly due to the existence of big size holdings of the tea gardens. On the other hand in Karbi Anglong and North Cachar Hills district the average size of holding is also high because, in these two districts the density of population is low in comparison to other plain districts of the state. Jhum cultivation is practised in these two hills districts of Assam and the holdings are generally bigger as jhum land occupies a large area of land (Fig.[13]).

Nowgong district is one of the agriculturally developed districts of Assam. According to 1976-77 agricultural Census there are 237060 operational holdings occupying 309810.36 hectares of land area. Out of 237060 holdings 137947 holdings belong to marginal holding. Small

DISTRICTWISE DISTRIBUTION OF NUMBER AND AREA OF OPERATIONAL HOLDINGS ASSAM 1976-77

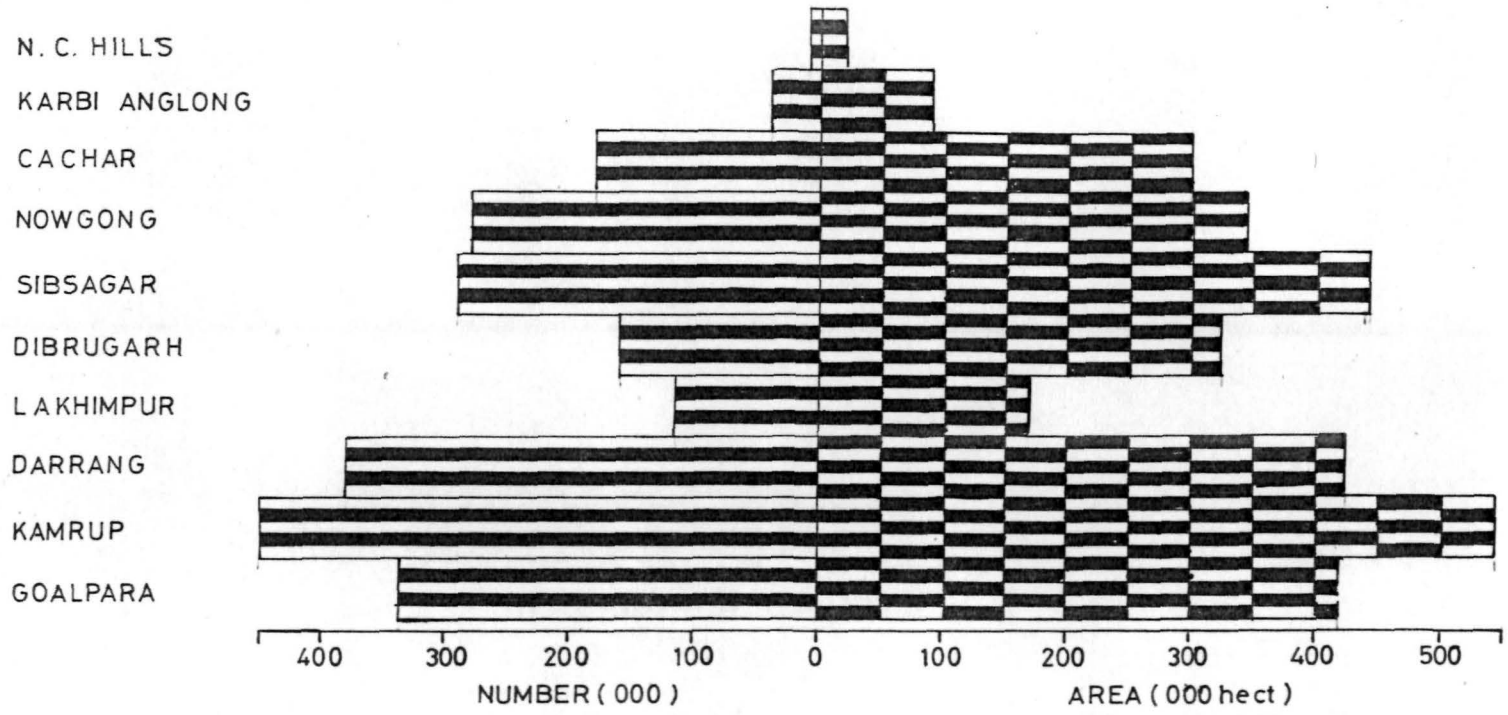

FIG.13

holding stands for second, occupying 55668 of land holdings. Area wise, though marginal holdings got 58.3 per cent of total land holdings, it occupies only 20.2

Table No.3

Districtwise number and area of operational holdings in Assam 1976-77

District	No. of Holdings	Area	Average
Goalpara	335311	422762	1.26
Kamrup	455335	547156	1.20
Darrang	388195	427349	1.12
Lakhimpur	115940	169328	1.46
Dibrugarh	161694	324334	2.01
Sibsagar	290402	445437	1.53
Nowgong	283866	344025	1.21
Cachar	177900	299132	1.68
Karbi Anglong	39727	80797	2.04
North Cachar Hills	10318	18928	1.83
Assam	2253690	3079248	1.73

Source: World Agricultural Census Assam 1976-77

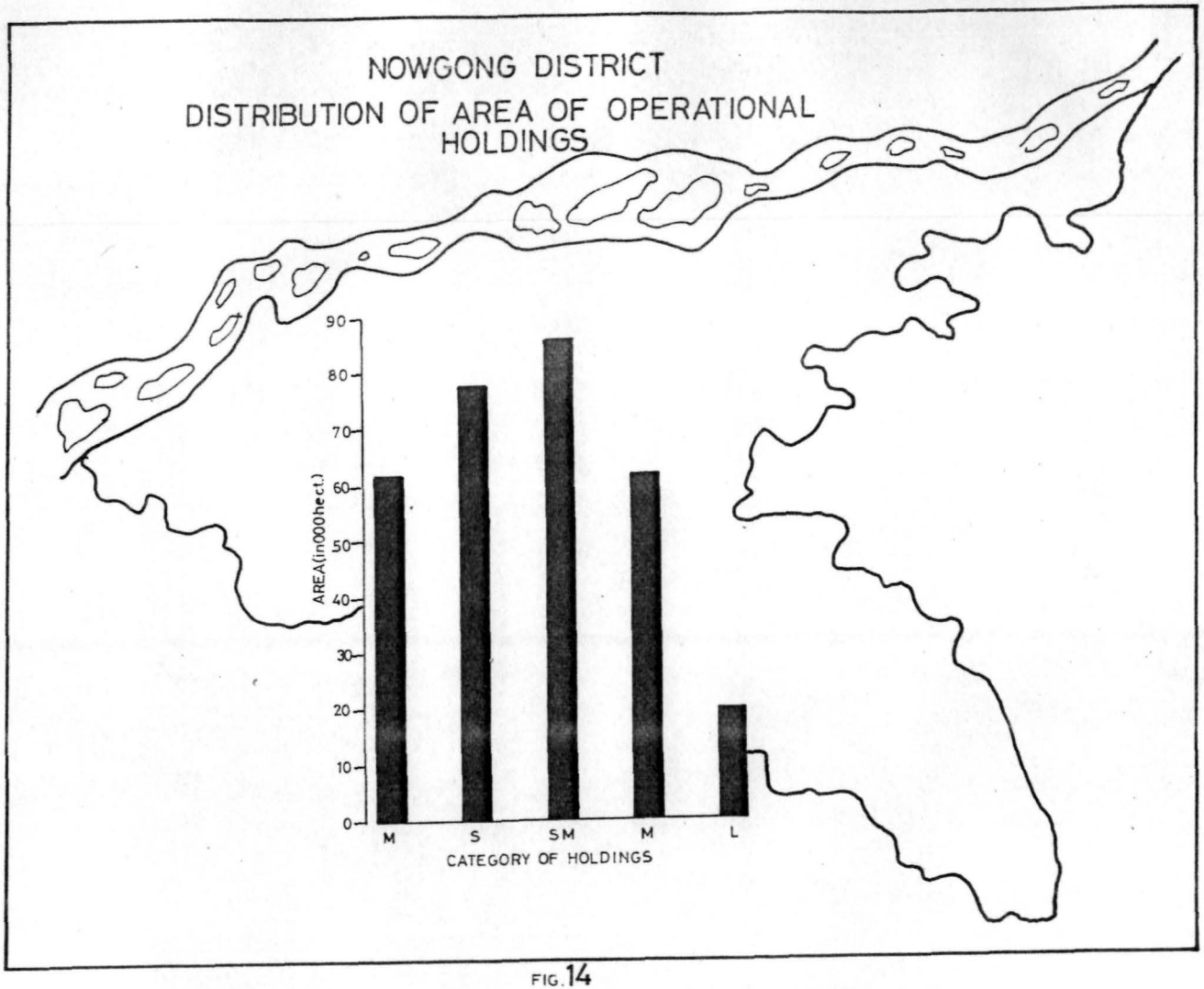
NOWGONG DISTRICT
DISTRIBUTION OF AREA OF OPERATIONAL HOLDINGS
AREA(in000hect.)
90
80
70
60
50
40
30
20
10
0
M
S
SM
M
L
CATEGORY OF HOLDINGS

