IMMIGRANTS AND THE AGRICULTURAL CHANGES IN THE LOWER BRAHMAPUTRA VALLEY

A CASE STUDY OF DARRANG DISTRICT

By

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Thesis submitted for the Degree of
DOCTOR OF PHILOSOPHY

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This is to certify that the thesis submitted by Sri Bijoy Singh Mipun, for the degree of Doctor of Philosophy (Ph.D.) at the Department of Geography, North-Eastern Hill University, Shillong, Meghalaya entitled "Immigrants and the Agricultural changes in the Lower Brahmaputra Valley" is a bonafide study of this author to the best of my knowledge and belief. This study may now be placed before the examiners for evaluation.

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(B. S. MIPUN).

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INTRODUCTION

During the last couple of decades the global agriculture has undergone dramatic transformation. This subsistence peasant farming to its modern and technically advanced counterparts in many areas is largely due to a pressing need of food grains specifically to eradicate the problem of hunger, under nutrition and malnutrition. The tremendous pressure exerted by population growth on arable land and the growing demand for food and agricultural raw materials are some of its pressing problems of the present day world. While doing extensive farming man has already pushed the frontier of arable land to the limit and hence agricultural production and diversification of crops by adopting new agricultural technology and practices. In recent years production of cereals has gone up in the developing countries nonetheless the numerous qualitative targets are miles ahead to be achieved.

One of the most spectacular aspects of technological revolution in agriculture is the introduction of high yielding varieties of crops which have since the outset comspicously transformed the agrarian phenomena in most of the developing countries of south east Asia. In so far as the introduction of HYV seeds during early sixties ago, the post introduction phase

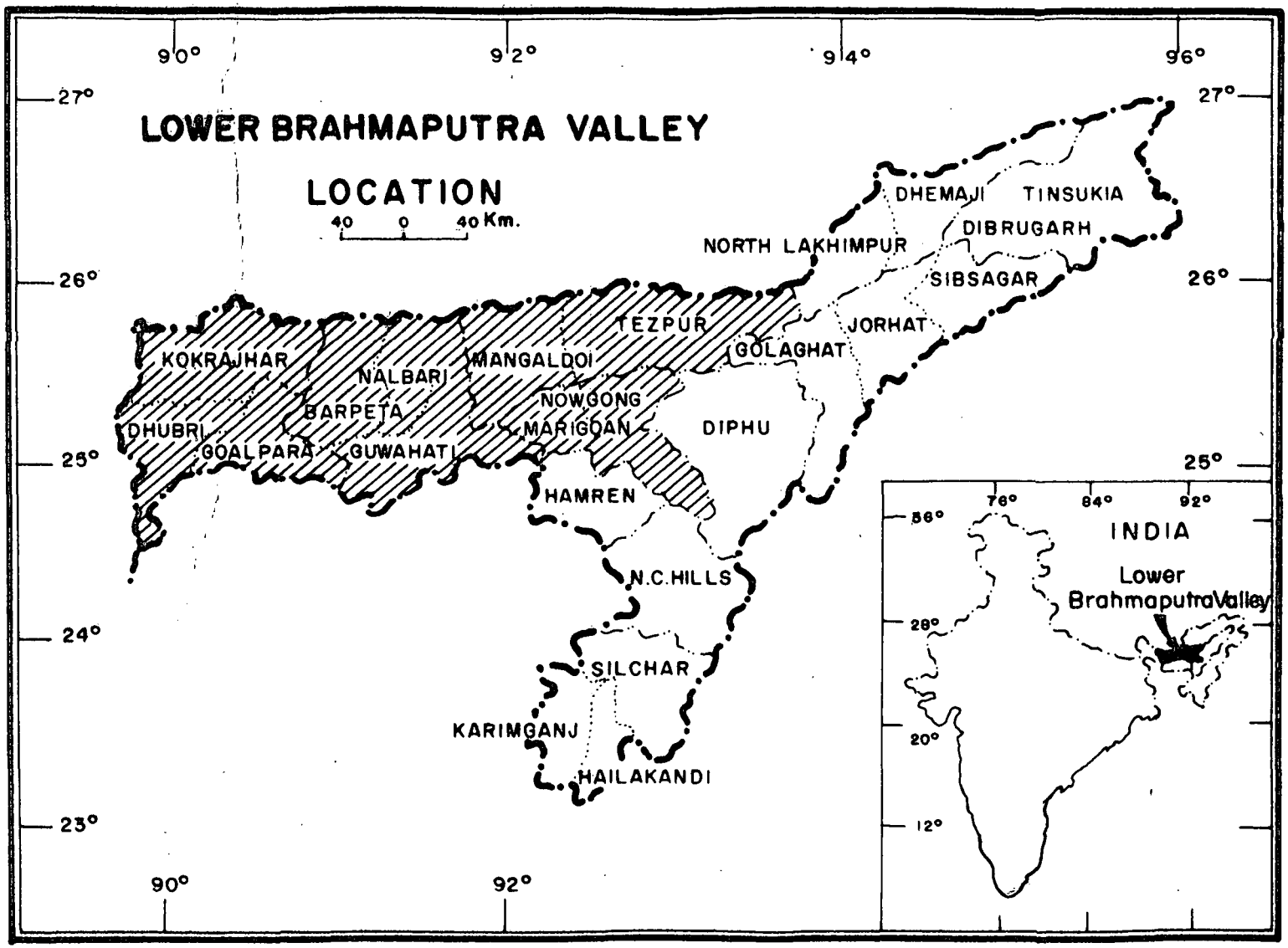
LOWER BRAHMAPUTRA VALLEY
LOCATION
40 0 40 Km.
90°
92°
94°
96°
27°
26°
25°
24°
23°
DHEMAJI
TINSUKIA
DIBRUGARH
NORTH LAKHIMPUR
SIBSAGAR
JORHAT
TEZPUR
GOLAGHAT
KOKRAJHAR
NALBARI
MANGALDOI
BARPETA
NOWGONG
DHUBRI
MARIGOAN
DIPHU
GOALPARA
GUWAHATI
HAMREN
N.C.HILLS
SILCHAR
KARIMGANJ
HAILAKANDI
INDIA
Lower
BrahmaputraValley
76°
84°
92°
36°
28°
20°
12°

Fig. 1.

highlights a discouraging productivity pattern of the new crops specially rice in terms of both absolute and relative figures. The introduction of HYV programme with an advent of technological breakthrough has failed to a large extent to bring down the hunger, malnutirition under nutrition and social inequality to minimum in the country. The per capita output has not appreciably increased. It has simply helped to maintain the existing levels of production per capita alongside the nutrition levels in many states and union territories confronting an acute problem of population growth. The varieties have thus resulted in a change in cropping structure, their rotation, methods and agricultural operations. Consequent upon the advanced technology has quickened the formation of a commercial agriculture. The subsistence peasant farming is therefore in the process of being destroyed with the advent of this new technology. This, as an attribute can be singled out so as to identify its wide spread effects such as growth of wage labour, formation of a stratum of agricultural labourers rise of large farmers in terms of social importance and emergence of a new class of rural elites. In turn it has brought about a polarisation of social classes creating greater disparities in the income of the rural people which have in the long run led to many social tensions.

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1. K. Griffin (1973). The Political Economy of Agrarian Change. Macmillan, Oxford, pp. 46-82, 171-194.

The social structure, relation alignment and status have drastically changed with a corresponding change in the income distribution. These features in rural India are largely due to the introduction of HYV crops by the immigrants which have substituted the human labourers with a high level farm mechanization. It has however, ultimately generated a vast potential of human labour, surplus in agricultural sector thereby substantially widening the gulf of economic inequality, regional disparity and increasing the problem of unemployment.

It would be worthwhile to study and analyse the changing pattern of the agricultural practices and production in a micro region of the Lower Brahmaputra Valley which has tremendous renewable resources base and enormous agricultural potential.

The study is aimed to enquire into the change in agricultural system and impact of immigrants on agricultural change in the Lower Brahmaputra valley. The issues thus raised incorporate as to how, why and to what extent the change and the impact has been reflected in the several holding strata of the rural peasantry. What have been the absolute and relative gain in terms of output? Whether the crop production is neutral to scale or dependent on a variety of socio-economic and physical input factors?

Before going into details, it will be worthwhile to discuss about the conceptual framework of agricultural change of any natural or social phenomenon, upon which the study is based on.

The relative existence over space has always formed an interesting study for both social and natural scientists. For an analysts however it is the spatial/behavioural aspects of such phenomena that stands as the primary concern. This relationship between man on the one hand and space and time on the other, if studied in the spatio-temporal dimensions brings out the dynamics of the spatial pattern of agricultural change.

There are a variety of phenomena whose scientific study of agriculture is very rare. The new technological innovation study in agricultural sector draws special attention to raise and improve the standard of living in a society which is predominantly agricultural in character. Agriculture being the backbone of a country's economy is also as the basic sector, an indicator of the overall socio-economic development. The modernization of an agrarian society i.e. the technological change from the contemporary to modern can be brought about only when the orthodox ideas conservatism and superstitions, of the rural lot are absolutely wiped out by means of adequate scientific

education and training. The advanced technology employed in agricultural sector can also be helped to accelerate the production and productivity of field crops to a considerable extent.

The main objective of the present study is to find out the pattern and extent to which the influence of immigrants among the indigenous farmers of the Lower Brahmaputra valley. Secondly, it seeks an answer as to the distribution of output of the impact of immigrants in agricultural sector. Thirdly, an attempt has been made to distinguish, identify and trace out the factors which in fact constrain and encourage their way of influence.

Study Area

The present study area is confined to the districts of Goalpara, Kamrup, Darrang and Nowgong of the Lower Brahmaputra valley. As a climatic region, Brahmaputra valley is unique itself. It records over 400 cm of rainfall annually. The soil is highly fertile being formed by the fluvial deposits of Brahmaputra and its tributaries. The agro-climatic conditions have made the valley an area of monoculture of rice in which more than 70 p.c. of the gross cropped area is devoted to this crop.

Lower Brahmaputra Valley has been selected as an area of study primarily because of its distance socio-economic and cultural character (as compared to the rest of the valley). Reasons are many, but suffice it to say that the influx of immigrants has contributed significantly to the complexity of agricultural landscape. The study contents that the elements of the distribution of phenomena are known and concern itself with the problem connected with the impact of immigrants in the agricultural system of the valley.

The change of agriculture and its distribution pattern in social and economic context in the region can also be considered as a spatial phenomenon whose influence will highlight the various physiographic, socio-economic and cultural barriers. Since this part of study deals with data and information in a time series and there are numerous limitations in procuring them. The study about the immigrants impact on agricultural change is a difficult task. The economic pattern of the immigrants and local rural farmers has been the focus of the study because of its physiographic and socio-economic personality.

Hypothesis

1) What is the extent of distributional pattern of agriculture in Lower Brahmaputra valley?

2) Whether the physical attributes of the region are conducive for the agriculture and attract the immigrants in the area?

3) Whether the socio-cultural economic change is created by the immigrants in the area or not.

4) The major influence and change in the agricultural practices and output will be identified.

5) It will be tested the production and improvement of agricultural system whether similar to the indigenous and immigrants.

6) Whether the Lower Brahmaputra Valley has adequate facilities for agricultural activities where maximum changed can be identified with the influx of immigrants.

7) Whether the immigrants cultivators are using any new seeds and improved technology in agricultural system than the indigenous cultivators which creates inequality in the distributional pattern of land and output.

8) Whether the immigrants are completely dominated the entire agricultural system of the valley in terms of output and economy.

Data Base

The whole study has been done with the help of the primary and the secondary data and information and also field study.

Most of the chapters are based on the secondary sources like Directorate of Agriculture, Government of Assam. Other relevant data on immigration and agriculture has been collected from the Census of India. The field survey in the sample villages of Darrang district was conducted in the form of questionnaires.

The field and on the spot collection of data by a direct interview with the farmers of the Lower Brahmaputra Velley (Darrang district) have been executed in the following way.

a) Social Setting - To know the social conditions of the farmers and compare them with the non-immigrants villages of the district. The size of the family and living condition etc. of the people are known through the social setting.

b) Holding Size - The landholding size of the farmers in terms of area operated, area owned, fragmentation of fields, pattern of land utilization, cropping pattern and concentration of crops, levels of productivity of the field crops.

c) Consumption levels of inputs - Information concerning the advanced economic inputs such as fertilizer, pesticides, irrigation, tractor, diesel pump, etc. The response of each farmers has been filled up against the respective question asked.

Criteria of Sample Study

Generally for a standard study dealing with socio-economic aspects about 10 - 15 percent of the universe is taken as the sample. But looking at the time, finance and several socio-cultural constraints in the valley only nine sample villages were selected and studied.

In the field study of these nine villages the author has to take lots of help from the local inhabitants of the immigrant villages. During the period the political instability and the problems of foreigners were the main problems to conduct such sensitive studies. All the time the villagers remained curious to know whether the incoming stranger is a government agent, politician, missionary workers, a social reformer or simply a research scholar.

About 324 (three hundred and twenty four) questionnaires were completed from the selected villages representing immigrants and indigenous farmers. It is hoped that a generalization on the basis of this sample taken can give a satisfactory and sufficiently reliable picture of the agricultural change among the immigrants and the indigenous farmers. The sample farmers adopting HYV rice in their farms have been therefore taken into consideration to see the change in agricultural change.

Methodology

The study planned and designed within an environmental-cum-socio-economic framework begins with an assessment of the physiographic background of the region. The agricultural operation being implicit phenomena within the agro-climatic set up of the Brahmaputra valley, various climatic indices have been prepared for a better understanding of the area in terms of environmental conditions.

In the third chapter an attempt has been made to understand the population growth and its characteristics by the immigrants during the last 50 years into the Brahmaputra Valley.

Chapter four is primarily an attempt to find out the concentration of high yielding varieties of crops and their productivity patterns among the farmers of the two different ethnic groups. Here is an attempt to explain the productivity variation of high yielding varieties in space. For this purpose regression analysis have been adopted as the tool to measure the composite effect of these variables on the yield per hectare. The inter-relationships of the variables have been tested through bivariate correlation coefficients. It also suggests whether a new variable is worth considering or not thereby helping to keep a watch over the changes in the values of regression coefficients and their standard errors.

The fifth chapter studies the general agricultural situation of the selected district. The effect and cause relationship between the environmental parameters and per hectare yield with the growth of population. Nelson's Method of crop combinations have been adopted to measure the districts' cropping pattern and crop combination. In the Darrang disteict there is a significance increased from 1.88 lakh hectare in 1961 to 2.75 hectare in 1981, a 46.28% increase over the last two decades. There is a change in cropping pattern due to increased in food crops. The technological changes and implements of high yielding varieties of seeds are the main cause in agricultural development of the district.

The sixth chapter embodies the socio-economic and cultural factors. The concentration is more on immigrant farmers and indigenous farmers comparative study of problems and prospects of landuse in the study area, the social setting of the farm households has been assessed and evaluated. The comparative relationships have been found out between the yield and the social variables. The variables include - family size, religion, age of the cultivator, formal education, number of working members of fragmented fields of the two different ethnic groups of farmers.

In the seventh chapter the overall impact of the immigrants on the agricultural situation has been discussed and concludes them with it. It has been discussed how the immigrants influenced the local farmers for multi-cropping. It has been also noticed that how the demographic pressure created by the immigrants depressed the rural economy.

CHAPTER - II

CHAPTER - II

PHYSICAL SET UP

The area selected for the present study is the Lower Brahmaputra Valley comprising the districts of Kamrup, Nowgong, Goalpara and Darrang of Assam (since 1983, redivided into the districts of Goalpara, Dhubri, and Kokrajhar (Old Goalpara), Kamrup, Nalbari and Barpeta (Old Kamrup), Darrang and Sonitpur (Old Darrang) and Nagaon). The lower Brahmaputra valley is very monotonous and therefore the physiography and the drainage pattern of the whole valley is discussed. Another point to be noted is that there are few meteorological stations that have recorded temperatures and relative humidity.

The valley of the Brahmaputra is situated between $25^{o}45'N$ to $27^{o}55'N$ Latitude and from $89^{o}4'E$ to $96^{o}2'E$ Longitude. It is a well defined area with peculiar physical and socio-economic characteristics. The valley includes the administrative districts of Lakhimpur, Sibsagar, Dibrugarh, Nowgong, Goalpara (Old district) Darrang and Kamrup. The boundary is demarcated by Arunachal Pradesh and Bhutan in the north and east, Bangladesh in the west, Meghalaya in the south and Nagaland in the south east.

It is surrounded by eastern Himalayas, Patkai and Naga Hills in the east and Khasi Garo-Jaintia hills and Mikir Hills in the south. The Brahmaputra valley extends from the eastern most tip of Upper Assam to the west of Dhubri on the border of Bangladesh. It covers an area of 56,279 sq. km (Fig. 1).

PHYSIOGRAPHY

The process of aggradation is characteristic of the Brahmaputra valley. The valley slopes from Dadiyer in the N.E. to Dhubri in the west. The contour line of 150 mts. separates the valley from the surrounding area. The general level of the valley varies from 130 mt. in the east to 30 mt. in the west; thereby indicating a fall of 12 cm per Km. The valley is predominantly built up of alluvium of 1500 Km. of thickness upon a tronga formed during the Himalayan uplift. It is very well defined between boundary fault in the north and the Naga thrust in the south (see appendix I). The slope of the valley seems to be steep in the northern margin having an immediate fall from the Arunachal Himalayas. But in the south, the valley has a gentle fall from the southern hills.[1]

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1. R.L. Singh edt. A Regional Geography of India, Varanasi, 1971, pp. 306-7.

The upper Assam valley is substantially wide, averaging between 80 - 100 Km. However in the middle part it narrows down to 50 Km, because of the granite-gnessic projection of the Mikir Hills. It widens in the west and the plain of Kopili joins the main valley.

The great ramp valley, from Dhubri to its bend beyond Sadiya, extends for over 400 miles (644 Km), with a remarkably even breadth of about 60 miles, except where the Mikir and Rengma Hills narrow it slightly. Most of this great area is formed by the alluvial terraces of the Brahmaputra and its tributaries. On the northern flanks the ramparts of the Himalaya tower up abruptly. The southern margin is less precise. The alluvium gives way to the tertiary foothills of the Naga and Patkai ranges, with some outlying fragments of the older Shillong rocks along the south bank of the river between Gauhati and Dhubri. On the either side of the Mikir Hills the Kopili and Dhansiri Rivers form re-entrants of alluvium in a complicated area which may once have been occupied by the main Brahmaputra cutting across the Barail range to the Barak (Surma valley) valley.[2]

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2. R.L. Singh, op.cit., p.