FIG. 14

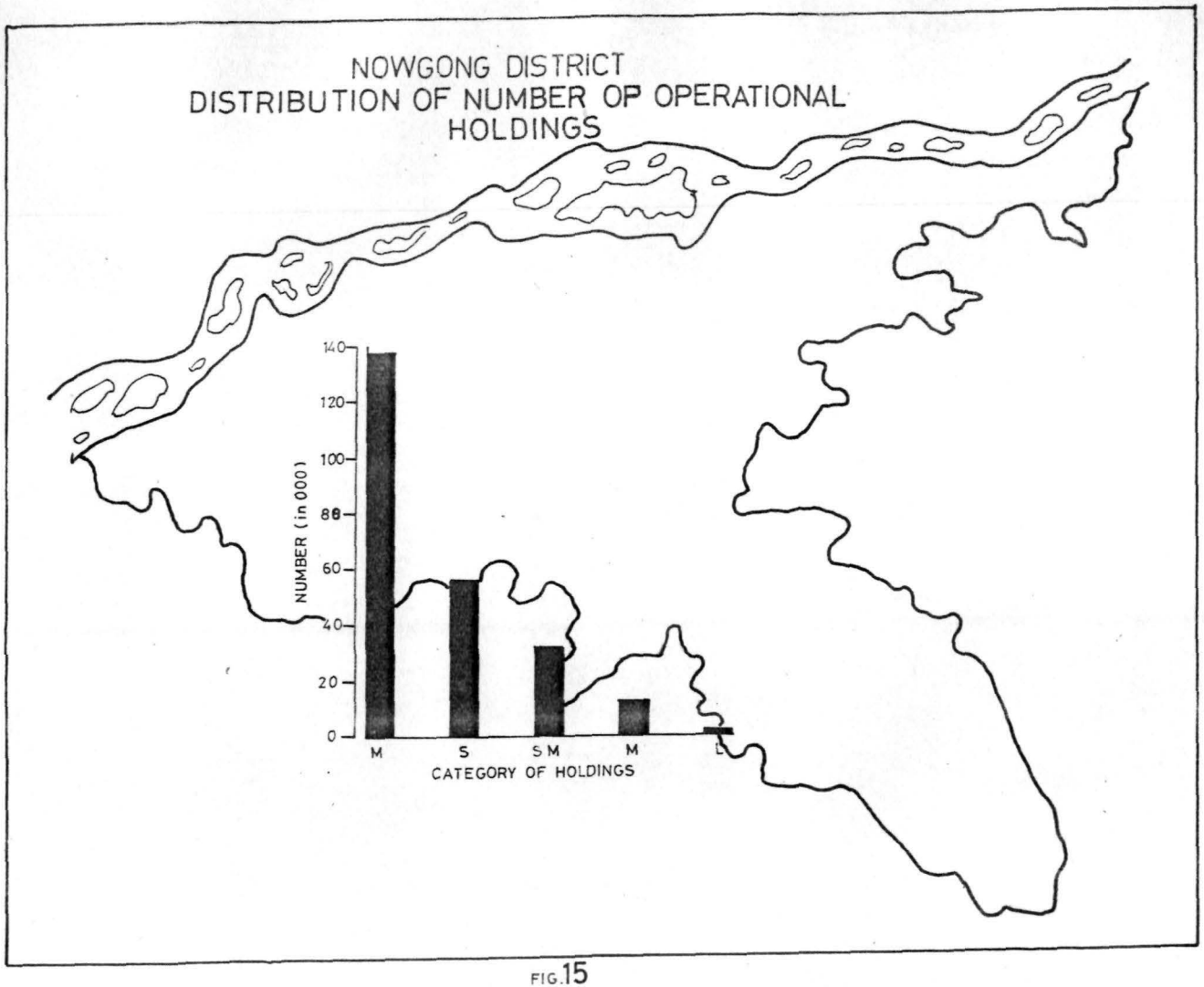
NOWGONG DISTRICT
DISTRIBUTION OF NUMBER OP OPERATIONAL HOLDINGS
NUMBER (in 000)
140
120
100
80
60
40
20
0
M
S
SM
M
L
CATEGORY OF HOLDINGS

FIG.15

per cent of total operated area. On the other hand semi-medium holdings which accounts for only 13.3 per cent of total holdings contains as large as 27.8 per cent of total operational area (Figs. 14 & 15).

Table No.4

Distribution of number and area of operational holdings Nowgong District, 1976-77

Category	No. of holdings	P.C.	Area in ha.	P.C.
Marginal	137947	58.3	62802.61	20.2
Small	55668	23.5	78485.71	25.3
Semi-medium	31367	13.3	85915.39	27.8
Medium	11108	4.5	62324.32	20.1
Large	970	0.4	20282.23	6.6
Total	237060	100.0	309810.36	100.0

In case of Nowgong district also the land holding pattern is not equally distributed. It is found that nearly 60 per cent of holding contains only 20 per cent of the total cultivated area. On the other extreme, 40 per cent of holding contains the rest 80 per cent of the total cultivated area (Fig. 16).

LORENZ CURVE

DISTRIBUTION OF LANDHOLDINGS

NOWGONG DISTRICT

1976-77

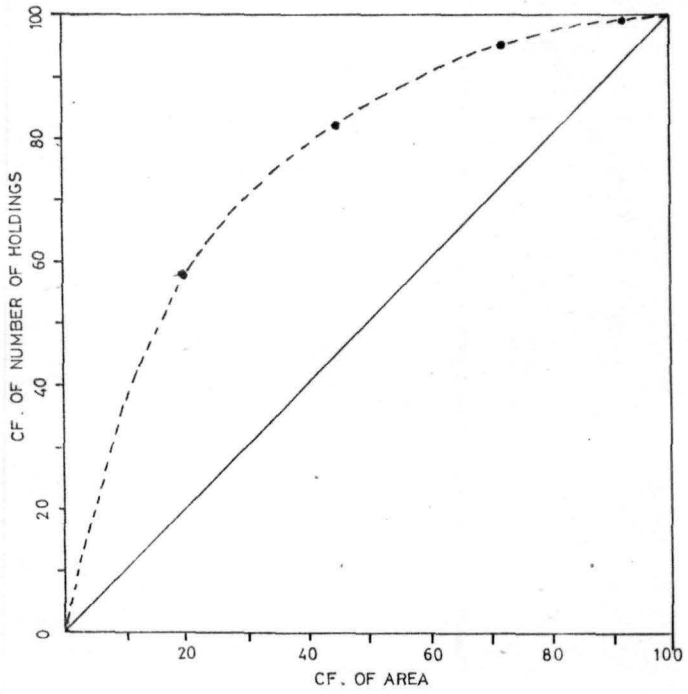

FIG. 16

Table No.5

Percentage Distribution of number, area of operational holding in 1976-77, Nowgong District, Assam

Category	P.C. of number of operational holding		P.C. of area of operational holding	
	P.C.	Cf	P.C.	Cf
Marginal	58.3	58.3	20.2	20.2
Small	23.5	81.8	25.3	45.5
Semi-Medium	13.3	95.1	27.8	73.3
Medium	4.5	99.6	20.1	93.4
Large	0.4	100.0	6.6	100.0
	100.0		100.0	

3.3 PRODUCTION

3.3.1. Landuse and Irrigation

The agriculture in Assam is on subsistence level and land is by and large below marginal. Though the whole Brahmaputra and Barak valley of the state are the two fertile regions of the country, the yield is much lower than some of the other regions of the country. Still the state is not self-sufficient in foodgrains. Every year it has to import foodgrains from other states to meet the necessary demand.

The total geographical area of Assam is reported to be 78.5 lakhs hectares, of which 21.14 lakh hectares are under forest, 15.89 lakh hectares are barren and uncultivated land and net area sown is 24.85 lakh hectares. In India the whole agricultural sector is managed by private individuals. Besides, the agriculture in India depends on monsoon rain, Assam being no exception. However, Assam receives plenty of rainfall well distributed over all the months in a year excepting one or two winter months. But, as a characteristic feature of the monsoon, the rainfall is highly unreliable and undependable. During the last few years, there has been an accentuation in these characteristics of rainfall so peculiar to the regions of monsoon domination. Therefore, irrigation is considered to be one of the vital component with respect to scientific method of cultivation (Fig. 17).

Quantity of rainfall during the winter season is very less in all parts of the state. Therefore rabi crops cultivation is difficult in Assam without irrigation. The development of irrigation system has been considerably poor in Assam. Since independence there has been little progress in the areas irrigated. In 1947-48 the total irrigated area was 456.50 hectares under various government and private sectors. By 1968-69 the total irrigated area increased marginally to 612.00 hectares within a span of twenty years.

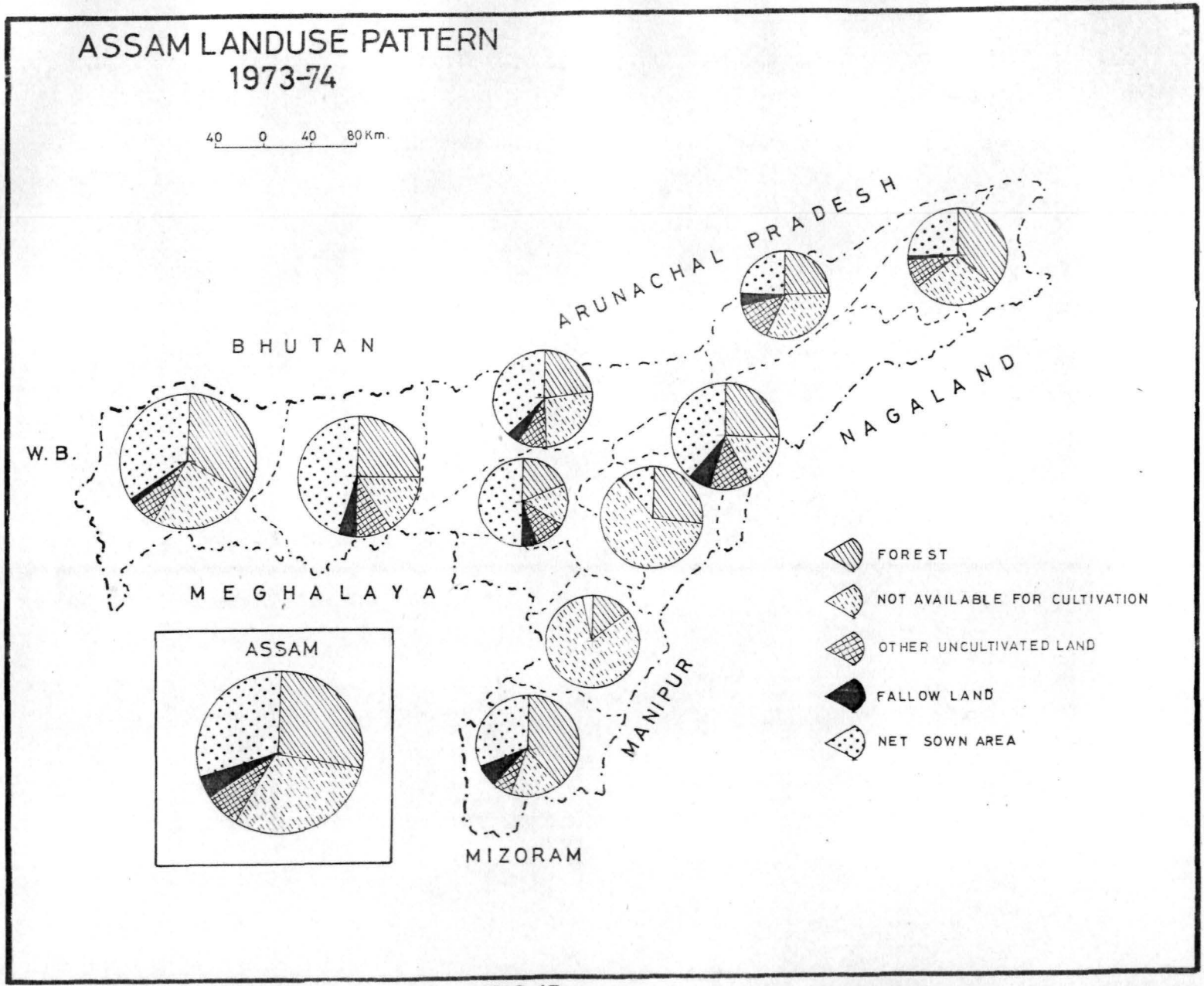
ASSAM LANDUSE PATTERN
1973-74
40 0 40 80 Km.
ARUNACHAL PRADESH
BHUTAN
W. B.
NAGALAND
MEGHALAYA
ASSAM
MANIPUR
MIZORAM
FOREST
NOT AVAILABLE FOR CULTIVATION
OTHER UNCULTIVATED LAND
FALLOW LAND
NET SOWN AREA

FIG.17

According to Irrigation Department of Assam, out of 2,18,000 hectares of total irrigated area 299,00 hectares are irrigated by medium irrigation schemes, and 189,000 hectares by minor irrigation schemes.

The figure in the table below shows the major irrigation schemes in Assam.

Table No.6

Major and Medium Irrigation Schemes in Assam

Name of Scheme and type	District	Established potential (000ha)	Target year of completion
Dhansiri(Major)	Darrang	41.20	1980-81
Kalang(Medium)	Nowgong	23.50	1981-82
Koliabor(Medium)	Nowgong	8.50	1977-78
Bordikrai	Darrang	17.40	1979-80
Longa(Medium)	Goalpara	5.00	1977-78
Kaldiya(Medium)	Kamrup	9.89	1978-79
Deka Dong(Medium)	Kamrup	4.90	1977-78
Jajlaigaon(Medium)	Goalpara	2.50	1977-78
Dithai(Medium)	Karbi Anglong	2.49	1978-79
Kollonga(Medium)	Karbi Anglong	2.01	1978-79
Deorani(Medium)	N.C. Hills	2.80	1978-79

Source: Irrigation Department, Government of Assam 1976.

The above table depicts a clear picture of the existing regional disparity in respect of irrigation projects within the state. Districts of Lakhimpur, Sibsagar,

Dibrugarh and Cachar are found to be completely neglected.

Agriculture is the mainstay of Nowgong district and more than three fourths of its working population derive their livelihood from agriculture. In the later part of the 19th century there were large tracts of government wasteland which were subsequently opened up with the influx of immigrants. At the same time large tracts of wasteland have also been brought under tea plantation. The following are the land utilisation statistics of Nowgong district during 1968-69.

(Area in ha.)

1.	Total geographical area	(a) Professional Survey	561316
		(b) Village Survey	560547
2.	Land not available for cultivation	(a) Land put to non-Agricultural use	53814
		(b) Barren and uncultivated land	38002
			91816
3.	Forest		113677
4.	Other uncultivated excluding fallow	(a) Permanent pasture and Grazing land	30810
		(b) Land under misc.	22465
		(c) Cultivable waste	16105
			69380
5.	Fallow land	(a) Fallow land other than current fallow	13338
		(b) Current fallow	14780
			28127
6.	Net area sown		257547
7.	Total cropped area		318504
8.	Area sown more than one		60957

The above figures present a broad picture of the way in which the available land in the district is put to use. It is evident that fallow lands constitute about 5 per cent of the total cadastral area. These include practically all unsettled lands, vast areas of which are either hills or too low lying making it unfit for cultivation. The total cropped area of the district is about 57 per cent of the cadastral area. About one sixth of the cadastral area is not available for cultivation. Other uncultivated lands excluding current fallows form about 12 per cent of the total cadastral area. Of such lands 30,810 hectares are under permanent pastures and other grazing lands. An area of about 22,465 hectares are under miscellaneous tree crops and groves not included in the net area and about 16,105 hectares are cultivable waste.

Irrigation: The district of Nowgong receives heavy rainfall during the monsoon and the bulk of the annual rainfall i.e. nearly eighty per cent is received during the months between May and September. However, the nature of the topography in the district influences considerably the actual availability of rainfall received. Rice and jute, mainly cultivated in the plain areas, get sufficient rain water but in the highlands of the district, rain water does not accumulate in the fields as most of it drains off. The

cultivators, therefore, generally raise "bunds" at certain points. A serious drawback is that the accumulated water spills over when its level exceeds the height of the "bund" and flows out as waste as a result of poor drainage system. This problem has been sought to be solved by implementing some minor irrigation schemes.

According to 1971 Census the areas irrigated by canals totalled 6405 hectares, while tank and tube-wells accounted for nearly 352 hectares. The remaining irrigated areas (359 hectares) were watered by other means of irrigation. The cultivator also resorted to indigenous methods of irrigation such as lifting of water by means of "Lahonis" (Swing Buckets) which, however, were highly inadequate for the requirement.

There are three principal agencies in the state of Assam engaged in the implementation of the irrigation projects. These are: i) The Agriculture Department, ii) The Flood Control and Irrigation Department and iii) The Brahmaputra Flood Control Commission.

During 1961-62 the Agriculture Department undertook the operation of thirty minor irrigation schemes at different places of the district at a total cost of Rs.26,341.67 benefiting an area of about 2295 hectares.