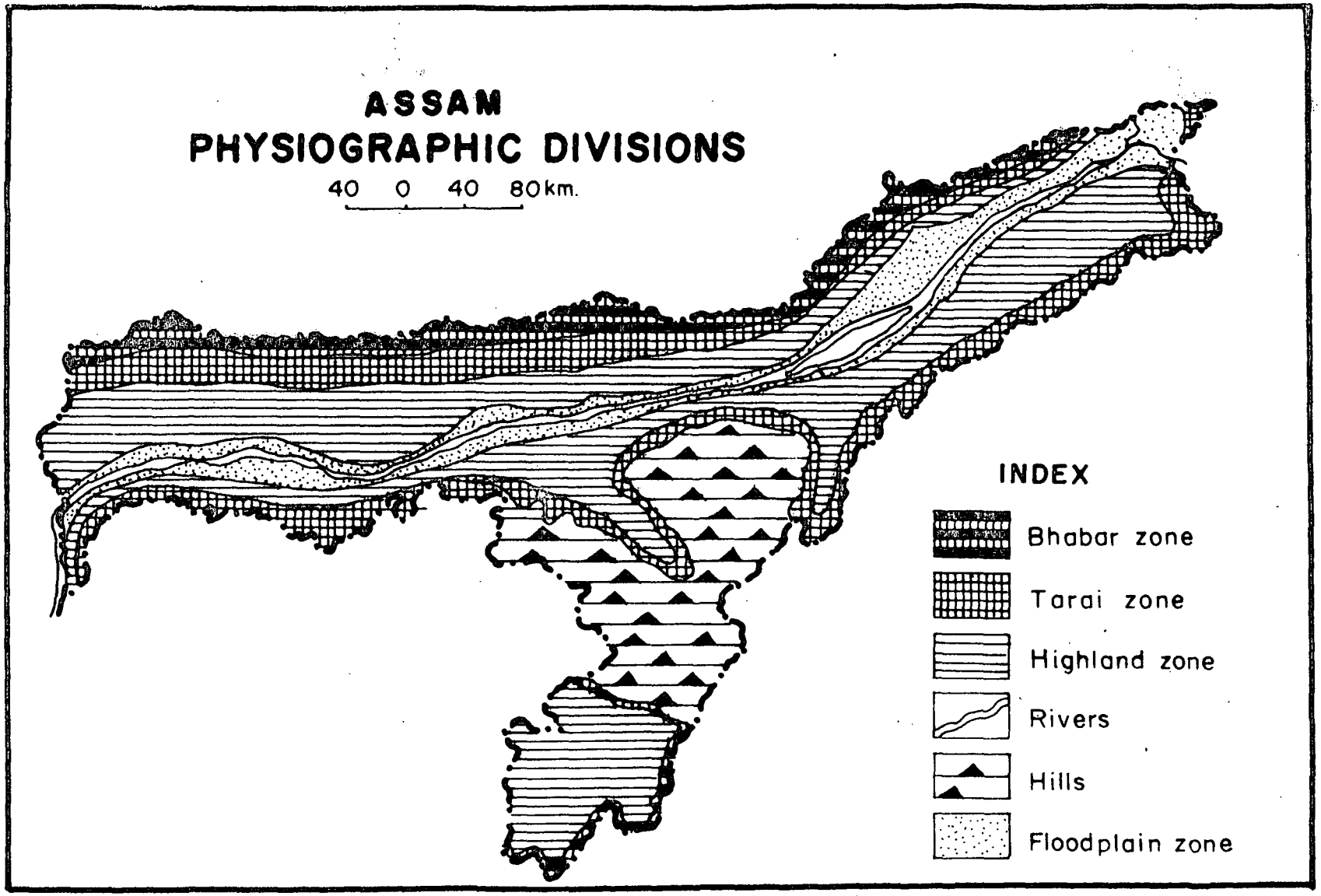
ASSAM
PHYSIOGRAPHIC DIVISIONS
40 0 40 80km.
INDEX
Bhabar zone
Tarai zone
Highland zone
Rivers
Hills
Floodplain zone

Fig. 2.

There is a spectacular difference between the physiography of northern and south bank of the river. In the north, innumerable tributaries run down from the Arunachal and Bhutan Himalaya. They debouch abruptly at the main valley and form a series of alluvial fans which join and obstruct the courses of the tributaries near the foothills. As a result, the tributaries branch out in different channels till they form permanent courses further down-stream, mostly in a southerly direction. But before finding their way into the Brahmaputra they run in a parallel courses to the main stream as they encounter its levels. Consequently, the tributaries have conspicuous meandering course leading to the formation of 'bils' and oxbow lakes and huge marshy tracts. It is noticed that the alluvial fans or cones are formed by the coarse alluvial debris in the northern fringe of the valley. They have given rise to tarai or semi-tarai condition where water trickles down resulting in wet soil and dense forest cover.

The southern part of the valley is less wide and the tributaries are very large in the south-east. An important physical characteristics of the Brahmaputra is that the river is considerably broadened by low gradient and has resulted in numerous river stands. (Map Geology - 1).

The present study, however, concerns itself with lower Brahmaputra valley comprising the districts of Nowgong, Darrang, Kamrup and Goalpara of the State of Assam. The physiographic profile of this area has varied characteristics and differentiates itself from those of the districts of Upper Assam. These characteristics can be summarized as follows.

The nature and structure of Geological formations have many indirect influences on agricultural development. Geological formations provide the basic materials and structures for the parent materials of the soil. Some aspects of Geology of Lower Brahmaputra Valley however, have an even more direct influence on agriculture activities, i.e.

a) Engineering Geology
b) Hydrology
c) Environmental Geology.[3]

Geologically, the districts of Darrang, Kamrup, Goalpara and Nowgong have Archean base, i.e., from oldest group of rocks to the youngest ones. The Archean rocks are in the form of metamorphic complex of gneisses and schists intruded by younger acidic and basic rocks in the northern part of the valley.

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3. Flawn, 1970.

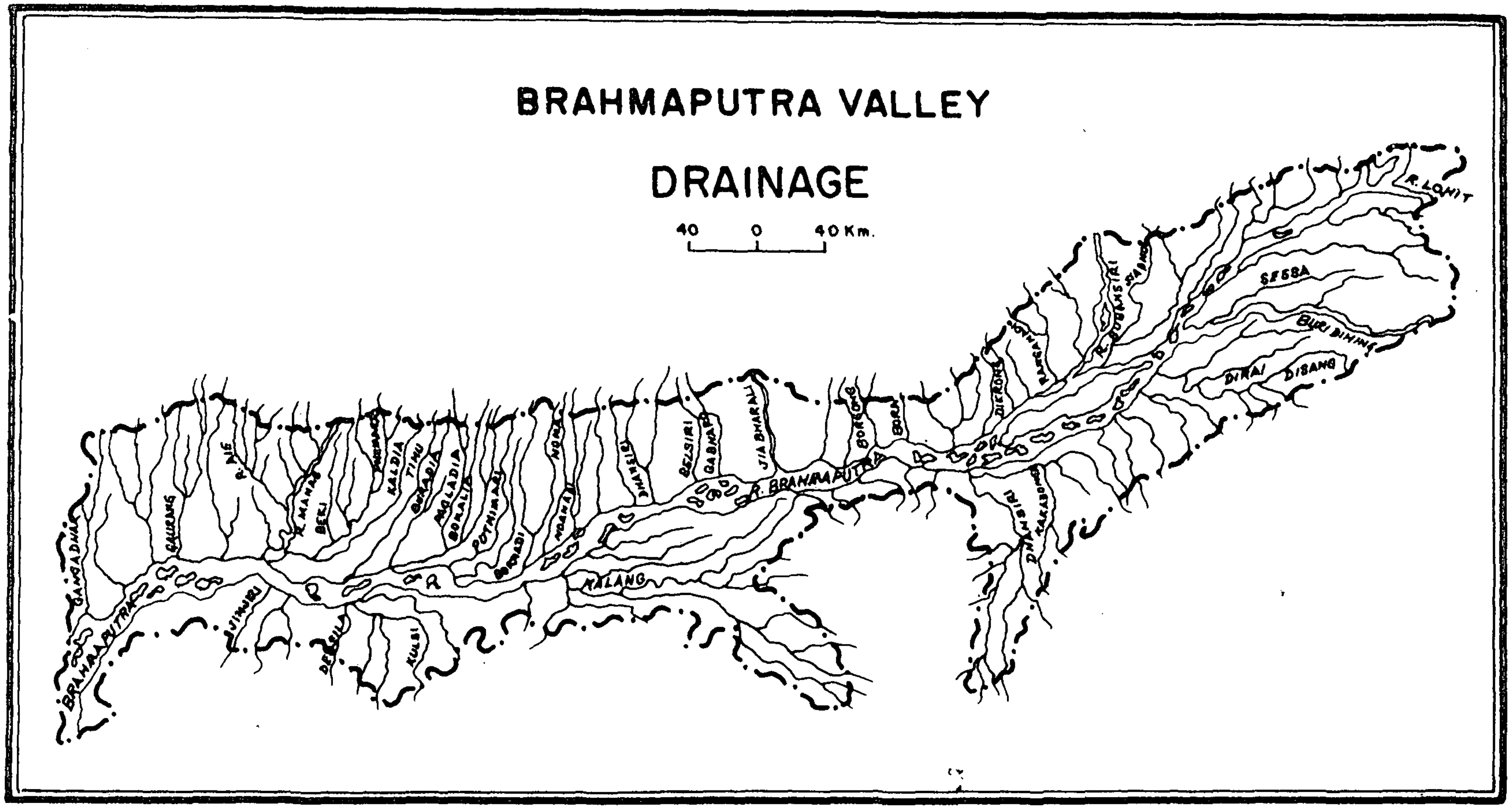
BRAHMAPUTRA VALLEY
DRAINAGE
40 0 40 Km.
R. LOHIT
SESSA
BURI DIHING
DIBANG
DISANG
DIKRAI
R. SUBANSIRI
RANGANADI
DIKRONG
R. BRAHMAPUTRA
BORGONG
JIA BHARALI
GABHARU
BELSIRI
DHANSIRI
RAKADONG
KALANG
NONOI
BARNADI
POTHIMARI
BORALIA
NALADIA
TIHU
KALDIA
R. MANAS
BEKI
R. AIE
GAURANG
GANGADHAR
BRAHMAPUTRA
JINJIRI
KULSI
R

Fig. 3.

Stratigraphically, the Archean group consists of bonded composite biotite silimanite gneisses and schists associated with feldspathic biotite, pyroxene, and aplites. Younger and coarse, the grained granite, gneisses intruded by massive perphytitic and coarse biotite granites, pegmatites and quartz veins, unclassified older and newer alluvium comprising of high level terraces, the red and black soils and recent alluvial deposits are found in the Dalgaon, Sialmari, Kalaigaon and part of Majbat blocks in the Darrang district. The new alluvial deposits get flooded in the rainy season and receive fertile layers of silt. The newer alluvial soil consists of inundated yellowish and brownish or reddish clay with sand, gravel and boulder deposits in the lower course of the Brahmaputra areas as in northern part of Majbat, Khairabari and Udalguri blocks of the Darrang district.

DRAINAGE:

The Brahmaputra and its hundreds of tributaries play a vital role in the drainage system of the region. The river Brahmaputra originates in Kailawn range in Tisei at an attitides of 5150 mts. In its upper course it is called Tsangpo. In Siang of Arunachal Pradesh it is known as Dihang or Siang. In Sadiya it is joined by Disang from the Poris and Lohit

from the east; from the point these Sikim join together to from the Brahmaputra. The river flows between the Dandy lands and has several divergent channels. The river carries a heavy load of silt and at times creates almost shaped banks that often forms a char land.

Most of the valley is frequently threatened by erosional activity of the river particularly during the flood season. Disrungang is situated on the Dandy banks and is susceptible to erosional activity in the flood season. Tezpur, Gauhati, Goalpara, and Dhubri are less prone to erosion as they are situated on the slopes of hard resistance rock. The southern bank of the river riften Dhubri is due to the projection of Garo Hills.

The major tributaries of the Brahmaputra include the Subansiri, Bharoli, Dhansiri, Barnodi, Pagladia and the Sankosh on the right bank and the Lohit, Dihang, Nao-Dihing, Burhi-Dihing, Disang, Dikhan, Jhanji, Kopili, Digaru, Kulsi, Singra, Jinjiram, Dudhnai and Krishnai are the most important rivers on the left bank.

Left Bank tributaries such as the Lohit, the Dihang, the Buri-Dihing, the Dhansiri and Kopili are seasonal monsoon streams and have a less meandering course. But Dhansiri is quite meandering. A few of these tributaries, however,

are navigable throughout the year. In the valley, during the rainy season floods and droughts are frequent, resulting in heavy damage to life and property.

This is because of the tremendous volume of water and heavy silt that raises the level of the river bed. Moreover, heavy rain water is supplemented by the melting of snow in the Himalayas. The river gets chocked and active erosion starts on the bank, thereby reducing the water-holding capacity. This sort of condition make the river swell, often resulting in innundation. Since the river valley lies in the seismic zone, earthquakes are frequent which enables the river to shift its course. Heavy discharge of water by the Brahmaputra thus affects the water profile. Hence floods have become common features in almost all the tributaries of Brahmaputra, thereby resulting in damage to crops, life and property.

CLIMATE:

The climate of the Brahmaputra valley is essentially monsoonic. The climate of the valley is characterised by a rhythmic change in the wind direction. Its climate is mainly governed by the following five factors:

1. The orography.
2. The alternating pressure cells of north west India and the Bay of Bengal.
3. The predominance of maritime tropical air mass (MT).
4. The local mountain and valley winds.
5. The periodic western disturbances.

The high and lofty mountains in the North create barriers in the path of the cold air mass blowing from the Tibetan Plateau to the valley. Moreover they provide conducive orography condition for high "relief rain" in the valley as they obstruct the warm moist south-west monsoon air mass. The east-ward moving upper air though called the western distrubance and the local phenomena such as mountain and valley winds, have considerable impact on the climate and weather of the valley.

The mountain and valley winds start moderating the temperature conditions so that heat waves in the valley are rarely experienced in summer. Fogs, thunderstorms and dust-raising winds also come under the local weather conditions. Winter mornings are very foggy in the valley and prolongs for a period of 60 to 70 days. At some places in the southern

part, fog persists from 90 to 100 days. The existence of fog is due to availability of moisture evaporated from the river beds and from marshy and swampy areas of the valley.

The dust-raising winds are frequent in the valley in the beginning of the pre-monsoon season i.e. in March when the high pressure of the Bay of Bengal intensifies and westerly distrubances move along the Arunachal Himalaya. This happens when a steep pressure gradient over the valley develops and consequently the winds gain speed, thereby lifting up the dust from the dry warm surfaces of the valley. These dust-raising winds subside when showers of rain occur during the passage of western depressions.

It is thus apparent that the climatic conditions in the Brahmaputra valley exhibit a major deviation, it is especially noticeable in the distribution of rainfall, which is very high and largely associated with storms in the pre-monsoon and monsoon period and in the prevalence of fog in the winter months. Evidently all these conditions along with the thermo-dynamic influence of orography have developed a climatic distinctiveness for the Assam Valley, different from the normal 'Cwg' or humid meso-thermal of the Ganga plain and as such, the climate of this region may be classified as "Cwb" or humid meso-thermal Brahmaputra valley type.

SEASONS

On the basis of temperature variation, rainfall and winds the seasons are well defined:

1. Winter season-December to February.
2. Summer or Monsoon - March to May.
3. Monsoon - June to September.
4. Retreating Monsoon - October and November.

The winter season starts from December and ends in February. The main characteristic phenomena of this season are cool weather, frequent morning fog with an average monthly temperature above 12.8°C. Mean rainfall amounts to an average of 11.4 cm. January is the coldest month.

The summer season begins from March and lasts till May. The season is characterised by a rise in temperature. The total average rainfall during the season is recorded as 51.87 cm with an average temperature of 23°C; and average during range of temperature is about 61°C.

Monsoon season in the valley starts from June and ends in September. The low pressure trough created in the valley shows the monsoon currents. The seasonal characteristics include high humidity; weak, surface winds; cloudy sky and very sultry weather due to high humidity. The mean temperature

during the season increases to 27.17°C with a diurnal range of over 6°C. August seems to be the hotest month of the year and falls in this season. The total rainfall is very high and number of rainy days averages to about 18-20 day in June, July and August and about 14 days in September.

The season of retreating monsoon covers the period of October and November. The season is characterised by a sudden retreat of monsoon when the monsoon weakens towards the end of September with a fall in temperature and appearance of morning mist and fog. The diurnal range of temperature starts increasing and varies from 2'8°C to 5'6°C. Winds in this season is about 15.2 cm with rainy days varying between 7 to 9 in October and 1 to 3 days in November.

Summing up the valley, it could be concluded that though there prevails a homogeneous climate in the valley, nevertheless there is considerable heterogeneity in climatic conditions within and between different parts of the valley in terms of variations in rainfall, range of temperature, and other phenomena like fog and mist. There is a spectacular difference between the eastern and western part of the valley so far as rainfall and temperature are concerned. The eastern part gets very high amount of rainfall and has a low range of temperature whereas the western part experiences

less rainfall and a higher range of temperature. At the same time the middle portion of the valley seems to be having a rain-shadow portion and many climatic phenomena different from east and west.

Since the present study is confined to the lower Brahmaputra valley, an analysis of the spatial distribution of temperature, rainfall and relative humidity has been done for the area in question for the years of 1977-78. These three variables temperature, rainfall and relative humidity — have a close bearing on the productivity of agriculture and therefore, the climatic study has been related to the productivity of agriculture.

There are also a few more studies on the significance of some important weather elements as far as the growth, production and productivity of rice are concerned. It is because climatic factors (such as temperature, sunlight and rainfall) are the major determinants of the growth and yield of rice. Such factors directly affect the physiological process involved in grain production, e.g. vegetable growth, development of spikelets and grain-filling. Indirectly the grain-yield is affected by them through incidence of plant diseases and insects.

Rainfall effectiveness

1) Total and mean monthly rainfall:- Much of the arable land available for agriculture lies on either side of the river Brahmaputra where, though rainfall does not vary so much round the year, but gets concentrated only during the Kharif season with the arrival of the monsoon, thereby creating water logged conditions which occasionally results in serious damage to the crop. Therefore it is unpredictable to generalise the pattern of annual and monthly rainfall. The rainfall effectivenss is studied in terms of patterns of the intensity of rainfall on a monthly or weekly basis. It is on this basis that the data available from the meterological stations situated in Tezpur, Gauhati, Nowgaan, and Dhubri are analysed.

Sixty to seventy percent of the average annual rainfall is recorded during the month of June to September, Nowgong being an exception where above 90% of the total annual rainfall is recorded during June to September, though the total monsoon rainfall is relatively lower than all other stations in the valley. In terms of percentage, Dhubri has the second highest (68'46 P.C.), rainfall during monsoon season.

Intensity

From the agricultural point of view it is the timely distribution of rainfall, which is more important and not the seasonal average. In fact, heavy rainfall for one week followed by long intervals of dry weather may affect the rice adversely.

The precipitation and the number of rainy days may be sufficient to meet the requirement of different crop production in general and HYV rice in particular, but successful harvest is noticed only when the rainfall is timely and well distributed over the rice growing period. So the concentration of rainfall over fewer months decreases its usefulness. In 1977 it so happened that the transplantation of HYV rice was carried on without rain because of the late arrival of monsoon in many blocks of the lower Brahmaputra valley.

So far as the intensity of rainfall is concerned in the monsoon period, Dhubri has the highest (1932-60) whereas Tezpur has the lowest.

Rain Factor

Another meteorological qualification has been fixed with the help of the rain factor formula which is an index to express the relationship between precipitation and temperature to have an idea about the climatic aridity of the

valley. On the other hand, it also helps in delimiting the climatic region. Since the number of stations are few, a general discussion over this index could be given. The index has been calculated as:

$$\text{Rain factor} = \frac{\text{Annual Precipitation in mm}}{\text{Mean Annual temperature m}^{o}\text{C}}$$

The following Table No. 1 presents the stationwise rain factor indices.

It would be, worthwhile if the intensity of rainfall is studied for the whole valley which explains the intension per 24 hours period. The intensity of rainfall is calculated with the help of following formula:

$$I = \frac{\text{Total monthly rainfall}}{\text{No. of days of rain}}$$

Table 1: Stationwise monthly intensity of rainfall.

Station	Years					
	1973	1974	1975	1976	1977	Average
Dhubri	90.5	80.22	59.67	90.49	135.48	91.27
Gauhati	65.52	82.61	62.19	67.33	106.06	76.74
Rangia	24.20	44.44	71.00	71.80	51.39	52.56
Tangla	58.88	90.02	61.17	82.0	91.15	76.64
Majbat	19.13	47.26	78.93	80.03	108.08	66.74

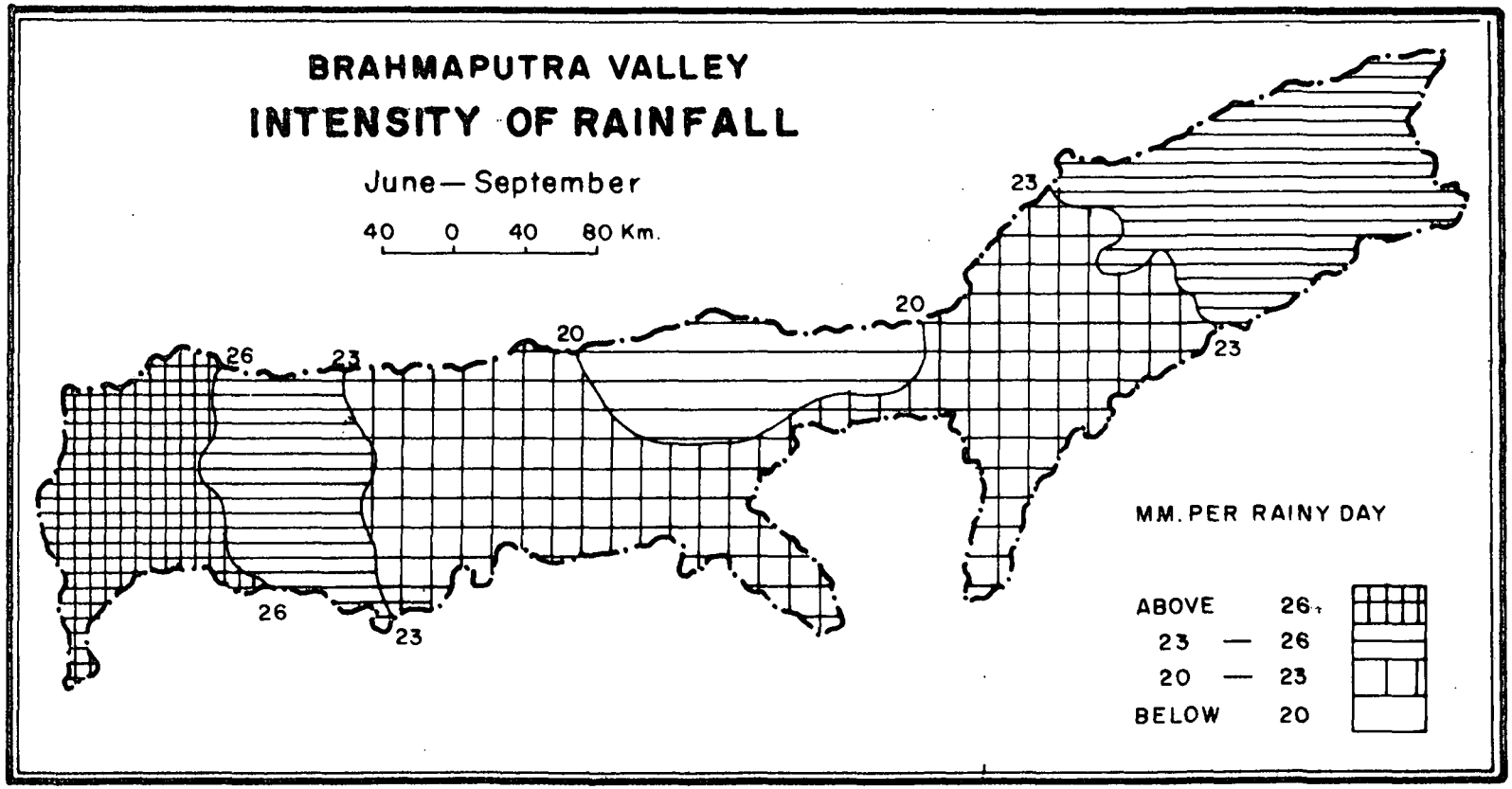
BRAHMAPUTRA VALLEY
INTENSITY OF RAINFALL
June — September
40 0 40 80 Km.
26
23
20
20
23
23
26
23
MM. PER RAINY DAY
ABOVE 26
23 — 26
20 — 23
BELOW 20

Fig. 4.

Table 1 (Contd.)

Station	Years					
	1973	1974	1975	1976	1977	Average
Tezpur	5.93	77.23	-	51.41	87.21	52.95
Gohpur	-	-	-	103.75	66.46	85.11
Chaparmukh	-	74.63	115.62	127.07	153.36	117.57
Lumding	-	40.06	41.85	56.87	62.58	50.34
Dibrugarh	97.77	124.7	105.08	82.94	140.91	110.68
Digboi	-	33.01	-	43.07	63.19	46.42
N. Lakhimpur	100.87	81.35	129.54	110.63	141.65	112.80
Silchar	114.98	98.14	69.88	151.66	133.71	117.66
Haflong	86.95	23.04	76.69	70.00	60.01	65.54

As evident from the above table the years average rainfall from 1973-77, varies between 46.42 to as high as 117.57 for Digboi and Chaparmukh respectively. The second and the third highest indices are found out for North Lakhimpur and Dibrugarh. Such slow index which shows high aridity in Digboi and its surrounding region may be attributed to higher temperature range and low rainfall. Moreover Lumding is also having comparatively lower index i.e. 50.34 and is situated on the south east of Nowgong and north of Mikir Hills which is otherwise interpreted as the rain shadow area having rainfall comparatively lower than all other stations in both lower and upper Brahmaputra valley. Hence crop risk in this area is considerable. In order to raise successful crops, immigration is, in fact, essential in this part of the valley.

In the Lower Brahmaputra valley the indices appear to be relatively lower than the stations in Upper Assam. In this area although rainfall (total, monsoonal, and mean monthly) are not very less, but the daily temperature range is very high, thereby causing considerable evaporation from water bodies. Though the mean annual rainfall of Dhubri, being situated in the western most tip of the valley, is more or less same as of Dibrugarh, there is a substantial difference between the rain factor index i.e. 91.27 for Dhubri and 110.68 for Dibrugarh. It is all because of the temperature variation between the upper and the lower valley. Rangia, Tezpur and Kamrup and Darrang Districts, respectively experienced acute aridity, the indices nearing 50.0. In the lower valley comparing the districts of Goalpara, Kamrup, Nowgong and Darrang, the index ranges between 50.34 to 91.27 for Lumding and Dhubri respectively. Hence, its district as one proceeds towards the western part of the valley the index goes on increasing, indicating less and less aridity in the region. Gauhati, being situated midway, experiences a moderate index which can be interpreted as not very arid and very wet climate.

In the year 1977, for which the highly, weather sensitive high yielding varieties of rice have been studied, the Lower Brahmaputra valley is observed and the rain factor

index has a significance variation between 51.39 to 135.48 for the stations Rangia and Dhubri respectively, since higher is the index, lower is the aridity and vice-versa, aridity decreases from east to west.

Switching over to the lower part of the valley, the indices appear to be relatively lower than the stations in Upper Assam. In this area although rainfall (total, monsoonal and mean monthly) is not very low, the daily temperature range is very high, thereby causing considerable evaporation from water bodies. Though the mean annual rainfall of Dhubri, being situated in the western most tip of the valley, is more or less same as that of Dibrugarh, there is substantial difference between the rain factor index i.e. 91.27 for Dhubri and 110.68 for Dibrugarh. It is all because of the temperature variation between the upper and lower part of the valley. Rangia and Tezpur in Kamrup and Darrang districts respectively, experience acute aridity indices nearing 50.0. In the lower part of the valley comprising the Districts of Goalpara, Kamrup, Nowgong and Darrang, the index ranges between 50.34 to 91.27 for Lumding and Dhubri respectively. Hence it is distinct that as one proceeds towards the western part of the valley the index goes on increasing, indicating less and less aridity in the region. Gauhati, being situated midway experiences a moderate index which can be interpreted as not very arid and very wet climate.

Humidity

Apart from temperature and amount of rainfall, the relative humidity also has a close bearing on the output of rice. The valley experiences annual relative air humidity exceeding 70 p.c. in each of the rainfall recording stations excepting Nowgong, whose mean annual relative humidity comes out at 55 p.c. only. The data relates to 30 years average for each month from 1931 to 1960. In the upper part of the valley, Dibrugarh and Sibsagar have more than 80 p.c. relative humidity in air. However, in the lower Brahmaputra valley the same has a range between 72 to 78 p.c. So far as the relative humidity is concerned there appears not much variation between lower and upper Brahmaputra valley. But the slightest variation in the lower valley is due to high temperature range in its air.

Coming to the relative humidity in the monsoon season, it is observed that more than 80 p.c. humidity is experienced in every part of the valley excepting Nowgong where even in June the air humidity is 49 p.c. The highest relative humidity is recorded in August being 81 p.c. while in June and September it is about .75 p.c. Dhubri being situated in the lowest tip of the valley has the highest relative humidity in its surrounding air. On the contrary, it is the humid

part of the valley where percentage of relative humidity exceeds 85 p.c. and in June average air humidity is 87 p.c.

Dibrugarh has a very uniform percentage of air relative humidity in wet monsoon months. An average 85 p.c. is observed in each month starting from June to September. Winter months in the valley also appear to be humid, the air humidity ranging between 60 to 80 p.c. But Nowgong and its surrounding air seems to be relatively dry, the lowest humidity being ,27 p.c. in April. Even February and March show 49 and 34 p.c. humidity in the air respectively.

It has therefore been observed in most places that rice gives satisfactory yield in the areas having less humid atmosphere. Hence higher relative humidity affects the crop yield adverse. Murata and Tagari[4] arrived at the conclusion that the daily air relative humidity is negatively correlated with the rice yields. It could be because the rainfall and the cloudy weather decrease the amount of solar radiation thereby increasing the relative humidity. So that the grain yield gets reduced specially when there is rainfall during

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4. Murata and Togari (1972). An Analysis of the affect of climatic factors upon the productivity of rice at different localities in Japan; proceedings of crop science societies, Japan, 14(4), pp. 372-387.

Table 2: Relative Humidity in Percentage

Stations	Months												Annual
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
Dibrugarh	83	78	71	74	81	85	85	85	85	82	80	84	81
Sibsagar	85	80	74	76	80	82	82	83	86	86	86	86	82
Tezpur	78	70	62	66	89	83	84	84	84	81	79	81	78
Gauhati	78	68	61	65	77	82	82	82	83	81	81	81	76
Dhubri	75	66	67	65	81	87	86	86	86	80	78	78	77
Nowgong	61	49	34	27	28	49	78	81	75	59	55	61	55

the reproductive stage. In view of the above analysis it is observed that either part of the valley seems to be having very humid surroundings which sometimes stand erroneous for rice crop. However, Nowgong and its immediate surrounding have very low relative humidity which is rather conducive for crop growth.

Temperature

As evident from the 30 years normals of the above mentioned stations, the mean annual temperature varies between as low as 23.2 to as high as 25.35 for Dibrugarh and Nowgong districts respectively. There is a spectacular difference in the range of temperature during the Kharif and Rabi seasons of the year. Stations falling in the lower part of the valley show a higher range of temperature than the upper, which is normally more than 24°C. Hence because of high range of temperature, during the ripenming stage of the sensitive high yielding varieties of rice, crops may be more prone to failure and low yield.

Matrushima and Manaka[5], hence, are of the opinion that 22°C is the optimum temperature for ripening stage of rice and temperature higher than 25°C adversely affects ripening

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5. S. Matrushima and T. Manaka (1957). An Analysis of developmental factors determining yield and yield production in low land rice, Proceedings of Crops Science Society, Japan, 25, pp. 205-206.

or rice grains. There are on the contrary critical high and low temperature normally below 20°C and above 30°C in different phases of rice growth.[6] It has also been found that temperature and yield rate are positively correlated. De Datta and Zarati failed to find out the negative influence of temperature on the yield of Indian varieties sown every month during the year at IRRI. So the higher the temperature, higher is the solar radiation which is associated with higher yield. The temperature is positively or negatively related with the yield of HYV of rice in the lower Brahmaputra valley.

The efficiency index for temperature recording stations in the Brahmaputra valley has been calculated with the help of the following formula:

$$I = \frac{T - 32}{4}$$

where T = mean monthly temperature in °F

divided by C.W. Thornthwaite.

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6. S.K. De Datta and P.M. Zarati (1979). Biometeorological problems in developing countries Environmental conditions affecting the growth characteristics, nitrogen response and grain yield of tropical rice. Bio-Meteorology, 4, pp. 71-89.

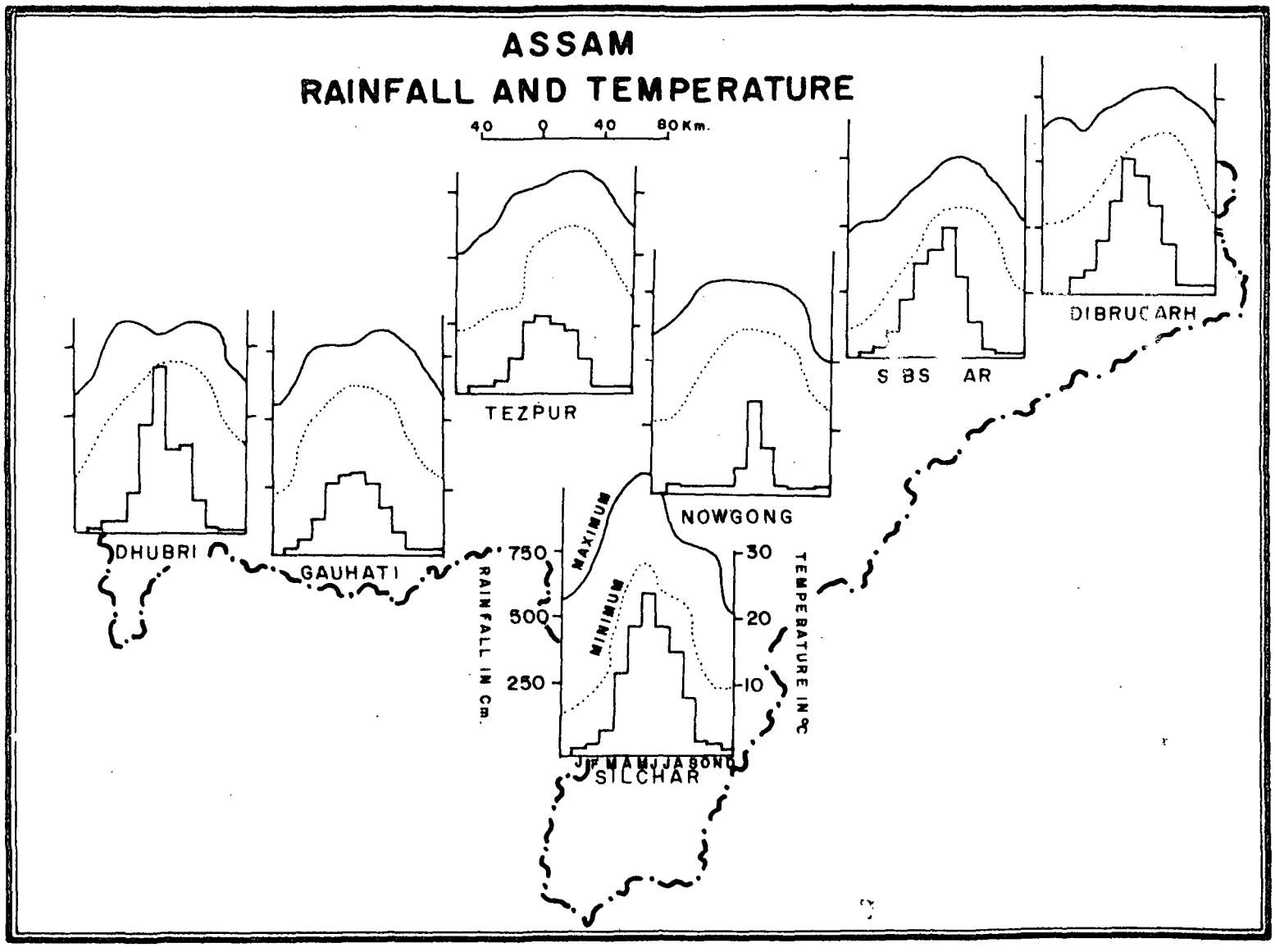
ASSAM
RAINFALL AND TEMPERATURE
40 0 40 80Km.
DHUBRI
GAUHATI
TEZPUR
NOWGONG
S BS AR
DIBRUGARH
SILCHAR
MAXIMUM
MINIMUM
750
500
250
RAINFALL IN Cm.
30
20
10
TEMPERATURE IN °C
J F M A M J J A S O N D

Fig. 5.