Beside these lift irrigation schemes with energised pumps were also introduced and as many as 120 such power pumps were installed.

Among the medium irrigation schemes Jamuna, Patradisa and Kondali irrigation schemes are significant. Since the reorganisation of the Department a new irrigation division covering the whole of the district has been created in 1974. Besides the existing schemes, it has now been proposed to undertake some new irrigation schemes in the District.

3.3.2 CROPPING PATTERN

The analysis of the cropping pattern in Assam reveals that cereals occupied as much as 2,244,300 hectares of land. Out of the total area occupied by cereals rice alone accounted for nearly 95.6 per cent (21,30,700 hectares). It is natural, because rice is the staple food for the bulk of the people living in the state. This is also evident from the fact that rice too accounted for more than 70 per cent of the total cropped area of the state during 1982. Rape and mustard (oil seed) rank second as the large producing crops in Assam. They occupy as much as 2.1 lakh hectares of total cropped area in Assam. Jute (fibre) is the third major crop in Assam which occupies

total 1.1 lakh hectares of cropped area.

Tea, another important cash crop in Assam occupies as high as 1.9 lakh hectares of land. There are in all 769 tea gardens in Assam according to 1979 Census where the total production amounted to 27,6190 kgs.

The table shows the area under principal crops in Assam.

Table No.7

Area (in ha.) under principal crops (1982)

Cereals	Rice	Maize	Wheat	Others	Total
Area (ha.)	2130700	22680	82270	8650	2244300
Pulses	Gram	Tur	Others		Total
Area (ha.)	3620	5960	92870		102450
Oil seeds	Sesamum	Rape & Mustard	Lin seed	Castor	Total
Area (ha.)	11821	210000	5870	2146	229831
Fibre	Cotton	Jute	Mesta		Total
Area (ha.)	3900	115030	12980		131910
Sugar cane					47390
Potato					35240
Others					29125

Source: Statistical Handbook of Assam 1982.

Target of Agricultural production by the end of the Seventh Plan in Assam is estimated as:

Table No.8

Target of Agricultural Production by the Seventh Plan

Crop	Area (000 ha.)	Production (000 tons)
1. Rice	2500	4388
2. Wheat	125	200
3. Maize	45	38
4. Pulses	250	150
Total food crops		4388
5. Sugarcane		3600
6. Oil seeds		280
7. Jute		1000 (bale)

The requirement of foodgrains by the end of the Seventh Plan is estimated as follows:

1. Rice	39.60 lakh tons
2. Wheat	5.25 lakh tons
3. Pulses	5.15 lakh tons
Total foodgrains	50.00 lakh tons

Paddy, jute, sugarcane, mustard, pulses and tea are the major crops and tobacco, potato, vegetables and fruits like mango, orange, coconut, banana, pine-apple are subsidiary crops of the Nowgong district. In 1971-72 paddy was grown over 20,2000 hectares comprising nearly two thirds of the total cropped area in the district.

Since the beginning of the present century, area under jute has registered enormous growth in the district jumping from a meagre 28 hectares in 1901 to 36,020 hectares in 1970-71. Cultivation of jute, mostly confined to the Mymensing immigrants, increased greatly during 1911-to 1931 when the immigrants came in large number. Jute cultivation has now become popular among other sections of people also.

Sugarcane is another important crop of the district. It is grown on highlands. Tiny patches of sugarcane fields are seen almost in every circle of the district. Area under sugarcane increased from about 693 hectares in 1901 to about 3,380 hectares in 1970-71. Cultivation of sugarcane became more popular since the year 1940.

Mustard is normally grown in conjunction with "Ahu" on riparian flats. The crop is ready to be pulled out from the field about the middle of February.

Pulses are grown mainly in alluvial flat lands near the river Brahmaputra. The most important variety is "Mati-Mah". The other kinds of pulses are "Magu-Mah", "Arahar", "Masur-mah", "Motor-mah", "Garo-mah", "Lesera-mah", etc.

3.3.3 Area, Production and Yield under Different Crops

Among the various foodgrains and cash crops, rice mustard, jute, wheat are noted in order of importance from the standpoint of percentage of area as well as production brough under the above crops during 1982. During 1979-80 foodgrains occupied 2.3 million hectares out of total 2.8 million hectares cropped area in Assam. So 83 per cent of total cropped area occupied by foodgrains with a production of 2.0 million tones having 866 kg average yield rate.

If the individual crops are taken into consideration the cultivation of rice tops over the other crops. During 1979-80 more than 70 per cent of the total cultivated area and production was recorded under rice cultivation. In 1979-80 the total rice produdtion in Assam

was 18,80,786 tonnes which occupied 75 per cent of total cropped area.

Table No.9

Total foodgrains (cereals + pulses) 1979-80

District	Area(ha.)	Production (tonnes)	Av.Yield kg/ha.	P.C. under grain of total area
Goalpara	389090	262289	683	81
Kamrup	528150	384690	730	85
Darrang	263300	220389	849	80
Nowgong	284100	262758	937	77
Sibsagar	272140	311750	1162	86
Dibrugarh	146380	138192	956	81
Cachar	199420	171215	859	93
Karbi Anglong	109900	123661	1125	81
N.C. Hills	12900	11792	914	79
Assam	2346750	2031784	866	83

Table No.10

Rice Production in Assam 1979-80

District	Area(ha.)	Production (Ton)	P.C. of area under rice
Goalpara	353070	238049	76
Kamrup	472020	343699	76
Darrang	237630	198747	72
Nowgong	253010	242736	69
Sibsagar	256150	300721	81
Lakhimpur	130500	138339	73
Dibrugarh	126019	129196	70
Cachar	196690	169996	92
Karbi Anglong	93820	113136	69
N.C. Hills	11810	11152	72
Assam	2130700	1880786	75

The aggregate picture of rice cultivation in Assam moreoor less similar in different districts, the percentage of paddy hectarage varying from 69 per cent in Nowgong district to as high as 92 per cent in Cachar. The percentage of paddy hectarage is more than the state's percentage in the districts, viz., Kamrup, Sibsagar and Cachar.

Among the various foodgrains and cash crops rice is the principal crop in Nowgong district. In 1979-80 the total rice production in the district was 24,2736 tonnes which accounted for about 12.9 per cent of the total state production. On the other hand rice occupied about 69 per cent of total cropped area of the district. In 1973-74 the total rice production of the district was 336.93 thousand metric tonnes and total area under rice was 203.5 thousand hectares. The second important crop of the district was jute which occupied 36.02 thousand hectares of area and production was 367.15 thousand metric tonnes.

Table No.11

Area Production and Yield of Different Crops Nowgong District (1973-74)

Name of crops	Area(000ha.)	Production (000m.t)	Yield kg
Rice	203.50	236.93	1182
Rape & Mustard	21.88	6.43	294
Jute	36.02	267.15	1135
Sugarcane	3.38	13.08	36807
Potato	1.55	3.75	2420

CHAPTER - IV

STRUCTURE OF FARMS IN THE STUDY AREA

4.1. INTRODUCTION

The purpose of this chapter is to analyse some aspects of production conditions in agriculture on the basis of field investigation of 150 farm families in the district. These various aspects of farms is divided into four sections, viz., section one includes the aspects such as the influence of the size of farms, tenancy and fragmentation on productivity section two analyses the land utilization and cropping pattern of the sample farms, section III examines the farm assets and finally the fourth section deals with the cash receipts and expenses as indicators of farm efficiency.

Section I: The questions pertaining to farm size, fragmentation and tenurial systems are inextricably interlocked with the extent of productivity. It is, therefore, imperative to bring to focus the nature of their relationship with productivity as structural forces and examine their influence in the specific situation under study. While it must be remembered that these three factors are themselves inter-related - acting upon each other - the following account separately analyses each of these only to have a cleaner understanding of the parts.

SECTION I

1.1. Farm Size

There exists a strong relationship between inputs and outputs of a farm especially in relation to size of

holdings. The one proposition which attracted considerable notice and has continued to recur in discussion is the alleged inverse relationship between yield (i.e. value of output) per acre and the size of holdings.[14] Even if such an inverse relationship holds, it does not provide a sufficient basis to judge the relative potentialities of the different size groups nor to predict the future patterns of size distribution that might emerge. Despite these limitation, the inverse relation acquired some significance as it could provide some rationale for arguing that the small farms are superior to large ones on purely economic grounds.[15] Explanation that have been advanced so far in favour of superiorly of small farms fall into three categories (a) differences in the techniques, the small holders using technically superior methods of production (b) qualitative differences in factor endowments; either land or labour on smaller farms is intrinsically of superior quality (c) more intensive application of other co-operant inputs like labour, bullock power or irrigation.[16]

---

[14] Bharadwaj, K. (1974), Production Condition in Indian Agriculture, (p.11).

[15] Ibid., p.13.