Table 3: The range of variation of temperature for each station.

Station	Range of variation	Month
Dibrugarh	14.29 - 18.91	December - August
Sibsagar	13.75 - 19.40	January - July
Tezpur	14.29 - 19.31	January - July
Gauhati	14.27 - 19.45	January - August
Nowgong	13.60 - 21.94	January - May
Silchar	14.77 - 19.20	January - July

The table shows that January is the coldest month in most of the valley when the efficiency of temperature has a variation between 13.6 to 14.29°F for Nowgong and Tezpur respectively. But December seems to be the coldest in Dibrugarh having less temperature efficiency.

July and August are the hottest months, except Nowgong where May records the most efficient air temperature.

Since most of the agricultural crops need efficient air temperature and solar radiation for their photosynthesis process within a certain range, temperature efficiency determines the productivity to a greater extent. So the favourable and unfavourable climatic regions are sorted out on the basis of precipitation and temperature efficiency indices which on

the other hand, more relate to humid character rather than the thermal. The temperature efficiency of the region under study reveals that temperature is not a constraint in the cultivation of the HYV of rice in each of the twelve months, the temperature is adequate for the determination, growth and development of the crop. Rainfall and availability of irrigation are thus the major factors which hamper its growth especially during the winter season.

Precipitation Efficiency

This is a quantitative index showing the efficiency of precipitation effectivenss in each month for the different meteorological stations of the area. The index has been devised by C.N. Thornthwaite for climatic classification based on humidity rather than on thermal character. Thermal efficiency 'I' is applied to subdivide these. Hence,

$$I = 11.5 \left(\frac{P}{T - 10}\right)^{10/9}$$

P = Monthly Mean precipitation in inches

T = Monthly Mean temperature

The indices help in distinguishing the major climatic regions based on humidity rather than on thermal character. Thermal efficiency 'I' index could be used to subdivide these macro-regions. In case of Brahmaputra valley, the stations

selected are Bibrugarh, Sibsagar, Tezpur, Gauhati, Dhubri and Nowgong covering almost the entire valley from east to west.

After a glance at the monthly indices (Table), it can be observed that the efficiency index for drier months such as November, December, January, February and March is more than for the wet monsoon and premonsoon months. The table presents the twelve-month indices for each station.

The table shows that the indices show an increasing trend from August-September to December - January and then show a decreasing trend from February to June, July and then again it is on the increasing. Hence it could be inferred that, higher is the index lower is the precipitation efficiency for that month and the vice-versa.

In order to have a comparative study of the efficiency indices, the mean annual efficiency index could be taken into consideration starting, from the upper Brahmaputra valley to the lower. It is observed that the average monthly efficiency index is the highest for Dibrugarh and lowest for Nowgong. So from the general point of view, the stations recording higher rainfall, have higher indices than that of the stations recording lower rainfall.

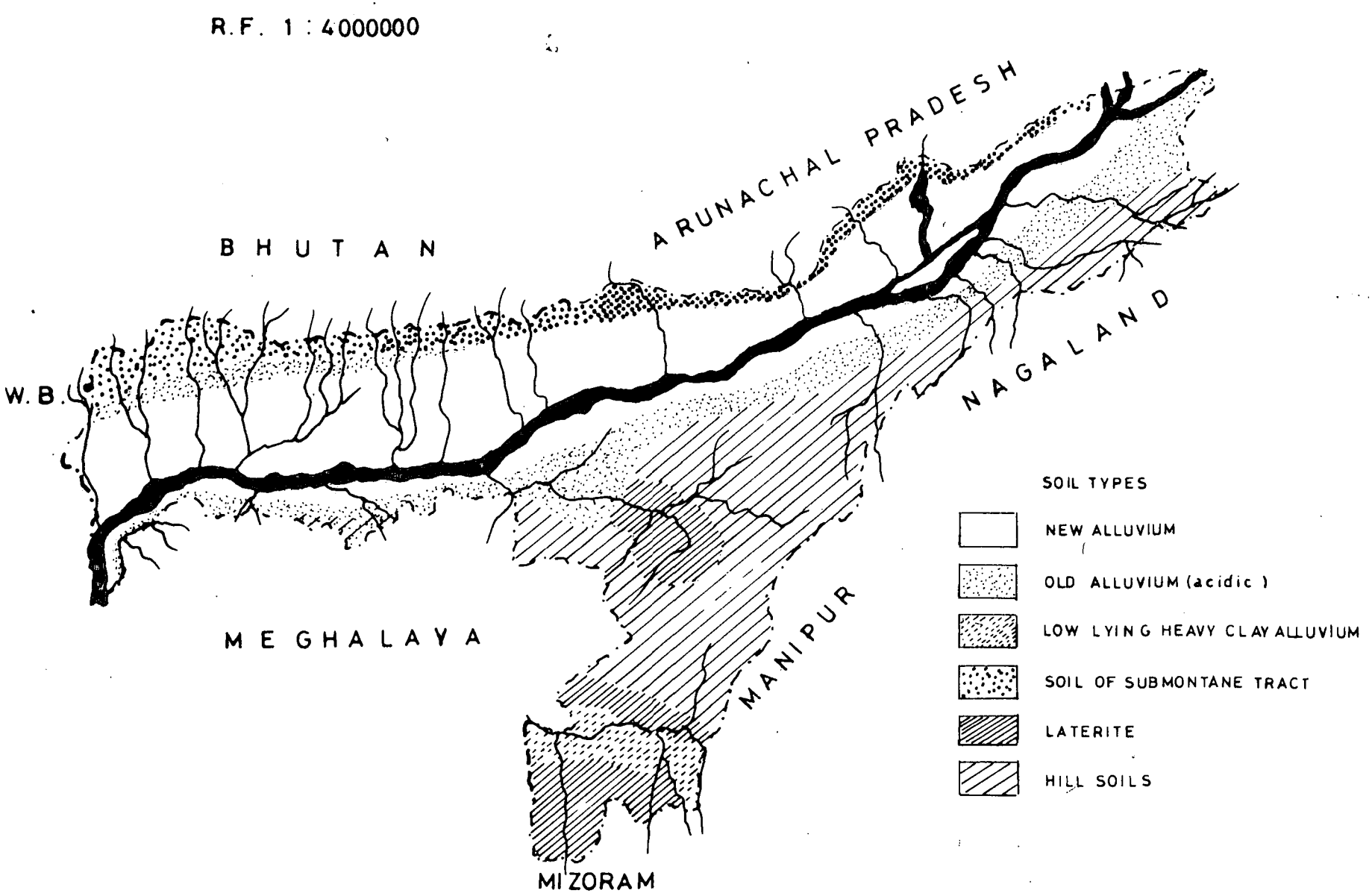

FIG. **6.** SOIL ZONES

However the monthly change of the index shows that the months in the monsoon period when the intensity of rainfall is high, have comparatively lower indices than the months in the winter season for a particular station.

Therefore Nowgong being midway between the upper and lower portion of the valley could be taken as the driest part having higher variability of rainfall, low intensity and low precipitation efficiency. From this point again every climatic index shows positive trend towards the lowest part of the valley. Gauhati and Tezpur being situated on opposite banks of the river have also relatively lower precipitation efficiency and the highest efficiency is observed in Dhubri lying at the western most tip of the valley.

Taking each and every point of the aforesaid, the agriculture of the lower Brahmaputra valley is not very unfavourable from the rainfall point to view. The rainfall is fairly reliable especially in the month of July and September, in which the variability of rainfall is higher at all the rainfall recording stations. In fact it is the excessive rainfall which damages the crop in the rainy season.

Soil

In addition to climatic factors, soil parameters play a vital role in the success and failure of rice productivity.

Ryn, et al. (1971)[7], arrived at the conclusion that alluvial plains of Korea with moderate drainage responded better yield than poorly drained soil. In local valley areas it was observed that the productivity was quite higher in imperfectly drained soils than that of the moderate. Even within the same type of soil series productivity come out to be different because of differences in chemical properties of surface soil. As far as the soil-water relationship is concerned it has been observed that the close association between soil and water determines the potentiality of the area for better production. In semi agatic conditions, rice cultivation needs a heavy soil the absence of which will lead to percolation of irrigation water at an easier and faster rate. This is because rice plants generally demand more water which depends on the conditions of the soil.

Therefore in the areas where paddy is grown dominantly are found to be enriched with more than 70 p.c. of the finer particles and clay plus silt in their soils.

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7. Ryn, et al. (1971), Studies on the relationship between productivity of paddy soils and their chemical and physical properties in Korea, Rep. Office Rural Development (Korea) 14 (Plan Environment) pp. 1-16. + PH Grist (1955), Rice, London, Longmans.

Ramial (1954) is of the opinion that there are two important reasons for the wide disparity of rice yields. First, the low water supply in certain areas and second, because of the variation in soil conditions.

The valley of the Brahmaputra is found by the alluvial deposits in which alluvial soils have been deposited by the Brahmaputra and its fifty other significant tributaries. The soils of Assam can be classified into the following major categories among which the first three cover the entire valley of Brahmaputra and the last one is found only in the hill districts.

i) New alluvial soil.
ii) Old alluvial soil.
iii) Lateritic soil.
iv) Red soil.

The new alluvial soils are confined in the low lying tracts of the flood plains of the river in which new silts are deposited almost every year. These soils are sandy loams or silt loams having less acidic contents and thus suitable for the cultivation of rice, jute, pulses, mustard, potato and vegetable. These soils are enriched with available phosphate potash and exchange-able calcium.[8]

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8. R.L. Singh, (1971), Op. cit., p. 313.

The old alluvial soils are found at relatively elevated tracts which are free from floods. These soils are more acidic in nature. The pH value bring less than that of the greater parts of the valley are covered by old alluvial souls. These soils lack in available phosphate with low or medium potash content and texturally vary from sandy to change loam with high to low content of nitrogen. These soils are favourable for rice, sugarcane fruits and vegetables but not conducive for the cultivation of pulses or mustard.

Laterite soils are found in limited areas in the valley, These are considerably leached, poorly contained with plant nutrients, thus agriculturally less useful. An important feature of the soil types in the valley is covering the district of Goalpara, Kamrup and parts of Darrang constitute of coarse alluvium formed by the debris which have been deposited by the streams in the Tarais tracts. On the other hand, red loam and extensive laterite soils are exclusively found in the hill districts. Soils of Brahmaputra valley in general have higher ingredients of nitrogen, phosphorous and potassium content.[9]

Soil is one of the major agro-climatic factors for the growth and yield of any food or non-food crop in general and for high yielding varieties of rice in particular, is a modern trend in agricultural change.

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9. R.L. Singh, 1971, Op. cit., pp. 313-314.

CHAPTER - III

CHAPTER - III

POPULATION GROWTH AND CHARACTERISTICS: IMMIGRATION INTO THE BRAHMAPUTRA VALLEY DURING THE LAST 50 YEARS

The Brahmaputra valley is a narrow elongated valley with an area of 21,726 sq. miles (56,270 sq. km.). It is the home of 19,902,826 lakhs people (1981, Office of the Registrar General of India), with a density of 253 persons per sq. km. Since ancient times, the valley has experienced migrants from different parts of India and beyond. The Aryans, the Mongoloids and the Muslims have migrated to the valley at different times of history. Since the latter part of the nineteenth century immigration to the valley has become distinct and large number of immigrants from Bangladesh and Nepal as well as from different States of India began to move in.

The apparently low density of population in the Assam valley received wide publicity for the sole reason that Mr. Jinnah and his Muslim League demanded the inclusion of Assam valley in the East Pakistan (now Bangladesh) though it was known to him that it was never a Muslim majority province.[1]

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1. M.C. Bhuyan. Immigrants to Assam Valley: A Geographical Analysis. Journal of the N.E. India Geographical Society Vol. I, K-19.

The population of Brahmaputra valley increased from 32.90 lakhsin 1901 to 146.25 lakhs in 1971, representing a fantastic growth of 344% over seventy years as against an increase of 132% for India as a whole during the same period.[2]

Table 1: Population trend in Assam Valley from 1901-1981 (in thousands)

1901	1911	1921	1931	1941	1951	1961	1971	1981
3290	3849	4637	5561	6694	8029	10837	14625	19903

Source: Statistical Handbook, State Govt. Assam Series I, 1981.

Table 2: Percentage variation of population from 1901-1981 in the valley.

	Total	Rural	Urban
1901 to 1911	+19.99	+ 16.90	+ 20.78
1911 to 1921	+ 20.47	+ 20.07	+ 36.56
1921 to 1931	+ 19.93	+ 19.71	+ 27.56
1931 to 1941	+ 20.37	+ 20.13	+ 25.93
1941 to 1951	+ 19.87	+ 18.39	+ 65.87
1951 to 1961	+ 35.06	+ 30.94	+126.67
1961 to 1971	+ 34.95	+ 3.63	+ 64.83
1971 to 1981	+ 36.09	-	-
1901 to 1981	+505.01	-	-

Source: Statistics of N.E. Region, Government of India N.E.C. 1982.

2. Pankaj Thakur (ed.) India's North East - A Multifaceted View, Prakash Pub. House, Tinsukia, 1982.

The above table reveals that the percentage increase of population (126.67) is the highest in the decade 1941-1951 (65.87%) and 1961-1971 (64.83%). From the above table it is confirmed that during those decades, the flow of immigration into the valley was obviously high.

Since the recorded population of the Brahmaputra Valley was 146.25 lakhs (1981), the population may be attributed to migrants and their descendents during the first seven decades of the current century. During 1951-1971; according to this method, the valley's migrant population stands at 24.43 lakh persons.

Public opinion on the immigration problem of the valley was generally confined to its socio-cultural and political aspects. But for a fuller understanding of the problem, appreciation is necessary also for the socio-economic impact of immigration on the economy of the state, particularly its rural economy. By 1971 Census, 91.9% of the valley was rural and 76.7% of the working force was engaged in agriculture. The corresponding national averages are 81.13% and 72.05% respectively.[3]

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3. P. Sarma. Immigration and its impact in the rural Economy of Assam. A socio-economical appraisal - India's North East, 1982.

While immigration into the fertile and resourceful Brahmaputra valley is a long historical process, and it is an unbroken continuity. The 1931 Census described the large-scale influx of farm settlers from East Bengal (Bangladesh) as "the most important event in the state of Assam in the first quarter of the present century."

Distribution of Population 1971

The distribution of population is uneven in Assam. The population is heavily concentrated in the plains districts of the Brahmaputra Valley. The concentration is again heaviest in the areas physically nearer to the rivers.

Table 3: Population during 1971

State/ Districts	Population		No.of Cities/ Towns	Class					
	Rural	Urban		I	II	III	IV	V	VI
Assam	1363056	1326981	74	1	4	11	26	24	8
Goalpara	2052809	172294	12	-	-	1	7	4	-
Kamrup	2519028	335155	17	1	-	2	4	7	3
Darrang	1632445	103743	7	-	-	1	4	2	-
Nowgong	1561558	119337	4	-	1	2	1	-	-
Sibsagar	1682665	154724	9	-	-	2	2	2	3
Lakhimpur	1869829	252880	13	-	2	1	5	4	1

Density of Population 1971

Twenty six police stations fall in the highest range of 280 persons and above per sq. km. The district of Nowgong leads, followed by seven in Kamrup, three each in Sibsagar and Goalpara and one in Lakhimpur.

As many as 55 police stations fall in the range of 150 to 279 persons. This range includes eight polic stations each from Goalpara, Kamrup and Sibsagar districts, nine each from Darrang and Lakhimpur, seven from Nowgong and six from Cachar.

The lowest range of 149 and below covers 27 police stations. Four in Lakhimpur, three in Sibsagar, two each in Goalpara and Darrang, one each in Kamrup and Nowgong districts fall in this range.

Table 4: Average density of population 1971

Districts	Total population	Total area in Sq. Km.	Density
Goalpara	2225103	10359	215
Kamrup	2854183	9863	289
Darrang	1736188	8775	198
Nowgong	1680895	5561	302
Sibsagar	1837389	8989	204
Lakhimpur	2122719	12792	166

Change in Population 1961-71

There are 107 police stations which show growth in population, and one shows decrease in growth rate. Sibsagar, Lakhimpur and Darrang show growth of 19.99%. 47 police stations fall in the range of 20.00-34.79% in the districts of Nowgong, Kamrup, Sibsagar and Darrang and Goalpara. There are 25 police stations falling in the range of 35.00 - 49.99% in the districts of Goalpara, Kamrup, Nowgong and Darrang. The next higher range 50.00-64.99% includes only ten police stations of Goalpara, Kamrup, Darrang and Nowgong and Goalpara.

Table 5: Percentage change (growth)

Districts	Population		Percentage variation during 1961-71
	1961	1971	
Goalpara	11103392	1495792	+ 44.12
Kamrup	1543892	2225103	+ 38.28
Darrang	2062572	2854183	+ 34.62
Nowgong	1289670	1736188	+ 38.83
Sibsagar	1508390	1837389	+ 21.81
Lakhimpur	1563842	1837389	+ 35.74

Growth of Population 1961-71

During the last decade (1961-71) there has been an absolute increase of about 3.9 million population in the State. This increase of 34.71 percent is incidentally one of the highest in the country. The growth is not uniform among the districts. But, it is evident that all the districts show a higher rate of growth during the decade.

Among the districts showing the highest decennial growth in the state are Goalpara (44.12) and Sibsagar (21.81) having the lowest growth rate during the decade.

The contiguous districts of Kamrup (38.38), Darrang (34.62), Nowgong (38.83) and Lakhimpur come under the range of 25.00-39.99 percent.

The chronicles and records show that in 1826 when the British Rule was established in Assam, the population of the Valley was fairly small. In 1835 the entire population was estimated at 799,519 being distributed as shown below.

Table 6: Population of Assam Valley, 1835

District	Population
Native state of Upper Assam (Sibsagar and Lakhimpur)	220,000
Nowgong	90,519
Darrang	89,519
Kamrup	300,000
Goalpara	100,000
Total A. Valley	799,519

Source: Gait, E. History of Assam.

The above population table was mainly worked out from the official returns prepared in connection with the assessment of land revenue and as such they are not quite reliable and the actual state of population prior to 1872 (The first census year) was not accurately known.

The population of the valley according to the census of 1901 was only 2618,566, which in subsequent years grew considerably.

Table 7: Population of Assam Valley

Census Year	Population
1901	2,618,566
1911	2,107,755
1921	3,856,507
1931	4,723,833
1941	5,666,248
1951	6,747,551
1961	9,179,125

Source: Census of India, 1961 Vol. III, p. 1-A.

The above table shows that during the last 60 years (1901-1961) the population of Assam Valley has recorded a net addition of 6,560,561 persons or a percentage of 250 as against the country's percentage of

This abnormal growth of population in the valley is mainly due to large-scale immigration since the establishment of British administration.

According to census figures, 1961, the total number of immigrants in Assam Valley is 1,099,902 of which, 660,927 are foreign born persons, and 438,775 are Indian nationals. The district-wise distribution of immigrants (both foreign and inter-state) is given below.

Table 8: Distribution of immigrants in Assam Valley (1961)

District	Immigrants from other countries	Immigrants from other states of India	Total immigrants
Goalpara	150,164	50,672	200,836
Kamrup	144,852	50,632	195,484
Darrang	108,060	91,256	199,316
Nowgong	140,078	42,964	183,042
Sibsagar	26,482	63,016	89,498
Lakhimpur	91,291	140,435	231,726
Assam Valley Total	660,927	438,975	1,099,902

Source: Census of India, 1961, Vol. III, p. II-C.

Immigration of Foreign nationals

Statistics on the foreign born persons who have migrated to the Assam Valley with their country of birth and numbers are shown below.

Table 9: Foreign Immigrants and their numbers in Assam Valley 1961.

Country of birth place	No.	% of total foreign immigration
Pakistan	593,745	90%
Nepal	64,216	9.7%
U.K.	664	Negligible
Burma	503	"
China	349	"
Afghanistan	191	"
U.S.A.	132	"
Other parts of the world	1,127	"
Total	660,927	100%

From the above tale it is clear that 90% of the immigrants have come from Pakistan (East Pakistan). After the Pakistanis, the Nepalis form the most conspicuous group with 9.7 percent of the foreign immigrants. The spatial distribution of foreign immigrants in different districts of Assam Valley may be seen in the following table.

Table 10: Distribution of foreign born immigrants in Assam Valley.

Immigrated to District	Foreign immigrants born in							
	Pakistan	Nepal	Burma	China	Afgha-nistan	U.K.	U.S.A.	Others
Goalpara	145,950	3,602	88	1	6	1	-	516
Kamrup	136,377	8,042	33	155	13	28	17	187
Darrang	88,424	19,019	29	62	48	239	20	219
Nowgong	136,625	3,329	62	9	7	32	-	14
Sibsagar	20,684	5,562	30	3	33	144	6	20
Lakhimpur	61,685	24,662	261	119	84	220	89	171
Total Assam Valley	593,745	64,216	503	349	191	664	132	1127

Source: Census of India, 1961, Vol. III pt. II-C.

The foreign born immigrants to Assam Valley may be classified into two separate categories, permanent and temporary. Most of the immigrants from Pakistan, Nepal, Burma and China have permanently settled and accepted Indian citizenship. The immigrants from Europe and America and other continents have come for temporary sojourn or managerial and technical assignments in tea and oil industries and a few other commercial undertakings. They usually go back to their own country.

Movement of Pakistani Immigrants

Immigrants from the former East Bengal (Bangladesh), who number 593, 745, are not equally distributed in all the six districts of the valley. They are mostly to be found in the four districts of lower Assam Valley. The two districts of Upper Assam Valley have only 86,369 persons. Goalpara, the westernmost district of the valley, being adjacent to East Pakistan, naturally received a large number of immigrants. Most of these immigrants have come from the former East Bengal districts of Mymensingh, Pabna, Bogra and Rangpur. Most of them belong to the Muslim community and are poor landless farmers. Almost 95 per cent of them have come before the partition of the country (1947). The landless farmers of the then East Bengal, being attracted by the unoccupied cultivated areas lying here and there in Goalpara district, started moving into it as early as 1900, At the initial stage they occupied the grasslands of the Brahmaputra. The magnitude of the immigration to the Goalpara district thereafter can be realised from the fact that the population of the district which increased by only 2 percent in 1891-1901, registered an abnormal increase of 30% in 1901-11. It is recorded that in 1911 the immigrants and persons of immigrant origin constituted one-fifth of the total population of the district. After 1911 the immigrants slowly began to spread to other

districts of Assam Valley, namely to Kamrup, Darrang, Nowgong, Sibsagar and Lakhimpur. The number of East Bengal farm labourers in the valley in different census years can be seen in the table given above. It is recorded that 85 per cent of the total immigrants belong to Muslim community and the rest is constituted by the Hindus.

Table 11: Number of East Bengal immigrants in Assam Valley district (1911-31)

Year	Goalpara	Kamrup	Darrang	Nowgong	Sibsagar	Lakhimpur
1911	77,000	4,000	7,000	4,000	14,000	14,000
1921	15,000	4,400	20,000	50,000	14,000	14,000
1931	170,000	134,000	41,000	120,000	12,000	19,000

Source: Census of India, 1961, Vol. III, Pt. I-A.

It is evident from the table that the total number of immigrants from East Bengal recorded in various census years are 1,200,000 in 1911, 301,000 in 1921, and 496,000 in 1931. In this connection, it may be noted that out of the total of 496,000 immigrants (in 1931) the Mymensinghias alone number 11,000. There was no tabulation at all of the birth place of immigrants in 1941, and in the census both Muslim and Hindu displaced persons were recorded separately. Some information may be gathered from the following table.

Pakistani immigrants (Refugee and Non-refugee, 1951)

Table 12: Pakistani immigrants into the Brahmaputra Valley 1961

District	Non-refugee immigrants	Refugee immigrants	Total Pakistani immigrants
Goalpara	91,000	45,000	136,000
Kamrup	143,000	43,000	186,000
Darrang	65,000	19,000	85,000
Nowgong	135,000	38,000	143,000
Sibsagar	19,000	7,000	26,000
Lakhimpur	47,000	14,000	61,000
Assam Valley	500,000	166,000	666,000

Source: Census of India, 1961, Vol. III, Pt. II-c.

From a comparative study of the table of immigrants of 1931 and 1951 it will be evident that the number of immigrants in Goalpara district, has decreased from 170,000 in 1931 to 136,000 in 1951. The main reason for such reduction is that many of the immigrants who migrated to Goalpara did not give the actual place of their birth and liked to be censused as born in Assam.

In the 1961 Census the number of persons born in Pakistan is shown as 593,745 persons. This includes both non-refugees and refugee immigrants. From the figure if we deduct the total number of refugees which is 166,000 the total number of the illegal immigrants stands at 427,745 persons. This

comapres lowly with the 1951 figures. It may be said that while the Hindu refugees did not object being recorded as Pakistan born, the Muslim immigrants in Assam Valley is not certainly known because of non-disclosure. Most of the immigrants came to Assam before the partition of the country but a large number of illegal immigrant is in the neighbourhood of 2 lakhs (213,739). It is difficult to estimate the total number of Muslim immigrants and person of immigrant origin vary accurately. The total number of Muslim population in Assam Valley in 1901 was 248, 833 and in 1961 it had become 2,199,330. At the general average rate of natural growth (84% over 60 years) the number of original Muslim population would not have exceeded over 5 lakhs by 1961. Therefore, the number of East Bengal Muslims together with their children born in Assam Valley is nearly 17 lakhs. If 2 lakhs illegal infiltrators are taken into account the total number of immigrants in Assam Valley since 1900 would be about 19 lakhs. The East Bengal (Bangladesh) Muslim immigrants were mostly concentrated in the Taanas of South Salmara, Barpeta, Hajo, Rangiya, Chayyagaon and Boko in Kamrup, Mangaldoi, Dalgaon, Tezpur, Dhekiajuli, and Sootea in Darrang, Jamunamukh, Rupahihat, Dhing, Lanka, and Laharighat in Nowgong.

The movement of the East Bengal Muslim farmers began merely as a result of the interplay of economic forces in East Pakistan vis-a-vis Assam. They were driven apparently

by pressure on soil and also due to actual loss of their lands, and even their homesteads, by devastating floods in their home districts. These landless people occupied the uncultivated charlands of the Brahmaputra Valley. This was due to availability of plentiful and cheap virgin land in the valley with the freedom of ryotwari settlement in place of expensive small and uncomfortable holdings as tenants or undertenants in East Bengal. The influx of the immense number of the hardy and labourious cultivators undoubtedly made immense contribution to the economic and political structure of the Assam Valley. They cultivated rice, mustard, jute and vegetables in the charlands and brought changes to the agricultural landscape of the valley. These Muslim immigrants together with their children born in Assam accounting for one-sixth of the total population of the valley constitute a major section of the present Assamese population. The immigrants are mostly illiterate, landless poor peasants and they have educated their children through Assamese medium and have now identified themselves with the interests of the indigenous people and have greatly contributed to the development of agricultural economy, but the pace of integration is considerably slow. The main reason for their slow integration with the social and cultural life of the Valley is that they have settled in blocks or in separate colonies away from settlements of the indigenous population.

Pakistani Hindu Displaced persons

The last phase of mass migration from East Pakistan into Assam Valley is of recent origin and its causes are too well known to be noted. After partition of the country in 1947 leading to the creation of the Islamic state of Pakistan the Hindus of former East Bengal became restless and considered their life and property insecure and assuch they started migrating in masses to India. Assam being one of the adjacent states of East Pakistan it had to receive a large proportion of such refugees. The total number of Hindu Displaced Persons at the time of 1951 Census was enumerated at 166,000. They were distributed as shown in the table below.

Table 13: Distribution of Pakistani Hindu displaced persons in Assam Valley, 1951.

Districts	Persons
Goalpara	45,000
Kamrup	43,000
Darrang	19,000
Nowgong	38,000
Sibsagar	7,000
Lakhimpur	14,000
Assam Valley	166,000

Source: Census of India 1961, Vol. III, pt.I-A.

Since 1951 the flow of the refugees has been continuing and till the end of December 1957 there were 487,000 displaced persons from Pakistan in Assam. In the six Assam valley districts their numbers would in no case be less than 350,000 persons. Most of the refugees belong to lower middle class Hindu Bengalis and they have mostly migrated to urban areas and have earned their livelihood through business, retail trade and unskilled jobs. Unlike the Muslim immigrants and labourers they have not contributed anything substantial towards the development of the economy of the state.

Nepali Immigrants

The total number of Nepali immigrants at the time of the 1961 Census stood at 64,216. More than two thirds of the Nepalis are settled in Lakhimpur and Darrang districts. The movement of the Nepalis from Nepal is an important event of considerable interest. Their movement to Assam Valley was associated with the movement of the Gorkha soldiers who, after retirement, began to settle in Assam Valley. The settlement of the Ex-servicemen encouraged the movement of their relatives in Nepal who were poor landless cultivators and livestock farmers. Most of the Nepalis are graziers by profession and as they preferred to settle in the grassland areas of the Brahmaputra charlands and the foothills of the north. Besides

livestock farming, they have taken to the cultivation of lands and have grown crops like rice, mustard-seed, jute and sugarcane. Some of them engage themselves as wood cutters, while some others are employed as chowkidars and darwans in different official establishments.

The total number of Nepalis in 1961 stood at 169,686 and they are distributed as follows.

Table 14: Distribution of Nepalis in Assam Valley 1961

Districts	Persons
Goalpara	12,487
Kamrup	15,670
Darrang	68,885
Nowgong	8,159
Sibsagar	14,573
Lakhimpur	49,902
Total Assam Valley	169,686

Source: Census of India, 1961, Vol. III, pt. I-A.

It should be noted that the total figure shown above includes not only the immigrants but also those of immigrant origin. The Nepalis of the Assam Valley have undergone partial Assamization and they have learnt the Assamese language and some of them can speak and write good Assamese. The educated Assamese Nepali women are fond of indigenous Assamese mates. They are attempting to involve themselves with the social, political and cultural life of the valley.

Inter-State Immigration

The movement of people from different parts of India to Assam Valley is also a matter of considerable economic and social importance. The immigrants from Bihar, Orissa, Madhya Pradesh, West Bengal, Uttar Pradesh, Rajasthan and Punjab have come in large numbers and have increased the general population in Assam Valley.

Table 15: Inter-state Immigrants to Assam Valley by birth place

State of sixth place	No. of immigrants	Percentage of total immigrants
1. Bihar	243,179	55.3
2. West Bengal	49,906	11.2
3. Orissa	47,545	10.7
4. Uttara Pradesh	33,422	7.5
5. Rajasthan	20,554	4.5
6. Madhya Pradesh	10,061	2.2
7. P & Haryana	9,569	2.0
8. Tamil Nadu	6,579	1.3
9. Tripura	4,546	.95
10. Andhra Pradesh	4,065	.91
11. Manipur	2,885	.5
12. Kerala	1,507	Negligible
13. Nagaland	1,457	"
14. Maharashtra	1,011	"
15. Gujarat	744	"
16. Mysore	534	"
17. Other parts of India	1,307	"
	438,975	100% 1961 C.1

Of the total of 438,975 inter state immigrants it will be seen that as many as 143,179 (above 55%) have come from Bihar alone. The other main states of the immigrants are West Bengal, Orissa, Uttar Pradesh, and Rajasthan.

Lakhimpur with 140,435 has received the largest number of immigrants followed by Darrang with 91,256 and Sibsagar with 63,196. This is mainly due to the employment opportunities available in the tea industry in the upper Assam districts. Most of the tea labourers were recruited from Southern Bihar. A considerable number of persons from North Bihar has also come to Assam Valley to work as labourers in construction and labouring jobs. Persons born in West Bengal numbers 69,906 and they are spread all over the valley with a bigger number in the Goalpara district. The Oriyas who have also come as tea labourers are mostly to be found in the two upper Assam districts of Lakhimpur and Sibsagar and in Darang. The Hindusthanis of Uttar Pradesh are equally spread in all the five districts, with an exception of 12,544 in Lakhimpur district.

The interstate immigrants in Assam Valley may be classified into four districts, classes namely, (1) the tea-garden labourers, (2) Bengali employees and professionals, (3) Rajasthani traders, and (4) Wage earners and manual labourers.

The tea garden labourers

The bringing in of labourers to work in tea gardens from other parts of India had to be done as there were very few surplus and landless labourers in Assam. The indigenous peasants who had land naturally preferred the independence and ease of their position as owner-cultivators to the disciplined and regular labour of tea gardens. It was found thus necessary, at every stage, to seek tea garden labourers elsewhere and in 1835, the Assam Company began bring in labourers from the then Bengal. The most suitable labourers were the aboriginal tribes of Chota Nagpur and the neighbourhood; but the supply of these was insufficient and had to be supplemented by men brought from the plains of Uttar Pradesh and elsewhere. These plains people took a long period for acclamatization and even then, were seldom quite satisfactory. After 1860 the influx rate of the garden labourers was accelarated when they had to be procured through commission agents posted at Calcutta. Many of the labourers died on their transit to Assam by steamers. In 1901, out of the total number of outsiders registered in Assam, 85 per cent were tea garden labourers and their number in Assam Valley may be estimated at 45,000 persons. During the next decades, upto 1921 there was considerable expansion of the tea industry and many more

labourers were brought in. From 1931 onwards, however, the movement of tea garden labourers began to decline very considerably, as the tea industry became fully established by them. It is to be seen that the immigration of the garden labourers from Southern Bihar, Orissa, West Bengal, Madhya Pradesh, Uttar Pradesh, Andhra Pradesh and Tamil Nadu was its highest during the period 1911 to 1931. Mr. Lloyd in his census report of 1921, estimated that in the whole province of Assam there were 840,000 labourers and 360,000 ex-tea garden labourers giving a total of 1,200,000 persons. If the figures for Sylhet and Cachar districts were deducted the total number of the labourer immigrants together with their descendants in the Assam Valley would stand at nearly 850,000. According to Mr. Mallan's estimation the number of tea garden immigrants and their descendants was 1,400,000 in 1931 and for the Assam Valley the figure would be nearly 1,000,000. In the census report of 1961 it was stated that about 12 per cent of the total population of the state is dependent on the industry. The total number of tea garden settlers together with their children born in Assam including the tea estates of Assam Valley in different years is as follows.

Table 16: Employment of average daily tea labourers

(in thousand)

District	1903	1911	1921	1931	1938	1954	1965
Goalpara	-	-	1	2	3	5	3
Kamrup	2	3	2	3	4	4	5
Darrang	50	54	80	77	71	89	71
Nowgong	14	13	16	15	13	16	13
Sibsagar	97	111	141	146	143	153	124
Lakhimpur	100	109	142	155	144	167	155
Total A.V.	263	290	382	390	378	340	371

Source: Annual Report on Tea Culture in Assam

Many of the tea garden labourers have given up their jobs in the tea gardens and have permanently settled by now with agricultural labourers. Though they speak Adibasi languages such as Santhali, Oriya, Mundari, Telegu, they have received their education through the Assamese medium. In recent times a few youngmen of ex-tea garden labour community have qualified with higher education and have become professionals like doctors, lawyers and teachers. They are now an integral part of the Assamese society and have taken part in the all round economic, social and political reconstruction of the state.