[16] Ibid., p.13.

In the background of the above generalities it may be worthwhile to understand the distribution of farms in Nowgong district as a prelude to understand its relationship with productivity.

The total area occupied by 150 farms of the sample villages is 425.25 hectares with average farm size of 2.83 hectares which is significantly higher than the state average of 1.73 hectare. The table below shows the distribution of farms, cultivated area and average size of farms by farm size groups of the sample households.

Table No.12

Distribution of farms, cultivated area and average size of farms by farm size group

Farm size group (ha.)	No.of farms	P.C.of total no.of farms	Total cultivated area	P.C.of cultivated area	Average size of farm
0.01-1.82	36	24.00	48.04	11.31	1.33
1.83-2.43	32	21.33	67.78	15.94	2.11
2.44-3.24	39	26.00	109.23	25.69	2.80
3.25-4.45	25	16.67	94.13	22.13	3.76
above 4.45	18	12.00	106.03	24.95	5.89
All farms	150	100.00	425.25	100.00	2.83

It is clear from the above table that the farm size category of 2.44 to 3.24 hectare contains the highest number of farm size, ie. more than a quarter of all farms (39 out of total 150 farms) with an area of about 109 hectares having average size of 2.80 hectare.

The smallest farm size category (0.01 hectare to 1.82 hectare) has as many as 36 farms but occupies only 11.3 per cent of the total cultivated area with an average size of 1.33 hectares. This is the lowest among all size classes. On the other hand the largest category of farm size (4.45 hectare and above) has only 18 farms but account for the largest amount of the total cultivated area. The average size of farm is also higher than all other categories which stands at 5.89 hectare.

It is evident from the above discussion that the larger sizes of farms are generally small in their number but they do occupy considerable proportion of the total cultivated area amounting to nearly a quarter of it. In fact the largest two categories (above 3.25 hectares) of farm sizes account for a little less than 48 per cent of the total cultivated area while in terms of their number, they account for a meagre 29.67 per cent. On the other hand the smaller holdings are too many but they account for an insignificant proportion of the total cultivated area.

The situation arising out of it inevitably leads to the question of fragmentation.

1.2 Fragmentation

The fragmentation of holding in the cultivated area is one of the most detevated factor in farm operations. Large number of small plots in cultivated area, lead to considerable work of different inputs, viz. Land, Labour and other important farms resources. According to Bhagwati and Chakravarty (1964),[17] the poorer productivity of land on larger holdings to the possibility that they may be characterised by higher degree of fragmentation of the plots constituting the holding.[18] Such fragmentation of cultivated area scattered over distances adversely affects the productivity per acre.

However, the intensity of fragmentation by the number of fragments per acre, goes on decreasing with the increase in farm size.[19] Thus farms of bigger sizes are in a more advantageous position that the smaller farms as the former possess bigger fragments than the latter.

The number of fragments per farm and per hectare of sample farms is given in the following table by farm size groups. It reveals that over-all intensity of fragmentation

---

[17] Ibid., (p.15)

[18] Bhagwati and Chakravarty (1964), Reports on West Bengal, p.24.

[19] Op cit., p.

per farm and per hectare is 3.33 and 1.17 respectively in the sample farms.

Table No.13

Number of fragments per farm and per hectare

Farm size group (in hectare)	Per Farm	Per Hectare
0.01-1.82	2.69	2.02
1.83-2.43	3.13	1.48
2.44-3.24	3.72	1.33
3.25-4.45	3.28	0.87
Above 4.45	4.17	0.71
All farms	3.33	1.71

It is interesting to note that the number of fragments per farm is inversely related to farm size groups. This means that the number of fragments per farm is higher in the case of smaller farm sizes and is less in the larger farm size categories. But conversely, the number of fragments per hectare shows to be higher in the case of larger farm holdings and less in the smaller size of holdings. Thus it may be concluded that the smaller holdings have greater fragmentation level per hectare but fewer fragmentation per farm. The case is reversed in the case of larger farm sizes.

Table No.14

Distribution of farms, area, with reference to category of ownership and farm size-groups

Farm size-groups (ha.)	Category ownership								Total	P.C. of owned to total
	Purely owned			Purely tenant		Owned-cum-Tenant				
	No.	Total area	Net cul. Area	No.	Area	Self-cul.	Areal leased in, out	Net cul. area		
0.01 - 1.82	33	45.86	44.83	-	-	13	1.62 1.63	3.25	48.08	96.60
1.83 - 2.43	23	53.42	48.84	1	1.96	8	10.78 6.35	17.13	67.78	87.73
2.44 - 3.24	29	87.80	80.91	1	2.70	9	16.58 9.04	25.62	109.13	89.25
3.25 - 4.45	22	84.31	82.69	-	-	3	8.20 3.24	11.44	44.13	96.55
Above 4.5	13	80.16	76.99	1	4.52	4	15.74 8.78	24.52	106.03	87.45
All	120	356.49	334.11	3	9.18	27	52.92 21.04	81.96	425.25	9.01

Thus it is clear that in Nowgong district the fragments of the larger holdings are many but each of these are big enough as far as the acreage is concerned. On the other hand the smaller holdings though have fewer fragments have extremely small acreage under each.

1.3 Ownership of farms

Tenurial conditions in India vary markedly from region to region and within region. Holding can be classified broadly as wholly owned, partially rented and fully rented holdings. The intensity of cultivation, inputs costs, the cropping pattern etc. are highly affected by the tenurial system.

A purely owned cultivator can undertake the provision and maintenance of irrigational facilities permanently. Where a partially rented or fully rented cultivator may not be willing to do so. In other words, wholly owned farmers mostly working on their own farms, generally take 'greater interest in performing their task and in better management'.[20] Tenurial system may also have considerable influence on cropping patterns. The share-rented lands have a higher percentage area under food and less under cash crops as compared with owner-

---

[20] Bharadwaj, K. (1974), Op cit., p.17.

cultivated and fixed-rented holdings. "It is possible that a share-cropper is reluctant to venture into the more profitable but risky crops, which, incidently, also generally require a high level of inputs since he has to share the profits with the landlords."[21]

The ownership of sample farms can be divided into three broad categories, viz. (i) purely owner cultivated, (ii) purely tenant cultivated and (iii) owner-cum tenant cultivated farms. It is found that out of the total cultivated areas about 91 per cent is owned by the farms in sample farms. Out of 150 families covered in the study as much as 80 per cent are purely owner cultivator. Only 18 per cent of the holders come under the category of tenant cultivator and only 2 per cent under the category of purely tenant cultivators.

Table No.14 depicts the distribution of farms and area under farm sizes with reference to categories of ownership and farm size groups. It is obvious from the table that the number of families belonging to the owner cultivated category are more in the smaller size holdings and the tendency to keep part of their land uner fallow is much less compared to the families having bigger holdings as evident from the difference between total owned area and net cultivated area.

---

[21] Ibid., p.13.

Table No.15

Average cultivated area, cropped area and intensity of cropping

Farm size group (ha.)	Zone A			Zone B			Zone C			Combined		
	Ave. net cul. area	Ave. gross cul. area	Int. of crop-ping	Ave. net cul. area	Ave. gross cul. area	Int. of crop-ping	Ave. net cul. area	Ave. gross cul. area	Int. of crop-ping	Ave. net cul. area	Ave. gross cul. area	Int. of crop-ping
0.01-1.82	1.38	2.29	165.94	1.34	1.96	143.26	1.18	1.55	131.35	1.33	2.08	156.00
1.83-2.43	2.06	3.14	152.42	2.05	2.02	93.53	2.26	3.28	144.24	2.11	2.96	139.97
2.44-3.24	2.80	4.11	140.78	2.86	2.99	104.54	2.74	3.67	133.94	2.80	3.75	134.19
3.25-4.45	3.80	5.78	152.10	3.91	3.80	97.18	3.64	4.59	126.09	3.76	4.83	128.30
Above 4.45	5.89	7.43	126.14	5.35	4.58	85.60	7.19	10.88	143.53	5.89	7.00	118.89
All farms	2.77	4.02	145.12	3.07	3.05	49.34	2.77	3.73	134.65	2.83	3.75	132.47

There are only three families available in the sample who work as purely tenant farmers. Only one among them has a very large farm size, i.e. 4.52 hectares.

The tendency to lease in more land to cultivate is marked among those families having relatively smaller farm sizes but not the smallest farm sizes. Thus 17 out of 27 families have leased in more land for tenant cultivation whose average farm size ranges between 1.83 and 3.24 hectares.

It may be presumed from the above analysis that most of the families belong to owner cultivator category with small size of land holding and everything remaining constant they must be taking requisite interest in cultivating their own land. This brings the topic of cropping pattern to be analysed to understand how the land is put under use.