Bengali Employees

It is rather difficult to ascertain the actual number of Bengali Hindu employee immigrants other than the East Pakistani (Bangladesh) Hindu displaced persons. In 1961 Census the number of immigrants from West Bengal has been shown at 49,906 persons. The highest number of immigrants from West Bengal have come to Goalpara district. This is followed by Darrang, Kamrup & Nowgong, while Sibsagar has received the smallest number. In respect of the immigration of this category of immigrants it is to be borne in mind that a considerable number of Bengali immigrants came to Assam Valley from the former undivided Bengal one hundred years ago. An idea about the size of this category of immigrants and persons of their origin can be made from the number of persons having Bengali as mother tongue. Postal, telegraphic and the railways staff had to be recruited from Bengal. The Bengali immigration is still continuing and exclusive Bengali settlements have grown in and around railway stations and junctions and in towns. Many such settlements have grown in and around of Pandu-Maligaon near Gauhati, Lumding in Nowgong, Bongaigaon in Goalpara, Rangapara in Darrang, Rangia in Kamrup etc. A small section have taken to cultivation in Goalpara district.

This category of immigrants because of their cultural distinctiveness, nearness to home districts, attitudinal disposition and urban living have remained conspicously unintegrated to the general socio-cultural spectrum of the Assam Valley and have retained their identity to the occasional discomfort of the local population.

Table 17: Distribution of persons having Bengali as Mother Tongue

Districts	No. of persons
Goalpara	184,902
Kamrup	203,642
Darrang	126,984
Nowgong	209,190
Sibsagar	46,036
Lakhimpur	127,874
Total A.V.	898,631

Source: Census of India 1961, Vol. III, pt.I-A.

From the above figure of 898,631 Bengali speakers if 3.5 lakhs of Bengali Hindu displaced persons who also speak Bengali are omitted the number of Bengali Hindus other than the displaced person shall stand at 5.5 lakhs. Most of the Bengali Muslims preferred to be censused as Assamese speakers

for certain obvious reasons. Even if we assume that some of the Bengali Muslims have returned their mother tongue as Bengali, the number of Bengali immigrants together with their descendants in no circumstances can be less than 5 lakhs. The first group of this category of immigrants came with the establishment of British administration in Assam. Most of them came from Dacca, Rangpur, Berhampur, Dinajpur, Rajshahi and Sylhet districts of the then undivided Bengal. They came as lower class government establishment and tea garden employees. A considerable number also came as doctors, pharmacists, druggists, physicians in indigenous medicines, engineers, surveyors, lawyers, accountants, teachers and also as administrators.

The movement of people of those business class and trading community from Rajasthan mostly took place since the beginning of the twentieth century. In 1961 there were 20,554 persons Rajasthani immigrants in the valley. Almost half of them (9,459) have immigrated to the upper Assam Valley districts of Lakhimpur and Sibsagar, Goalpara, Kamrup, Nowgong and Darrang have received 11,095 persons during that year.

This next phase of immigration started with the extension of railways. The immigrants, though numerically quite small, yet they are conspicuous in view of their commercial supremacy.

Now almost the entire business in whole-sale trades in food stuff, consumer goods, textile goods, hardwares, engineering goods, machineries, constructional materials and cash crops like jute, mustard seeds etc. are handled by them. Besides trade and commerce they have also contributed to the general workshop and steel works and factories are owned by them. Most of the Rajasthanis have come from Bikaner and Marwar and they include male members as will be seen from the sex ratio is only 360 females for every 1000 males. They have migrated singly to earn their livelihood through business and have kept their families in their home state. They are generally distributed in the towns and important commercial centres where the scope for business and commerce is sufficiently large. They have kept their socio-cultural characteristics in that and are yet to assimilate with the general socio-cultural famework of the local people.

Wage Earners and Manual labourers

The last category of immigrants to Assam Valley is the wage earners and manual labourers who have migrated mainly from Northern Bihar and Eastern U.P. They are about 200,000 in number and they essentially belong to the classes of temporary and seasonal immigrants. The immigrants mostly include male members and the sex ratio is only 376 famales for every

1000 males. They keep their families at home and have migrated only to work and earn their livelihood for their families. These immigrants were mostly unemployed in their home state and are under acute economic hardship. They are mostly distributed in the urban areas and other commercial centres where the scope of their employment is sufficiently large.

It will be seen that upto the time of last census, 1961, the number of immigrants together with their children born to them in Assam Valley was approximately as follows: Tea garden and ex-tea garden labourers - 15 lakhs, East Bengal (Bangladesh) landless Muslim farmers - 17 lakhs, Hindu displaced persons - 3.5 lakhs, Bengali employees - 3.5 lakhs. This about 45 lakhs or roughly about half of the total population of the Assam Valley is constituted by immigrants and their children born to them. This may be readily substantiated by the fact that the total population of Assam Valley which was only 26 lakhs in 1901 would not have exceeded by more than 50 lakhs in 1961 instead of its present population of 91 lakhs had the rate of population growth during the last 60 years been similar to that of all India pattern (84% increase in India during the last 60 years).

Except the wage earners and seasonal labourers all categories of immigrants have settled permanently. Though the inflow of immigrants has declined in recent years yet a large

number of job seekers, manual labourers and people of other occupational groups are migrating each year to find themselves engaged in different vocations of life, so this inflow continues. As such, the number of immigrant settlers in Assam Valley would be large enough in real future to raise many socio-economic problems whose consequences might not appear to be inspiring to the general interests of the original population.

Decennial Analysis: Immigration into the Brahmaputra Valley during the last 50 years

1901 - 1911

The first decade saw an overall increase of 6.68 lakhs, i.e. a mean decennial growth rate of 16.1%. These are the lowest figures during the last five decades. This is largely due to the fact that Assam during this decade was still recovering from the terrible Kala Azar in the central districts of Assam Valley during 1891-1901 which had wiped out a quarter of the entire population of the district of Nowgong. The earthquake of 1897 [illegible] sent a death wave over the state in the last years of the 1891-1901 decade. Both these factors caused heavy mortality at the extremisties of life which people in the prime of life increased. The result was the decade 1901-1911 had a more than normal increase in population. The proportions of the old people and the young

people who are liable to a high mortality were diminished by 1901 and the decade started with more than normal proportions of persons in the reproductive period of life; accordingly, the mortality was lower than the average and the birth rate was higher. During the latter half of the decade the tea industry advanced from the condition of a continual struggle for existence to one of very substantial prosperity.[3] Immigration which has always been a most important factor in the variation of population of Assam apparently began to be something more than a mere supply of the actual needs of the tea industry. The census report of 1911 mentions for the first time the commencement of a voluntary stream of settlers, then most in evidence at the outskirts of the Brahmaputra Valley, but had ventured as far east as Tezpur and Nowgong. The excessive mortality which was due to the jungle and insanitary conditions prevalent till than or due to the unusual calamities seemed at last to have been reduced.

1911-1921

During the decade 1911-21 progress in growth and advanced but its speed was retarded by various events of local importance and the universal influenza epidemic of 1918-19. There was hardly any improvement in the standard of life and the economic condition of the people was no better in 1921

than it was in 1911. In this decade there were three main factors which added largely to the population and one which decreased it. The plus factors were: (i) the natural growth of the old population, (ii) the large expansion of the tea industry which imported 7.69 lakhs of the garden labourers into the state, (iii) the immigration of East Bengal (Bangladesh) colonists and the Nepalis. Against this must be set of the terrible influenza epidemic of 1918-19 which was estimated to have carried of over a lakh of persons. Of the large increase of population of 8.5 lakhs, nearly half was due to immigration. Most of the increase, both in immigration and in the natural population, occurred in the Assam Valley.

It does not appear that the influenza epidemic affected the Assam Valley and Cachar with the same severity as was evident in other parts of the place or in the rest of India.

1921-1931

The tea industry lost a very large number of the labourers as the result of the economic and political troubles at the beginning of the decade and 422,000 of labourers imported into the state during 1921-31 many of whom returned to their homes on the expiry of their agreements - were not enough to fill the gaps carried by their desertion and discharge. There was no visible epidemic and public health was decidedly good;

in fact the decade from the point of view of public health was the best in the history of Assam. Hence the natural population of the state grew at twice the rate it did in 1911-21. The population growth in spite of being the highest recorded in Assam till then, was mainly due to natural increase, not immigration which formed only 10 per cent of the total. The immigration of eastern colonists and Nepalis continued. The immigrants consolidated their position in Goalpara and completed the conquest of Nowgong. The Barpeta Sub-Division of Kamrup district had fallen to their attack while Darrang was being invaded. Only Sibsagar had escaped completely while a few thousand Mymensinghias had already created an outpost in North Lakhimpur.

1931 - 1941

This decade saw another tremendous growth in Assam's population constituting a mean decennial growth rate of 17.9 per cent which is a record unsurpassed upto date. It is impossible to correlate this rapid growth in population in any way to the economic conditions of the decade. The cultivator was in distress except during the last two years and his purchasing power was greatly reduced. The whole state was seriously affected by the world-wide great economic depression of 1928-32 and especially by the precipitous fall in the prices of

agricultural produce. Whatever little trade and commerce there was, including the tea industry of Assam, had suffered a severe depression. It was only after the outbreak of the Second World War in 1939 that there was a steep rise in food grains with prices soaring and profiteering became rampant and prices showed an upward trend. Hence, this record decennial increase is mainly due to the three demographic factors, viz -

i) The natural growth of the old population.
ii) Immigration of East Bengal colonists, the garden labourers and the Nepalis, and
iii) The absence of any epidemic due to the growing mastery of Kala Azar and other epidemic as well as non-epidemic disease.

Table 18: Number of immigrants to and Emigrants from Assam.

State	Immigrants	Emigrants
1. Bihar	206,346	2,466
2. Orissa	87,216	544
3. Uttar Bharat	33,463	3,733
4. Madhya Pradesh	23,323	60
5. West Bengal	23,454	19,570
6. Rajasthan	17,280	679

Table 18 (Contd)

State	Immigrants	Emigrants
7. Tripura	15,098	9,908
8. Madras	12,719	347
9. Madhya Pradesh	10,637	1,669
10. Punjab	5,508	651
11. Bombay	4,786	986
12. Manipur	3,923	3,806
13. Vindhya Pradesh	1,594	6
14. Hyderabad	1,027	41
15. Pakistan	833,288	N.A.
16. Other areas	63,301	N.A
17. Total from other states	1,344,003	45,267

Source: Census of India 1951, Vol. XII Assam, Part I-A.

It will be noticed from the above, figures that largest number of immigrants to Assam is from Bihar, 206,346 followed by Orissa 87,216, U.P. 33,463, and others etc. It may interest some to learn the number of persons coming from PEPSU (255), Delhi (119), Himachal Pradesh (88), Jammu and Kashmir (71), Andaman and Nicobar Islands (3), and Ajmer (1), (1951).

Immigrants from adjacent States in India

These adjacent states are West Bengal, Manipur, Tripura, all of which have very slender links with Assam or with one another. Those born in West Bengal, Tripura and Manipur accounted in Assam to about 23,000; 15,000 and 4,000 respectively. Tripura and West Bengal are adjacent states in a Pickwickian sense, as at present apart from newly constructed Assam Railway link and a motorable road, there is little organic or geographical contiguity, much less physical or cultural contact. In no time in its census history, Assam received large contingent of immigrants from the districts of Bengal which at present constitute West Bengal. The overwhelming majority of its immigrants come from districts which all now have gone to East Pakistan. For the state as a whole, we find that only 1.1 per cent of the population of these states was enumerated in Assam.

Immigration from non-adjacent states:

The vast majority of the immigrants into Assam from India came from states which are not adjacent to it. There is an indeterminate number of periodic visitors, mostly general labourers and earth workers from Bihar and U.P. and the traders from various parts. As the Nepalis are included under

"Beyond India" and the Hindu refugees and the land Muslim cultivators under "other territories - Pakistan" the only important current immigration is the garden labour immigration of Assam which is treated at some length in the next para.

The immigrants from the rest of India or beyond are not numerous. The men of Rajasthan are Marwaris who do a large part of the trade in this state, both wholesale and retail, in tea-gardens and outside. The immigration of Marwaris is of a semi-permanent nature, that it is not permanent can be readily seen from the sex ratio which shows 5,528 females only against 11,752 males. The Punjabis are principally contractors, skilled mechanics, mistris, motor mechanics and carpenters on the railways and the tea gardens & also motor drivers on the Gauhati-Shillong road. Their woman number is considerably less than even one half of their men (3,945 males and 1,563 females). The number of immigrants from Bombay has remained constant since 1931 by far the large majority of those have gone to the three principal ten districts of Assam; Lakhimpur, Darrang and Sibsagar. They are all permanent immigrants as can be seen from their sex ratio, 2,264 men and 2,522 women.

Tea Garden Labour Immigrants

The number of immigrants from the states of Bihar, Orissa, U.P., M.P., Tamil Nadu etc., show large decreases in the 1951 census over their figure in 1931 in spite of the fact that states sending out tea garden recruits to Assam, show consistently large increase. Apart from this general statement, unfortunately, it is not possible to make an exact comparison between the 1931 and 1951 figures because the 1931 figure include those for Sylhet whereas 1951 figures include only a fraction of the tea garden labourers in Sylhet to the extent, which they were found in $3\frac{1}{3}$ themes of Sylhet retained in India. As Assam depends more and more on home grown labour, tea garden labour immigration has come to be of decreasing importance in Assam (being easily surpassed both by the Mymensinghias or the Hindu refugees from Pakistan). Most of the people are born in Bihar, Orissa, Madhya Pradesh, U.P. and Tamil Nadu and enumerated in Assam are either tea garden labourers or ex-tea garden labourers.

With the solitary exception of agriculture, tea industry gives maximum employment to the people of the states. More than half the number of those employed in all industries and services in Assam is supported by tea. In the case of self-supporting persons who are employees, tea alone accounts for a full three-fourths of the number.

There is no need here to undertake even a brief historical survey of recruitment arrangements of the tea industry till the passing of the tea districts. Emigrants Labour Act, XXII of 1932 (those who are interested may refer to pages 20-23 of the report on an enquiry into conditions of labour in plantations in India, by D.V. Rege ICS, Chairman, Labour Immigration Committee) states that labour commission on labour more generally known as Whitley Commission found the Sirdari system of recruitment under the Assam labour and emigrants act, VI of 1901 to be very defective. As a result of the recommendations, this act was replaced and the emigrants labour act of 1932 was passed, which now regulates recruitment for the tea gardens. The previous Assam labour board whose duties had been rather that of a police to watch over activities of the district labour's measure of freedom.

Muslim Immigrants from Bangladesh

There are 274,455 refugees and 558,833 non-refugees from Bangladesh in Assam. The districts which did not import tea garden labourers into Assam now form a part of Bangladesh. This number by and large consists of land hungry elements of Bangladesh, seeking entry as refugees into Assam. Apart from an insignificant number of those who came for the purpose of trade, commerce or miscellaneous sources of employment, a small element of Hindus, especially of the Namashudra class

forms a part of land hungry immigrants. Yet an overwhelming majority of over 90% consists of Muslims alone.

Sir Edward Gait wrote in his census report of 1891 that the cultivators from Bangladesh came to Assam to take up land wherever available for agricultural activities. But the coolies for tea gardens came to Assam through recruitment.

During 1891-1901 a slight fall in the number of immigrants from Bangladesh into Goalpara was noted in the census report of 1901. The same authority, however remarks "the district is a purely agricultural one and there is nothing to attract immigrants" - as if the vast amount of virgin and readily available land in this district was itself not good enough to attract any land-hungry peasant.

Before 1911, however a change came which proved to beyond any shadow of doubt that the two authorities mentioned above have false prophets. The Mymensinghis began to advance into Assam driven apparently by population pressure on the land at home. The census report of 1911 is the first to comment on the extraordinary [illegible] case of settlers to the virgin lands of Goalpara from the Bangladesh districts of

Mymensingh, Pabna, Bogra and Rangpur. The population of Goalpara which increased only by 1.4% in 1881-91 and 2% in 1891-1901 shot up to 30% in 1901-1911. The Thanas most affected were the western districts, where the percentage rate of increase was 70.01% in South Salmara, 61.8% in Lakhimpur and 88.6 in Bilasipara. The extent of immigration can readily be estimated from the fact that the growth of natural population was only 15.6% in Goalpara district. Thus began the peaceful invasion of Assam by advancing hordes of Mymensinghias, which has continued right up to the present day. The most important single event in the history of this state during the last 50 years was an event aptly described by Mullan as - "likely to alter permanently the whole future of Assam and to destroy more crudely than the Burmese invaders of 1820 the whole structure of Assamese culture and civilization". At this period, however, few cultivators went beyond Goalpara, those censused in other states of the Brahmaputra Valley were mostly clerks, traders and professional men numbering only a few thousands.

The decade 1911-1921 estimates that the Bangladesh settlers have increased more than four-fold in their present total of 250,000 in Brahmaputra Valley. Sibsagar and Lakhimpur are scarcely touched yet. In the Goalpara district nearly 20%

of the population is made up of settlers. The next favourite district is Nowgong where they form about 14% of the whole population. In Kamrup waste lands are being taken up rapidly, especially in Barpeta sub-division. In Darrang exploration and settlement by the colonists were in stage, but they have penetrated far from the Brahmaputra banks.

Table 19: Person born in Bangladesh and enumerated in each district of the Assam Valley in 1911, 1921 and 1931 (in thousands)

Year	Goalpara	Kamrup	Darrang	Nowgong	Sibsagar	Lakhimpur
1911	77(34)	4(1)	7(1)	4(1)	14(0)	14(0)
1921	151(78)	44(30)	20(12)	58(52)	14(11)	14(11)
1931	170(80)	134(91)	41(30)	120(108)	12(1)	19(2)

The above table gives the figures, in thousands, of persons born in Bengal and enumerated in the districts of the Assam Valley in 1911, 1921, and 1931, those from Mymensingh district being given in brackets as the districts are the ones which are chiefly responsible for the flood of immigrant settlers. It must be remembered that the children of settlers born to them after their arrival in Assam have been recorded as Assam born and hence do not appear in the above figures.

The table shows that the total number of people born in Bangladesh, not merely the number of settlers; still it gives us a very good idea of what has been taking place during the last 10 years. These figures enabled Mullan to arrive at the following conclusion.

"The second army corps which followed in the years 1921-31 has consolidated their position in the district and has also completed the conquest of Nowgong. The Barpeta Subdivision of Kamrup also has fallen to their attack and the Darrang is being invaded. Sibsagar has so far escaped completely but the few thousand Mymensinghias in North Lakhimpur are on outpost which may, during the next decade prove to be a valuable basis of major operations."