Section II

II.1 Land Utilization and Cropping Pattern

The qualitative differences in inputs, so far they exist, would be most predominantly reflected in the cropping pattern and intensive use of land. Then differences in value productivity thus finally boil down to

differences in intensity of land-use and cropping pattern.[22] Apart from intensive land use, cropping patterns also contribute to the relative higher value productivity on smaller farms. Intensive use of land, in turn, involves the application of other inputs to land.

The cropping pattern, along with the intensity of cropping may explain a number of relations observed between input uses and the average size of holding which appears to hold for total crop production. The intensity of cultivation in general shows, however, a "significant inverse relation to size of holding, declining sharply on large holdings. This probably explains the significant inverse relation between value productivity per acre and the size of holding despite the higher value cash crops on large holdings".[23]

In the district of Nowgong as evident from the following table the intensity of cropping by farm size-group decreased with the increase of farm size groups, which varies between 118 and 156.

It may be noticed from the table No.15 that there is a sharp decline in the intensity of cropping as there is increase in the size of holdings indicating that the smaller size farms are, in most cases, put to multiple

---

22 &
23 Bharadwaj, K. (1974), Op cit., p.18

use while the larger sized ones are not as intensively cultivated. Thus, an inverse relationship between the size of holding and intensity of cultivation is clearly established.

But, this may not sufficiently indicate as to an inverse relationship between size of holdings and productivity which is a product of more complex factors. Therefore, it is necessary to supplement this vital clue with other indicators such as farm assets and income earned through sale of agricultural surplus.

Section III Farm Assets

The various assets of farms can be divided as (i) Bullocks labour, (ii) Machinery and implements and (iii) Others, viz. farm buildings, seeds, manures and fertilizers, irrigation and others.

In the economy of crop production bullock labour plays an important part. Bullock has a multi-purpose use for the cultivator. It is a source of draught, a power used extensively in ploughing, irrigation, harvesting and transport operations. It is also a source of supply of manure to the farm.

The figures for value of implements and machinery, as well as then for 'fixed capital' (which includes residences, wells, farm buildings, etc.) are very shaky. Mainly implements can be classified as 'traditional' and 'improved'. It is found that in most regions there are not many users of improved implements, the performance varying greatly between regions in terms of value as well as typed of implements.

III.1 Value of Operational Assets for Holdings in the Sample Villages

The value of operational asset of the sample farms includes self-cultivated land, livestocks, implements and machineries and farm buildings. The average overall value of the agricultural assets is worked out at Rs.18,98,106 of which self-cultivated land alone account for about 92 per cent of the total agricultural assets.

Table No.16

Value of assets(in Rs.) per farm under the major heads according to farm size-groups

Farm size (ha.)	Farm Building	Implements & Machineries	Live-stocks	Total
0.01-1.82	268.05	105.46	537.63	10557.80
1.83-2.43	427.18	68.93	621.25	13997.04
2.44-3.24	456.41	114.94	782.21	17874.32
3.25-4.45	578.40	153.24	1181.32	28181.96
Above 4.45	556.55	262.60	1226.98	34306.79
All farms	436.60	119.75	809.08	18981.06

The average per farm value in all categories of assets increases from lower to higher farm size groups.

III.2 Value of assets per hectare

The average value of assets per hecatre is Rs. 6695.23 for all 150 farm families of the district. An inverse relationship is clearly visible in respect of investment of all types and size of holdings. Thus the picture obtained by using per farm data is negated when the data per hectare is used.

Table No.17

Value of assets per hectare under major heads according to farm size-groups

Farm size (ha.)	Farm Buildings	Implements & Machineries	Live-stocks	Total
0.01-1.82	200.70	78.96	402.53	7905.15
1.83-2.45	201.68	32.54	293.30	6608.22
2.44-3.24	162.95	41.03	279.27	6381.90
3.25-4.45	153.61	40.69	313.73	7484.81
Above 4.45	93.46	34.39	208.28	5824.01
All farms	154.00	42.23	285.38	6695.23

Section IV Cash Receipts

In most regions of India, small farmers seem to cultivate their lands more intensely in the sense that they employ more labour and non-labour material inputs per hectare. Among the factors that permit small farmers to undertake more intensive effort are the cheapness of family labour, indivisibilities of capital, superior quality of land, quality of management that can be applied to a smaller farm etc. Another factor is that most of the poor peasant family mainly depend upon small piece of land without having any alternative means of income. Therefore, they try to maximise the output from the available piece of land.

However, a poor peasant by his very position is at a disadvantage compared to the bigger farmer in so far as his capacity to apply capital and other monetised inputs are concerned. As such even after all the efforts he can uner-take, output per hectare on his farm may not be larger than on the farms of bigger farmers.

The value of cash receipts in rupees from the sale of crops of the sample farms of the Nowgong district has been analysed as an indicator of the efficiency of farm to understand the relationship between the size of holdings and productivity. The net receipts will indicate the value of the total inputs by farms as well as the economic status of the sample households.

IV.1 Distribution of Cash Receipts from the Sale of Crops by Farm Size Groups and Per Hectare

As far as the size of the holdings are concerned it is observed that the cash receipts from the sale of crops sharply increases from smaller to bigger farm size groups in the sample farms. About 74 per cent of the total cash receipts came from the big holdings.

It is quite obvious that the gross cash receipts from sale of crops will be more in big holding as they can sell more agricultural surplus.

But if we see the situation of cash receipts from the sale of agricultural produce per hectare, it is interesting to note that there is proportionate increase. From the following table we can see that there is no such significant variation of cash receipts among the different farm size groups.

But the small and big farms sale surplus products. There is a tendency of slight increase of cash receipt with the increase of farm size but it is only because of high average size of farm in large categories and not because of higher productivity. It is also noticed that in the big holdings, i.e., size groups of above 4.45 hectare there is a tendency of decreasing of cash receipts.

Table No.18

Distribution of Cash Receipts from the Sale of Crops
Farm Size-Groups

Farm size Groups	Total cash receipts (Rs.)	Cash receipts per holding	P.C.
0.01-1.82	24968.55	693.55	9.47
1.83-2.43	42472.00	1327.25	16.12
2.44-3.24	60476.00	1550.67	22.94
3.25-4.45	66365.00	2654.60	25.17
Above 4.45	69339.00	3852.17	26.30
All farms	263620.00	1757.47	100.00

It may be concluded that there is a tendency for cash receipts per unit of land to decrease or to remain unchanged as farm sizes increase and ultimately starts to decline in case of larger farms.

Table No.19

Cash Receipts from the Sale of Crops per Hectare

Farm size-groups	Average size of farms	Receipts per hectare
0.01-1.82	1.33	519.30
1.83-2.43	2.11	626.61
2.44-3.24	2.80	553.66
3.25-4.45	3.76	705.04
Above 4.45	5.89	653.96
All farms		619.92

Table No.20

Per hectare net receipts in different farm size groups

Farm size (ha.)	Net receipts (Rs.)
0.01-1.82	385.59
1.83-2.43	504.16
2.44-3.24	445.71
3.25-4.45	567.79
Above 4.45	548.79
Total	500.95

The situation remains more or less unchanged as far as the net receipts per hectare in different farm sizes are concerned.

The chapter provided an account of the various factors that contribute towards a relationship existing between sizes of landholding and productivity. It is imperative at this concluding stage to recount the broad observations made at several stages.

The sizes of the farms in Nowgong district are generally small with a few holdings exceeding 4.45 hectare. It has also been observed that the small holdings are extremely fragmented compared to the larger ones thereby inhibiting the modernizing forces to be accepted unrestrained. The excessive fragmentation of small holdings is easily understood in the context of a fast growing population and inequality among social classes. Thus, the problem of fragmentation of small land holdings may be identified as the major impediement being faced by the cultivators to get the benefit of increased productivity. While small holdings have been identified by many to have a better productivity range may not prove to be justified in the background of their excessive fragmentation into small pieces.

The factor which goes in favour of a higher productivity expectation relates to the ownership pattern of the holdings. It is noteworthy that although a large section of the peasants have small holdings very few of them are totally landless forcing them to cultivate on other plots. A great majority of the survey families are themselves owner cultivators with little absent-landlordism prevalent. Thus it may be expected that they must be taking enough interest in cultivation of their farms however small it may be.

But one is disappointed to observe a very low cropping intensity among the small holding sizes although it is relatively higher than the intensities observed in the large holdings. This, probably, is a result of factors such as the quality of the land in this category not permitting a very intense use of the land. It must be admitted that the dissertation does not attempt to study the quality of the lands in various categories, nor does it attempt to understand the types of crops cultivated; particularly the extent of commercial crops. These factors probably result in a lower intensity of cultivation in the small size holdings.

The value of operational assets is generally large in large-sized holdings but the picture is reversed when the value is seen per hectare of land in different sizes of holding. This proves that the sample size holdings are in a disadvantageous position as regards their initial investments are concerned. This must be putting incalculable difficulties for the small holders in raising the productivity thus acting as another impediment.