Floyd in 1921 estimated that (including children born after their arrival in Assam) the total number of settlers was at least three lakhs in that year. Mullan placed their number in 1931 to be over half a million. The number of new immigrants from Mymensingh alone was 140,000 and old settlers were undoubtedly increasing and multiplying. Out of the total of 338,000 persons born in Mymensingh and censused in Assam in 1931, over 152,000 were women, confirming the fact already pointed out in the 1921 census report that the colonist were settling by families and not singly.

From the data available during the decade 1931-51 Mullan tried to forecast the future course of this invasion follows: "What of the future? As far as can be foreseen, the invasion by no means is complete. There are still large areas of wasteland in Assam particularly in North Lakhimpur and Kamrup, in spite of the large immigrants it has absorbed during the last 10 years as capable of holding many more. The Mangaldai sub-division is also capable of future development. Now that most of the wasteland of Goalpara and Nowgong have been taken up by the immigration should therefore more and more towards Kamrup, Mangaldoi and North Lakhimpur. The latter sub-division should prove a veritable 'El Dorado' if news of its empty spaces awaiting the hoe and plough of the colonist reaches the ears of the main body of trekkers."

This prophecy has been fulfilled to the latter part during the last 20 years.

In 1951 Census sixth place was sorted only for the Assam district separately, while those who were born outside the state were merely dumped under their respective states. The table below shows various districts of Assam and gives the number in thousand of persons born in Bangladesh and enumerated

in the various districts of Assam, As the number of refugees and their sex break-ups are separately available the two are given : enabling us to arrive at the numbers of the persons born in Bangladesh who were not refugees.

Table 20: Person born in Pakistan both refugees and non-refugees with their sex break-up and enumerated in the districts of Assam Valley 1951

Districts/ State	Bangladesh			Non-Refugees			Refugees		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Assam Valley	796	445	351	536	304	232	260	142	118
Cachar	130	70	60	37	20	17	93	50	43
Goalpara	136	78	58	91	23	38	45	25	20
Kamrup	186	106	80	143	82	61	43	24	19
Darrang	84	44	40	65	34	31	19	10	9
Nowgong	173	98	75	135	77	58	38	21	17
Sibsagar	26	15	11	19	11	8	7	4	3
Lakhimpur	61	34	27	47	26	21	14	8	6

Source: Census of India, 1951, Vol. XII Part I-A.

Persons born in Bangladesh and enumerated in Assam had reached the enormous total of 833,000 persons. A close approximation of their sex ratio which gives only a slight preponderance of men over the opposite sex is clear indication of the

Permanent nature of this immigration. Of course this huge number includes a large number of refugees born in Bangladesh who had migrated to Assam at the time of the partition.

The above table gives the breakup of Bangladesh born population censused in Assam district wise. Sibsagar accounts for a very small number of Bangladesh born people (26,000) while the Lakhimpur returns (61,000) contrast them with the hugh numbers which are found in Kamrup (186,000) and Nowgong (173,000). Goalpara and Cachar with 136,000 and 130,000 persons respectively also returns substantial number of Bangladesh people. These figures are striking testimonies to the vast number of Bangladesh settlers in Assam. This stream has been continuous in the last two decades, gathering momentum in the first half of the present decade during the Muslim League ministry in Assam upto January 1946. It however, continued thereafter and even after the setting up of the two dominions of India and Pakistan did not prove to be a deterrent to those settlers who continued to move in even after the partition. A study of the census figures reveals the number of the persons born in Bangladesh and enumerated in Assam 1951 was itself as high as 573,000, as the number of persons in the district which are now in West Bengal but which were enumerated in

Assam at the earlier censuses was very low. It could not be fair to assume that only 500,000 born in the district now in Pakistan were censused in Assam. The number might account 430,000 for the earlier two decades.

Muslim Immigration according to the Land Revenue Records

During 1940-41 there was no immigration, but inter district immigration of cultivators occurred as usual. Assamese cultivators from the neighbouring districts continued to enter North Lakhimpur in large numbers.

The influx of immigration from Bangladesh continued towards Kamrup, Darrang, Nowgong and Lakhimpur as landless people. "Reserved" and "Khas" lands would be opened to them for cultivation. These people have apparently misunderstood the subject of the development schemes or have been misinformed about them. It is not unlikely that many of them will ultimately find their hopes unfulfilled as there are already landless immigrants who will have to be given preference over the new comers. In Darrang and Kamrup many of the immigrants still remain as encroachers upon reserves and closed areas.

But in 1941-42 the influx of Bangladesh immigrant was less marked than the previous years. The reasons are:

i) Unsettled conditions during the war.

ii) The withdrawal of the development scheme.

In 1942-43 due to the acute scarcity of food in Bangladesh the influx into the valley, included a large number of beggars and destitute persons. A large number of labourers from other states had also entered the province to work under the military authorities.

But during 1943-44 the influx of Bangladeshis including a large number of destitute persons continued as in the previous years. And a large number of labourers from elsewhere entered the province for work, on military project.

In 1944-45, owing to the increasing pressure on their villages in Goalpara many Santhals and Bodo families emigrated to Darrang district. The influx of Bangladesh immigrants also continued during the year.

In 1945-46, same as the previous year, the influx continued. About 9,000 labourers from other provinces immigrated into the district of Sibsagar to work in the tea gardens.

In 1946-48, the influx of Bangladesh immigration continued with great rapidity. The number was very high in Goalpara

district. In Sibsagar about 8,111 labourers immigrated from other provinces to work in various capacities.

During 1948-49, the influx of Bangladesh immigrants continued in the beginning of the year. After the disturbances of January 1950 it was very high till the Delhi pact (Nehru-Liaquat Pact), was signed. In Sibsagar 8,151 labourers immigrated from other states to work in various capacities. In Goalpara the influx was accounted about 50,000 but most of them went to other districts of Assam Valley.

Pressure on Agriculture

High growth rate of population due to continuous influx of immigrants has created complex problems in Assam, as 70% of the households consist of uneconomic holdings and share croppers. The land per capita income comes to 0.5 hectare in Assam, the available per capita agricultural land was 0.27 hectare in 1961 and it was decreased to 0.20 hectare, in 1971 as against 0.30 and 0.25 hectare respectively for the country as a whole. The tragic part of the fact is that most of the local people are not in a position to compete with them who have strong financial support and business links with other parts of the country. The hard working immigrant settlers from Bangladesh and Nepal with abilities in the field of agriculture

and animal husbandry have attained much better economic positions than the inhabitants in the rural areas. The poor section of the original inhabitants had gradually become poorer because of their sole dependence on agriculture.

The pressure of population on land in rural areas like Goalpara and Cachar is increasing gradually doe to immigrants from Bangladesh and Nepal.

Another vital problem created in this region by the major section of the immigrants is that they do not like to be assimilated with the original inhabitants. By ignoring the language and culture of the original inhabitants, most of the immigrant settlers, have arranged schooling of their boys and girls in their own language. This may be viewed in the light of the fact that out of every 5 persons in Assam (in 1970) one is an immigrant.

Further, the gradual increase of theft, social crimes like murder, arson, etc. have some relations with the influx of destitute people from outside. Research studies revealed that major crimes in this region are committed by immigrants. This process will lead to disruption in the social set up in the region in the near future.

In the economic fields too, it is observed that the major point of the trade and commerce is in the step of immigrant settlers and that they have accumulated vast wealth. The migrants from Bangladesh have played an important part in the improvement of agricultural production but not in the agricultural economy of the Assam. Due to over population of migrants the per capita consumption has also increased.

In the case of agricultural production rate of the zone of high yield and high spread is considered the most efficient zone whereas the zone of low yield and low spread is the most inefficient zone of production. In Cachar district and Goalpara District we find rice is the high yielding and important crop. There are few other districts in the category of low yield and low spread. This type of cropping pattern and low production is affected by some of the environmental problems. There it is very difficult to increase the area under crop. Agricultural production can be increased to a considerable extent by increasing the use of high level of input to increase the per hectare production. And at the same time if the growth of population also increases then the higher per hectare production becomes insignificant. Immigration is the main problem in case of Cachar and Goalpara. Large number of immigrants

from Bangladesh and Nepal occupied the agricultural field. They might increase the per hectare production but at the same time per capita consumption also increased. So there is insignificant development in agricultural economy of the country.

CHAPTER - IV

CONCENTRATION OF HIGH YIELDING VARIETIES OF CROPS AND THEIR PRODUCTIVITY PATTERNS

Rice

The methods and techniques of cultivation of different types of crops vary from crop to crop and show distinct affinities with the Gangetic Delta. Rice, the staple food crop in India, is grown in different seasons with varying agricultural methods and practices. Its sowing, growth and harvest however can be seen all through the year. In the Lower Brahmaputra Valley three crops of rice in an agricultural season are common. The rice season includes Sali and Bao, Ahu and Boro of which Sali and Ahu are the most important crops.

Sali and Bao

This is mainly called Sali or summer paddy season. During this season paddy is grown along with jute in low lands. It is usually grown by transplantation in the rainy season during the months of July and August. Seedlings are raised in highly manured nurseries or fields. Before transplantation takes place, the paddy field is ploughed and harrowed four to six times depending on the nature of the soil and the availability of time. After having been ploughed, the

field is pulverised with bamboo ladder. The seedlings raised in the nurseries are transplanted in bunches with standing water in the field. Transplantation is done by human labour and is a labour-intensive process. After a month and a half from the date of completion of transplantation, the farmers have to apply plenty of fertilizer for their good growth. Sali crop flourishes during the rainy season and is harvested in the month of November and December. Bao is grown in flooded fields and low lying marshy areas between March and April. The crop is generally grown with the help of broadcast method, after having ploughed the dried field at least four to five times. Before the Bao land gets flooded, weeding is carried on in large scale. Bao paddy grows in water level upto 4" to 5" inches. After the flood water recedes from the Bao field, the plants settle on the land and start flowering. Bao crop is harvested during the months of December and January. Another shallow water paddy locally known as Asra is cultivated like Bao and is harvested on November and December. Sali and Bao are the principal crops which occupy about 57% of the total cropped area which is 72% of the total area under rice in the State, particularly in the lower Brahmaputra valley.

Ahu

Ahu is cultivated during the autumn season. The broadcast varieties are sown in well prepared fields between March-April. Weeding is essential for broadcasted Ahu paddy. It is harvested in June and July. Transplanted Ahu is grown in irrigated fields. During March-April seeds are sown in well manured nurseries. When the seedlings come up, (after 4 to 5 weeks) these are transplanted in puddled fields.

Transplanted Ahu gives higher yield than the broadcast paddy. Ahu is followed by Sali and is grown in particular types of lands which has standing water facility over the field. After the introduction of HYV of rice, the importance of this crop has decreased relatively.

Boro

The paddy grown during December-January is called Boro. It is cultivated in marshy and swampy lands. Boro is usually called a winter crop and hence requires adequate and timely irrigation. Boro seeds are raised in nurseries in the months of November and December. Transplantation of seedlings are done in the months of December-January in a well puddled fields. It is harvested during April - May and is extensively cultivated in Goalpara and Nowgong districts of the Lower Brahmaputra Valley.

It is seen that Ahu and Sali rice crops are the most important and principal crops of the Lower Brahmaputra Valley. Ahu, Sali and Boro are extensively grown in this valley and the area under these crops exceeds 60% of the gross cropped area.

The irrigation potential in the Brahmaputra Valley is a primary indicator for successful and effective implementation of HYV of rice cultivation programme.

The percentage of area under irrigation is very low. Nalbari, Nowgaan, Maligaon and Gauhati and is only 30.64% of the total irrigated land. Mangaldoi, Kokrajhar and Tezpur are under the high categories of area under irrigation having together a share of 44.56% of the total irrigated land. Kokrajhar and Tezpur have an irrigation potential of more than 30% of their net cropped area. It is interesting to note that Dhubri being located at the Western tip and in the high rainfall zone of the valley, does have areas under irrigation ranging between 8.75 to 30.20% of the net cropped area (Barpeta and Kokrjhar). The areal units in the lower valley along with irrigated net cropped land to the time and 38.03% to that of the State as a whole.

Area Concentration of Rice

Agricultural landscape of a region is well conceived of when its area of dominance under different crops is identified with the help of some standard statistical techniques. The simple delineation of an area into a wheat or cotton region may be useful in knowing the areas of wheat or cotton cultivation but it does not identify the degree of their density of cultivation in a given space and time. The study of concentration of crops therefore, is of great relevance in understanding the agricultural land use planning at macro and micro level. The main objective of such an area on a regional basis with a view to bring out their areal concentration.[1]

Data for the 7 distributional patterns of the area under rice in Lower Brahmaputra Valley was obtained from the basic Agricultural Statistics for the years 1974-75 to 1976-77, published by the Directorate of Agriculture, Government of Assam. The study encompasses the whole of Assam so as to highlight the relative significance to the Lower Brahmaputra Valley a micro region investigation.

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1. Majid Hussain (1970). Patterns of crop concentration in U.P. Geographical Review of India, Vol. 32, pp.8-109.

In order to have an average picture of the area devoted to rice in Assam, 3 years data of 1974-77 have been taken into account with the intention that the 3 years average to an extent would take into account the vagaries of weather on the area of rice cultivation. The density pattern of area under HYV of rice has been shown with a 2 years average (1975-77) as the data for 1974-75 was incomplete. The total potentiality in the State for irrigation till 1977 was taken into consideration. The analysis of cropping pattern and productivity of rice was primarily based on data published by the Directorate of Agriculture Government of Assam and the Agro-Economic Research Centre, Jorhat.

To show the density pattern of rice cultivation in Assam with special reference to Brahmaputra Valley, a season wise break-up of the area under rice has been taken. The regional dominance of rice has been determined firstly, by comprising the sown area in proportion to hectare and secondly, by relating the crop density in each of the components area with that of the province as a whole. Hence for the purpose, the location quotient method has been applied. The location quotient or the index of concentration of crop, has been worked out in the following manner.

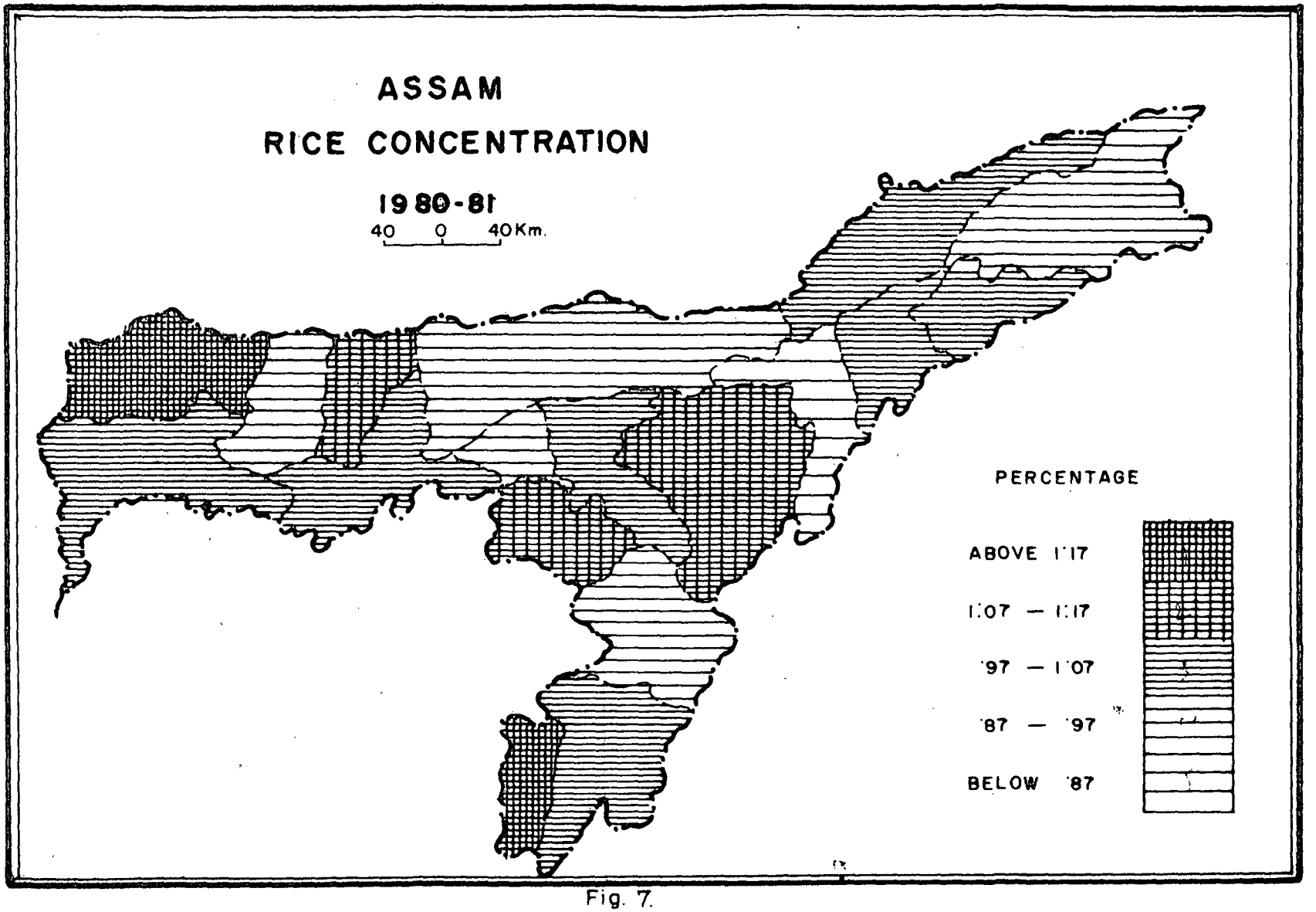
ASSAM
RICE CONCENTRATION
1980-81
40 0 40Km.
PERCENTAGE
ABOVE 1·17
1·07 — 1·17
·97 — 1·07
·87 — ·97
BELOW ·87

Fig. 7.

I = Index of concentration of crop

$$\frac{\text{Area of crop 'X' in a component area unit}}{\text{Area of all crops in component area unit}} \div \frac{\text{Area of crop 'X' in the entire region}}{\text{Area of all crops in the entire region.}}$$

If the index value is greater than the unity, the component areas unit accounts for a greater share than that it would have if the distribution were uniform in the entire region of the particular crop under study.[2]

The percentage values for the density of areas under rice in all the component areal units that show concentration have been put in descending order. The index was derived by dividing the descending order into five equal parts in order to distinguish the very high/high/medium/low/and very low concentration with the help of index scale. The concentration of rice as the first ranking crop in every unit has been plotted in figure No. .