Finally, the indicator of net receipts of cash received through sale of crops per hectare shows no definite relationship with the sizes of holding. But it is seen that the net receipts for the small sizes of

holding is extremely small compared to other sizes of holding. On the other hand the receipts for the large holdings are also not proportionately large, making it difficult to draw any definite relationship between sizes of holding and productivity.

The situation in Nowgong is therefore more complex than may perhaps be apparent. In the context of a backward economy lacking extensive modernization in agriculture, and dominated by highly fragmented holdings of small size of an essentially peasant economy perhaps has not allowed any strong relationship to emerge. This chapter made an attempt only to understand the pattern in a specific agricultural ecology and further insights will be necessary to account for other factors which may be playing significant role in establishing the relationship between the two. It is also expected that with forces of modernization eventually penetrating the agricultural sector and creating sharper social divisions with relation to land availability between social groups a definite relationship between the two variables will emerge.

CHAPTER - V

SUMMARY AND CONCLUSION

Agriculture is the most extensive form of human occupation where half of the world's population earns its livelihood. Agricultural geography, dealing with the spatial organisation of crops and their concentration, provides an interesting field in which geographers can play a vital role for well-being of the society.

The process of economic development inevitably entails efforts to raise productivity in the agricultural sector so that not only a small working force can produce enough food for the rest of the society, but also release a big chunk of its working hands to join industrial sector. Thus raising agricultural productivity forms one of the most important tasks of most of the developing countries aiming at a quicker pace of economic development. In India, efforts have been made to raise agricultural production by raising more and more land under cultivation in its early decades of planned development. However, it was soon realised that emphasis has to be laid more on productivity than on production. All out efforts were to be made to increase productivity of land by way of introducing improved varieties of seeds, mechanization and other modernized methods of cultivation popularly known as 'Green Revolution'. In the history of post independent India, contrary to the expectation, by

the late seventies it was seen that the effects of green revolution were highly localized and in the larger part of the country its impact was minimal.

This led many to wonder about the structural questions which were so far ignored. Social scientists began to question the very nature of the relationship, that existed between productivity and the size of land holdings. This relationship has been a very controversial issue in India. While some economists argue in favour of "inverse" relationship between the size of holdings and productivity, others attribute such a conclusion only to certain "statistical traps" and in turn suggest that, there exists no consistent relationship between productivity and size of agricultural land holdings. There are still others who feel that the relationship tends to become positive, particularly in those areas receiving the impact of green revolution.

In this study an attempt was made to understand the specific nature of the relationship existing between land holding and productivity in a backward agricultural setting of the Brahmaputra valley. The district of Nowgong which is one of the agriculturally developed district of Assam was taken as the field of the study. In the course of the analysis the study aimed at examining the relation-

ship in its matifarious facts ranging from the size and the distribution pattern of farms, tenancy and fragmentation to broader aspects such as, land-utilization and cropping pattern etc. and avoid making a sweeping judgement arising out of a simple one to one relationship.

Agriculture is concerned not only with the growing of crops, it is also a form of applied ecology. Agriculture is directly dependent on the immediate natural environment which can be changed only at heavy cost. Initially, agricultural systems are imposed by the physical conditions till the latter are modified. Assam as a whole and Nowgong district in particular, reveals regional contrasts in agriculture which is largely because of differences in environment.

Physical factors affecting agriculture may be divided into geology, physiography, location, soil, climate, hydrology, etc., although they are clearly inter-related. Therefore, the role of these factors in the area agricultural complex is undeniable.

The district of Nowgong is located on the south bank of river Brahmaputra occupying the central portion of the state of Assam. It belongs to lower Assam part, bordering between lower and upper Assam. The soil of the district is mostly alluvium particularly in the north which

is formed by the river of Brahmaputra and its tributaries. The alluvial soil is mostly loamy and consists of a mixture of clay and sand which is quite unfit for cultivation. Marshy soil which is black in colour is chiefly found in the low-lying water logged areas. The red soil which generally occupies the hill slopes and foot hills are mostly formed by weathering.

The climate of the district is characterised by a highly humid atmosphere throughout the year. Summer is hot with plenty of rainfall. On the other hand winter is cool and almost dry.

The average annual rainfall in the district is about 1753 mm. The rainfall in the district generally increases from the south towards the north. On an average there are ninetyeight rainy days in a year in the district.

Brahmaputra is the principal river of the district which flows along the entire northern boundary of the district and the whole drainage of the district ultimately finds its way to it. The main tributaries of the river in the district are Kalong, Kopili, Diphlu, Sonai, Leteri and Pakaria. The total length of the river within Nowgong district is about 175 kms.

In the light of the new strategy adopted by the Government of India during 1966-76 for agricultural development, the individual operational holdings assumed special significance in India as units of decision making. It became more important on account of changed socio-economic conditions.

The rural settlements in Assam are surrounded by innumerable operational holdings of different shapes and sizes. According to 1976-77 census, there were 22.5 lakhs hectares operational holdings accounting for 30.8 hectares of operational area in Assam. The number of operational holdings in 1976-77 as compared to 1970-71 has gone up by 2.9 lakhs and the percentage increase is to the tune of 14.7 per cent. The operational area has increased by 2 lakhs hectares (i.e., 6.8 per cent). The average size of an operational holding in Assam is as small as 1.47 hectares much below the all India average of 2.71 hectare.

It may be mentioned that, 80 per cent of the total land holdings in Assam are below 2 hectares, which is under estimation of the most important consideration of economic variability or non-variability of farm size. From the economic point of view 2 hectares' size of holdings is floor level and such a small size of holding suffers from various problems like size-disability, tenurial uncertainty and available human and animal labour.

Another notable feature is that, in Assam the land holding pattern is not equally distributed. In 1970-71 it was found that 57 per cent of holding contains only 17 per cent of the total cultivated area. On the other extreme, 43 per cent of the holdings contains the rest 83 per cent of the total cultivated area. Lorenz Curve shows that distribution of holdings in Assam is highly concentrated. By and large land holding system is dominated by small size holdings and number of large holding are comparatively less but occupy large amount of cultivated area.

According to 1976-77 agricultural census there are 237060 operational holdings occupying 309810.36 hectares of land area in Nowgong district. Out of 237060 holdings 137947 holdings belong to marginal holding. Small holding stands for second, occupying 55668 of land holdings. Area wise, though marginal holdings got 58.3 per cent of total land holdings, it occupies only 20.3 per cent of total operated area. On the other hand semi-medium holdings which account for only 13.3 per cent of the holding contains as large as 27.8 per cent of total operational area.

The agriculture in Assam is on subsistence level. Though the whole Brahmaputra and Barak valley of the state are the two fertile regions of the country, the yield is

much lower than some of the other regions of the country. Still the state is not self-sufficient in foodgrains. Every year it has to import foodgrains from other states to meet the necessary demand.

Among the various foodgrains and cash crops, rice, mustard, jute, wheat are noted in order of importance from the stand point of percentage of area as well as production brought under the above crops during 1982. Out of the total cropped area (2.8 million hectares) foodgrains occupied (2.3 million hectares) 83 per cent of total area with a production of 2.0 million tonnes having 866 kg of average yield rate. If the individual crops are taken into consideration rice production in Assam was 18,80,786 tonnes which account for 75 per cent of total cropped area in 1979-80.

Agriculture is the mainstay of Nowgong district and more than three fourth of its working population derive their livelihood from agriculture. Paddy, jute, sugar cane, mustard, pulses and tea are the major crops and tobacco, potato vegetables and fruits like mango, orange, coconut, banana, pine apple are subsidiary crops of the Nowgong district.

Among the various foodgrains and cash crops rice is the principal crops in Nowgong district. In 1979-80 the total rice production in the district was 242736 tonnes which accounts for about 13 per cent of the total state production. On the other hand rice occupies about 69 per cent of the total cropped area of the district. The second important crop of the district is jute which occupied an area of 36.02 thousand hectares and production was 367.15 thousand metric tonnes in the year 1973-74. The average yield of rice of the district is 1182 kgs.

The sizes of farms in Nowgong district are generally small with a few holdings exceeding 4.45 hectares. It has also been observed that the small holdings are extremely fragmented compared to the larger ones. The excessive fragmentation of small holdings may be as a result of fast growing population and inequality among social classes. The problem of fragmentation of small plots may be identified as one of the major impediments being fa faced by the cultivators to get the benefit of increase in productivity.

Another most important factor of agriculture which goes in favour of a higher productivity expectation relates to the tenurial pattern of holdings. It is noteworthy that, although a large section of the cultivators have small holdings very few of them are totally landless. Thus, it

may be expected that the cultivators must be trying enough interest in cultivation of their own farms however small it may be.

But one of the disappointed fact to observe is that the intensity of cropping is very low among the small holding sizes though, it is relatively higher than the large holdings. This, probably, is a result of quality of land or crops although this dissertation does not attempt to study these factors.

In case of operational assets the value is large in large-size holdings but the picture is reversed per hectare of land in different sizes of holding. It proves that the small farmers are in a disadvantageous position in their initial investment. It may also affect in raising productivity among the different size class groups.

Finally, the indicator of net receipts of cash received through sale of crops per hectare shows no definite relationship with the size of holdings. But it is seen that the net receipts for the small holdings are extremely less as compared to other big size of holdings. On the other hand the receipts for the large holding are also not proportionally large, making it difficult to draw any definite relationship between size of holding and productivity.

Intthe context of a backward economy lacking extensive modernization in agriculture and dominated by primitive nature of cultivation of an essentially peasant economy perhaps has not allowed any strong relationship to emerge.

In the present study an attempt has been made only to understand the pattern in a specific agricultural econology and further insights will be necessary to account for other factors which may be playing significant role in establishing the relationship between the two.

REFERENCES

Bhalla, G.S. (1972). Changing Agrarian Structure in India, Meenak Prakashan, Meerut (p.27).

Khusro, A.M. (1968). "Return to Scale in Indian Agriculture" in A.M. Khusro (ed.), Readings in Indian Agricultural Development, Allied Publishers, New Delhi.

Khusro, A.M. (1973). Economic of Land Reform and Farm Size in India, Macmillan India,(pp.4-5)

Majumder, D. (1965). "Size of Farm and Productivity" A Problem of Indian Peasant Agriculture, Economica Vol.32, May.

Rao, Hanumantha (1966). "An Alternative Explanation of the Inverse Relationship between Farm Size and Output Per Acre in India", Indian Economic Review, Vol.1. October.

Rao, A.P. (1967). "Size of Holding and Productivity", Economic and Political Weekly, Vol.2, 11 Nov.

Rani, Usha (1971). "Size of Holding and Productivity" Economic and Political Weekly, Vol.6, 26 June.

Sen, A.K. (1962). "An Aspect of Indian Agriculture" Economic Review, Vol.14 Annual Number, February.

Saini, G.R. (1971). "Holding size, Productivity and Some Related Aspects of Indian Agriculture" Economic and Political Weekly, vol.6, 26 June.

Sankhyan, R.L. (1978)."Size of Holding and Productivity" A Case of Panjab, Agricultural Situation of India, Vol.12, March.

BIBLIOGRAPHY

Agrawal, A.N. (1986). Indian Agriculture, Problems, Progress and Prospects, Vikas Publishing House, New Delhi.

Arora, R.C. (1976). Development of Agriculture and Allied Sectors; S. Chand and Company, New Delhi.

Alam, K. (1985). Planning in NE India, Omsons Publication New Delhi, Gauhati.

Bora, A.K. (1986). Pattern of Land Utilization in Assam, Manas Publication, Delhi.

Basic Statistics of Assam (1980), Directorate of Economic and Statistics, Govt. of Assam, Gauhati.

Basic Statistics of NE Region (1980), North-Eastern Council, Shillong.

Bhagawati, J.N. and Chakravarti, S. ( ). Contribution to Indian Economic Analysis.

Bharadwaj, K. (1974). Production Function in Indian Agriculture, A Study Based on Farm Management Survey.

Bhalla, G.S. and Alagh, Y.K. (1979). Performance of Indian Agriculture, A Districtwise Study, New Delhi.

Bhatia, B.M. (1977). Poverty, Agriculture and Economic Growth, Vikas Publication House, New Delhi.

Bose, S. (1961). Characteristic of Farmers who adopt Agricultural Practices in Indian Village, Rural Sociology

Brown, D. (1971). Agricultural Development in Indian Districts. Harvard University Press, Cambridge, Massachussettes.

Census of India (1971), Govt. of India.

Chakravarti, T.K. (1980). Development of small and Marginal Farmers and Agricultural Labourers, An Over-view of Policies and Programmes. Natural Institute of Rural Development, Hyderabad.

Chauhan, D.S. (1966). Studies in Utilization of Agricultural Land, Agra Publication.

Chattaraj, S. and Hussain, M. (1979). Cropping Patterns and Crop Combinations in Assam, Unpublished Research Paper, Department of Geography, NEHU.

Chaudhury, P. (1972). Readings in Indian Agricultural Development, George Allen and Unwin Ltd., London.

Cole, J.P. & King, C.A.M. (1968). Quantitative Geography, New York, John Valley.

Das, M.M. (1984). Peasant Agriculture in Assam. A Structural Analysis, Intra Indian Publication, New Delhi.

District Census Handbook (1971), Nowgong District, Director of Census Operation, Assam.

Dasgupta, B. (1977). The New Agrarian Technology and India, MacMillan, Calcutta.

Dutta, N.C. (1968). Land Problem and LandRReforms in Assam, S. Chand & Co. Delhi.

Goswami, A. (1986). Land Reform and Peasant Movement : A study of NE India, Omsons Publication, New Delhi.

Goswami, D.N.D. (1960). Geology of Assam, Department of Publication, Gauhati University.

Goswami, H. (1985). Population Trend in Brahmaputra Valley 1881-1931, A Study of Historical Demography, Mittal Publication, Delhi.

Gogoi, K. (1975). Population and Agriculture, Assam Inform 27(5-6).

Goswami, L.P. (1969). Agriculture Development in Assam. Assam Inform 20(9).

Gazetteer of India (1978) Assam State, Nowgong District, Government of Assam, Gauhati.

Goswami, P.C. (1975). Agricultural Economy of Assam, Commerce 131.

Guha, A. (1966). Land Rights and Social Classes in Medieval Assam, Indian Economic Society Historical Review 3(3).

Hussain, M. (1979). Agricultural Geography, Inter India Publication.

Hussain, M. (1982). Crop Concentration in India Concept Publication Company, New Delhi.

Jha, B.N. (1974). Problems of Land Utilization, A Case Study of Kosi Region, Classical Publication, New Delhi.

Khan, W. and Tripathy, R.N. (1972). Intensive Agriculture and Modern Inputs, Prospect of Small Farmers. A Study in W. Godavari District. National Institute of Community Development, Hyderabad.

Khusro, A.M. (1988). Readings in Agricultural Development, New Delhi.

Khusro, A.M. (1973). The Economics of Land Reforms and Farm Size in India, Madras Macmillan.

Kotovsky, G. (1964). Agrarian Reforms in India, New Delhi.

Mohanta, K.C. (1969). Agriculture in Assam, Its Prospects and Retrospects, Assam Inform, 25.

Mohanta, K.C.(1974). Agriculture in Assam, Today and Tomorrow, Assam Inform, 25.

Mathew, T. (1978) (ed.) North Eastern Hill Region of India (NEHU) Delhi Agricole Publication Academy.

M'Cosh, J. (1975). Topography of Assam, Delhi Sanskaran Prakshak.

Mohammad, A. (1978). Situation of Agriculture Food and Nutrition in Rural India, Concept Publication Company, Delhi.

Mohammad, N. (1981). Perspective in Agricultural Geography, Concept Publishing Co. Delhi.

Morgan, W.B. and Munton, R.J. (1972). Agricultural Geography

North-East Region (1984). Problems, and Prospects of Development, Chandigarh Centre for Research and Rural and Industrial Development, Abbi, B.L. (ed.).

Pohikar, G.S. (1970). Studies in Green Revolution, Bombay, United Asia Publication.

Raychaudhari, S.P. (ed.) (1981). Advance in Indian Agriculture Vol.I Books & Periodicals Agency B-1, India Puri, Delhi.

Rudra, A. (1982). Indian Agricultural Economics, Myths and Realities.

Saha, N. (1966). The Growth of Food Production in Assam, Indian Journal of Agricultural Economics, 21(4).

Sharma, A.C. (1976). Mechanisation of Punjab Agriculture, Economic Publishing House, New Delhi.

Sen, B. (1974). The Green Revolution in India, A Perspective, New Delhi, Wiley Eastern.

Shaw, L.M. (1978). Shifting Cultivation, Tropical Agriculture.

Shenoi, P.V. (1975). Agricultural Development in India, Vikas Publication House, Delhi.

Singh, J. (1974). Agricultural Atlas of India, Vikas Publication, New Delhi.

Singh, J. (1976). An Agricultural Geography of Haryana, Kurukshetra Vishal.

Singh, R.L. (1971). India - A Regional Geography, Varanasi.

Singh, S. (1976). Modernisation of Agriculture, Heritage Publishers, New Delhi.

Symono, L. (1970). Agricultural Geography, G. Bell and Sons Ltd., London.

World Agricultural Census (1970-71), Directorate of Economic and Statistics, Govt. of Assam, Gauhati.