If one looks at the figure No. (rice concentration) it reveals that the rice is the dominant and principal food crop in all the component areal units of the area under study

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2. Majid Hussain, Op.cit., p. 170.

and irrespective of sub-division, districts and state, it has a substantial percentage share, which invariably exceeds more than fifty percent in each units. The percentage of rice being significantly high, the whole of Assam can be delineated as an area of monoculture. The medium and maximum area varies between 55.2 to 85.14 p.c. for the sub-division of Golaghat and Karimganj respectively.

Rice had major share of area under cultivation in each areal unit. The percentage share of grossed area other than rice is invariably below 50% in each areal unit.

The following table shows the frequency distribution of the indices of concentration of area under rice.

Table 1: Frequency Distribution of the Indices of Concentration of area under rice.

Class group of the indices of concentration	Degree of concentration	Frequency	Cumulative frequency
0.87	Very low	1	1
0.87 - 0.97	Low	7	8
0.97 - 1.07	Medium	10	18
1.07 - 1.17	High	2	20
1.17	Very high	2	22

Source: Adhoc Study No. 38, Agricultural Development in Assam (1950-51 to 1975-76).

The above table reveals that the indices of concentration varies between 0.784 in Golaghat to 1.20 in Karimganj. The reason for such a low concentration of area under rice in Golaghat may be attributed to less areas under rice, and low irrigation facilities. Karimganj having higher concentration of rice, seems to be an exception because the area despite low irrigation potential has the highest density of rice cultivation as compared to rest of the sub-divisions in Assam.

The table shows that maximum number of sub-divisions are observed within the medium degree of concentration with a range between 0.97 to 1.07. These sub-divisions constitute Goalpara, Dhubri, Gauhati, Nowgong, Jorhat, Sibsagar, North Lakhimpur, Dhemaji, Silchar and Hailakandi. The reasons for this uniform tendency in concentration of area are better irrigation facilities, favourable climatic conditions and a host of other socio-economic conditions.

However, very high concentration of area under rice is noticed in the sub-divisions of Kokrajhar and Karimganj. The index values exceeds 1.07 to 1.77 in Nalbari and Karbi Anglong Districts.

The subdivisions of Barpeta, Tezpur, Mangaldoi, Marigaon, and North Cachar show a low concentration ranging from 0.87 to 0.97.

Table 2: Area, Production and Average Yield of Rice in Assam, 1950-51 to 1975-76 with Index Numbers

(Base = 1952-53 = 100)

Year	Area		Production		A. Yield	
	Hectares	Index	In lakh tonnes	Index	Kg/Ha	Index
1950-51	1,492,020	80.43	12.75	82.62	855	102.76
1951-52	1,783,589	96.15	14.12	91.50	793	95.31
1952-53	1,854,937	100.00	15.44	100.00	832	100.00
1953-54	1,573,906	84.85	15.18	98.33	965	115.98
1954-55	1,560,723	84.14	15.66	101.46	1004	120.67
1955-56	1,600,827	86.30	15.40	99.79	963	115.74
1956-57	1,601,940	86.36	16.17	104.78	1010	121.39
1957-58	1,593,556	85.99	15.37	99.57	965	115.98
1958-59	1,690,242	91.12	15.89	102.97	941	113.10
1959-60	1,696,502	91.46	16.67	107.99	983	118.15
1960-61	1,716,154	92.52	16.33	105.76	968	116.34
1961-62	1,755,930	94.62	16.48	106.74	985	118.39
1962-63	1,777,520	95.83	14.76	95.60	956	102.88
1963-64	1,754,979	94.61	17.54	113.62	1015	121.99
1964-65	1,779,168	95.92	17.88	115.84	1021	122.71
1965-66	1,797,546	96.91	17.13	110.96	968	116.34
1966-67	1,851,815	99.83	16.32	105.72	895	107.57
1967-68	1,886,831	101.72	17.87	115.76	957	115.02
1968-69	1,952,790	105.28	19.89	128.85	1035	124.40
1969-70	1,967,598	106.07	19.67	127.42	916	110.09
1970-71	1,968,370	106.12	19.80	128.22	1022	122.83
1971-72	1,967,530	106.07	19.08	123.58	985	118.39
1972-73	2,068,770	111.53	21.77	140.99	1052	126.44
1973-74	2,077,820	112.02	20.66	133.81	994	119.47
1974-75	2,057,500	110.92	19.83	128.47	960	115.39
1975-76	2,199,053	118.55	22.49	145.69	1038	124.76

Source: 1. Estimates of Area and Production of Principal Crops in India, 1950-51 to 1964-65, Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India.
2. Directorate of Economics & Statistics, Govt. of Assam.

The above analysis shows that the Lower Brahmaputra Valley has got better agricultural potential in the entire state of Assam.

Productivity Pattern

So far the levels of output of rice in Assam is concerned, it can be observed from the table 3, that the output has shown an increasing trend. From about 12.75 lakhs tonnes in 1950-51, the production has gone up to above 22.50 lakh tonnes in 1975-76. There has been a net increase of 9.70 lakh tonnes during the past 25 years. The simple annual growth rate, linear growth rate and compound growth rates are thus 3 p.c., 1.58 p.c. and 2.3 p.c. respectively.[3]

Fluctuations in the out turn from year to year in terms of percentage rate of change in the index number shows that, the same has fluctuated between 118.55 percent to 10.44 per cent. The average rate of change during the period 1950-51 to 1975-76 is found to be 1.83 percent annually. The annual rate of increase in index number was notably high during the period 1966-67 to 1968-69. The index number for areas has gone up to 105.28 in 1968-69 from 96.91 in 1965-66. The yield rate also appears to have changed from year to year.[4]

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3. Adhoc Study No. 38, Agricultural Development, Assam (1950-51 to 1975-76) published by AERC for NIE Indian AAU, Jorhat, 1975, pp. 26-156.
4. Adhoc Study op.cit., pp. 22-156.

The average yield is about 964 kilograms per hectare. The linear growth rate of productivity comes out to be only 0.61 percent. Better yield rate depends on favourable agro-climatic and socio-economic factors. Absence of floods and timely rains stand favourable for rice production. The average production of rice during 8 years out of 16 years (from 1950-51 upto 1975-76) was 1,000 kg. per hectare. During 1966-67 the yield rate dropped below 900 kg. per hectare. But production of rice increased by 60.5 percent against the area under cultivation of rice which increased by 68.74 percent over the plan periods. Thus, the increase in production is mainly due to the increase in area.[5]

Because of little or no control over floods and drought there is little use of irrigation and power inputs in agriculture, so there is a relatively slower growth of agricultural production trend in comparison to all India trend.

HYV of Rice in Assam

During the adhoc annual plans (1966-67 to 1968-69) for the first time, the quick maturing HYVs were introduced in the State of Assam, such as Tichung, Monohar Sali, IR and Mexican

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5. Evaluation Report No. 76. Evaluation of Monetary Planning and Development Department of Government of Assam, April 1979, pp.27.

variety of wheat, etc. At the end of the adhoc plan period the strategy adopted for increasing agricultural production was on quck maturing programme such as extensive use of HYV seeds.

Data available on the area under HYV from 1969-70 to 1975-76 and from 1976-77 to 1978-79 as total area under HYV rice for the District of Assam show that only 15 per cent of the total area under rice have been covered by HYVs by the end of 1972-73. This average continued till 1975-76. On the contrary, the area under cultivation has increased by more than double.

The table 2 shows that in 1969-70 about 5 to 12 per cent of the rice cropped area was under HYV and since then it has shown a continuous upward trend. In 1975-76 the area under HYV of rice varies between 0.83 to 18.88 p.c. of the total rice area for the district of N.C. Hills and Dibrugarh respectively. District Kamrup has 9.29 p.c. of its rice area under HYVs followed by Goalpara 10.32 p.c.

According to report on performance of HYV rice in Assam for which trials were conducted in Titabor rice research station, the recommended varieties such as Jaya, Pusa-2-21, Pusa-2-103, Jagannath and Monohar Sali cultivated in Kharif

and Rabi season shows that Jaya variety sown during the winter gave the highest yield i.e. 8,111 kg. per hectare. A comparison of the Kharif and Pasi rice shows that the per hectare yield of rice in Rabi season is more than double in the case of all the three varieties.

Table 2:

Unit	Year	Crop	Max./yield in kg/hc
Dibrugarh	1972-73	Jaya	8,987
	1973-74	Jaya	6,323
Kamrup	1972-73	Jaya	7,333
	1973-74	Para	7,076
Cachar	1972-73	IR	9,346
	1973-74	IR	7,092

Source: Adhoc Study No. 38, Agricultural Development in Assam (1950-51 to 1975-76).

The table reveals that the maximum yield Jaya HYV of rice varies between 6,323 to 8,987 kg. per hectare during the period 1972-74 in the plain districts of Assam. The performance of IRS seems encouraging in Cachar, the yield varying between 7,092 to 9,346 kg. per hectare.

The Assam Agro-Economic Research Centre, Jorhat confirms that the short duration HYV paddy is grown in the areas having adequate irrigation facilities during the Ahu season. The traditional indigenous varieties were cultivated mainly in the Ahu, Sali, seasons both in plain and low-lying marshy and flooded lands.

Levels of Agricultural Development of Lower Brahmaputra Valley

Identification of economic regions in a broader perspective has always formed the core subject of the regional planners for their commitment to the process of national development. The intricate relationship between the physical and socio-economic characteristics of different regions have posed immense problems in drafting an uniform policy for relatively developed area of the country. It is felt imperative to highlight the levels achieved by individual sectors such as agriculture, industry and so on, in terms of some selected economic indicators.

Agriculture being the backbone of the national economy, the study of regional disparity in the levels of agricultural development draws urgent attention of research to involve a rational and programme policy at the micro-levels. The present study is however an attempt to highlight the levels of development in agriculture attained so far in Lower Brahmaputra

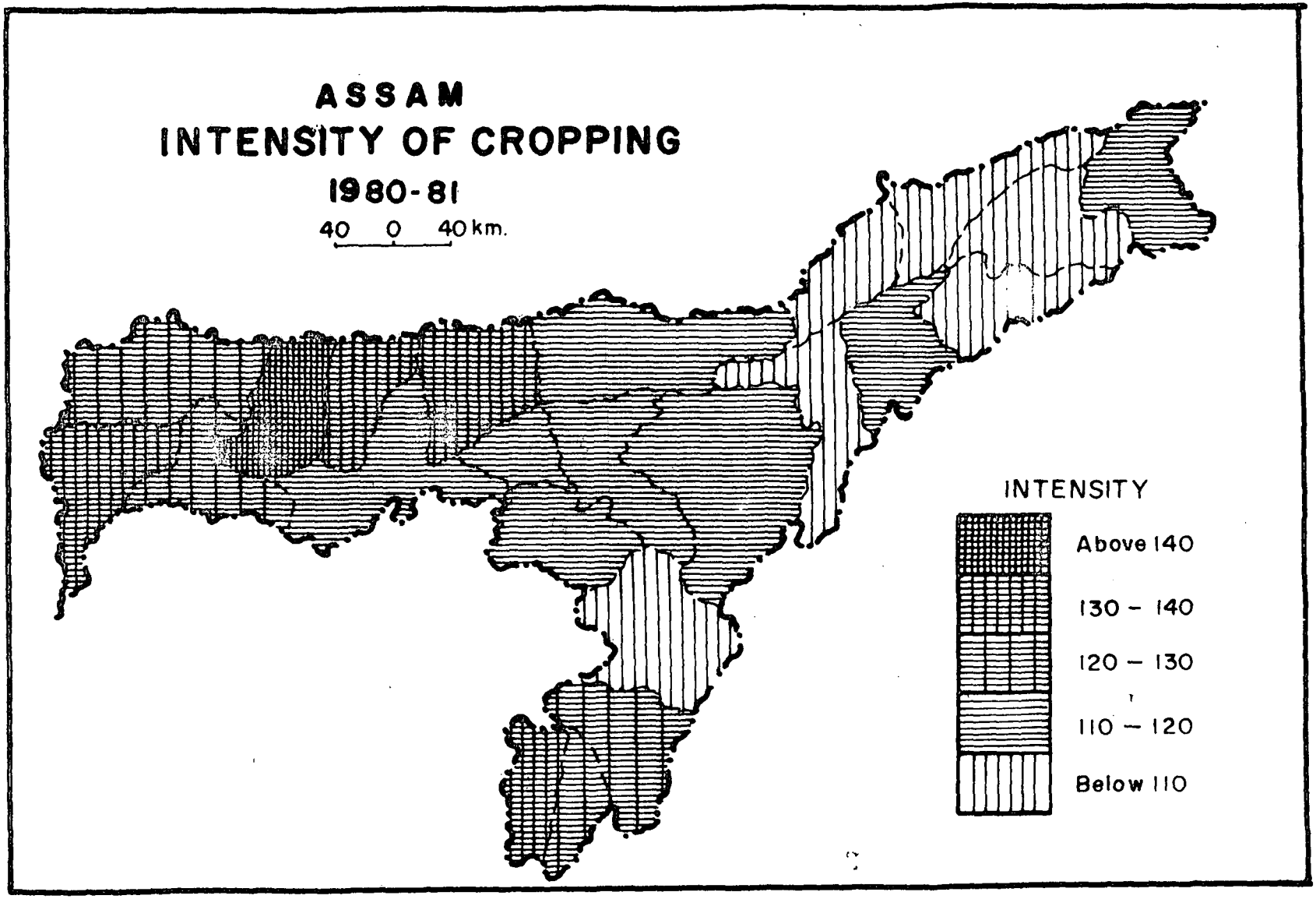
ASSAM
INTENSITY OF CROPPING
1980-81
40 0 40 km.
INTENSITY
Above 140
130 – 140
120 – 130
110 – 120
Below 110

Fig. 8.

Valley. Agricultural development in Assam has been conditioned by several factors viz. lack of necessary institutions, the largely unstable agricultural economy subjected to recurring floods, erosion and other natural calamities inadequate communication facilities, lack of power etc. which are not so pronounced in other parts of the country.

In order to measure the agricultural efficiency in England and Wales, Kendal[6] tried to sort out the areas of high and low agricultural productivity. Hence for the purpose, he took the countrywide data or per acre production of different crops. Before preparing the composite index of agricultural efficiency the scale effort was eliminated by converting the production per acre of each crop into ranks. So far as the weightage problem was concerned, each crop was given equal weightage.

Ashok Mitra[7] also classified the Indian districts into four quartiles of development by using Kendal's method of preparing composite index. He took as many as 35 indicators of regional development. A. Kundu[8] has also given many guidelines for construction of composite index for regionalization.

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6. M.G. Kendal (1939). The Geographical Distribution of Crop Productivity in England. JRSS Vol. 102, No.21, pp.23-25.
7. Ashok Mitra (1961). Levels of Regional Development Census of India. Vol. 1, Part IA(ii).
8. C.R. Pathak, and Khundu, A. (1973)."A Critique of the techniques for meaning the levels of Development." An Abstract presented to Symposium on Regional Disparities in India, First Indian Geographical Congress, New Delhi.

Since the levels of Development are not directly measurable one must select suitable indicators. A development indicator should represent some aspects of development such as efficiency, equality, participation, etc. because development involves changes in structure, capacity and output. But the choice of indicators is not an easy task; the proper choice of which in turns depends on theoretical assumption. Raza[9] has amply demonstrated the selection of such indicators which are really not related to expression of economic development in developing countries, but their selection is made on account of the influence of the conventional Anglo-Saxon Theories of regional development.

The coice of indicators of regional development should distinguish between the basic forces and derivative results, and base itself on the intrinsic relationship between spatial and sectoral process in a holistic frame. With such an approach, the groups of economic and social indicators, or individual indicators within each group, reflect different aspects of phenomenon which in spite of its complexity and its apparently fragmented character is essential one.[10]

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9. Moonis Raza and Chattapadhyay (1973). Regional Development, Analytical.

10. Framework, and Indicators working paper prescribed in the Symposium organised by CSRD, J.N.U.

For the measurement of the levels of agricultural development in valley the following indicators have been choosen for the study:

1. Cultivable area per agricultural worker.
2. Net sown area per agricultural worker.
3. Double cropped area to net sown area.
4. Net irrigated area to net sown area.
5. Wage rate of agricultural worker.
6. Consumption of fertilizer per hectatare of net sown area.
7. High Yielding Varieties to net sown area.
8. Per capita net agricultural production (in Rupees)
9. Ratio of Pumps to net sown area.
10. Per capita credit in Rs.
11. Tractors and other implements per district.
12. P.C. area under each crop to net sown area.

The first indicator will throw light on the availability of land to workers, which is the basic requirement in agriculture.

Net sown area per agricultural worker is also a good indicator of agricultural development, because all the cultivable area is not sown every year. The share of net sown area

to total cultivable area indicates the fertility of the soil. So net sown area per agricultural worker is a refinement of the first indicator i.e. cultivable area per agricultural worker.

Area under double crops to net area sown was regarded as a composite and expression of effort in three directions, area, yield and cropping pattern. Other things are similar, the more number of crops raised in a year from a piece of land, the higher is the level of agricultural development. The percentage of area sown more than once to net area sown is, therefore, an important economic indicator.

Net irrigation area to net sown area was regarded as an indirect measure of total inputs that go with irrigation, viz. better techniques, manure and fertilizer, seeds and higher level of farming activity and the urge for each crops.

A sizeable amount of the agricultural workers are agricultural labourers in the valley, their wage rate may be selected as a separate indicator. The higher the wage rate, the better would be their economic condition.

Area under HYVs to net sown area and area under cash crops to net sown area is a good indicator to assess agricultural change of a particular region. However, the gross value

of agricultural output per agricultural workers seems to be the best indicator of agricultural development. om account for total production as well as their market value.

Consumption of fertilizer, ratio of pumps, and tractors are expected to provide an estimate of agricultural development of a particular region.

After having assigned ranks to the observations in descending order of magnitude, the area-wise composite indices have been worked out by adding the ranks row-wise. The composite indices later have put in ranks row-wise. The composite indices later have put in ascending order to divide the former into 4 equal parts after housing found out the 1st quartile, medium and 3rd quartile. The levels of development have been assigned to each part as high, medium, low medium and low.

CHAPTER - V

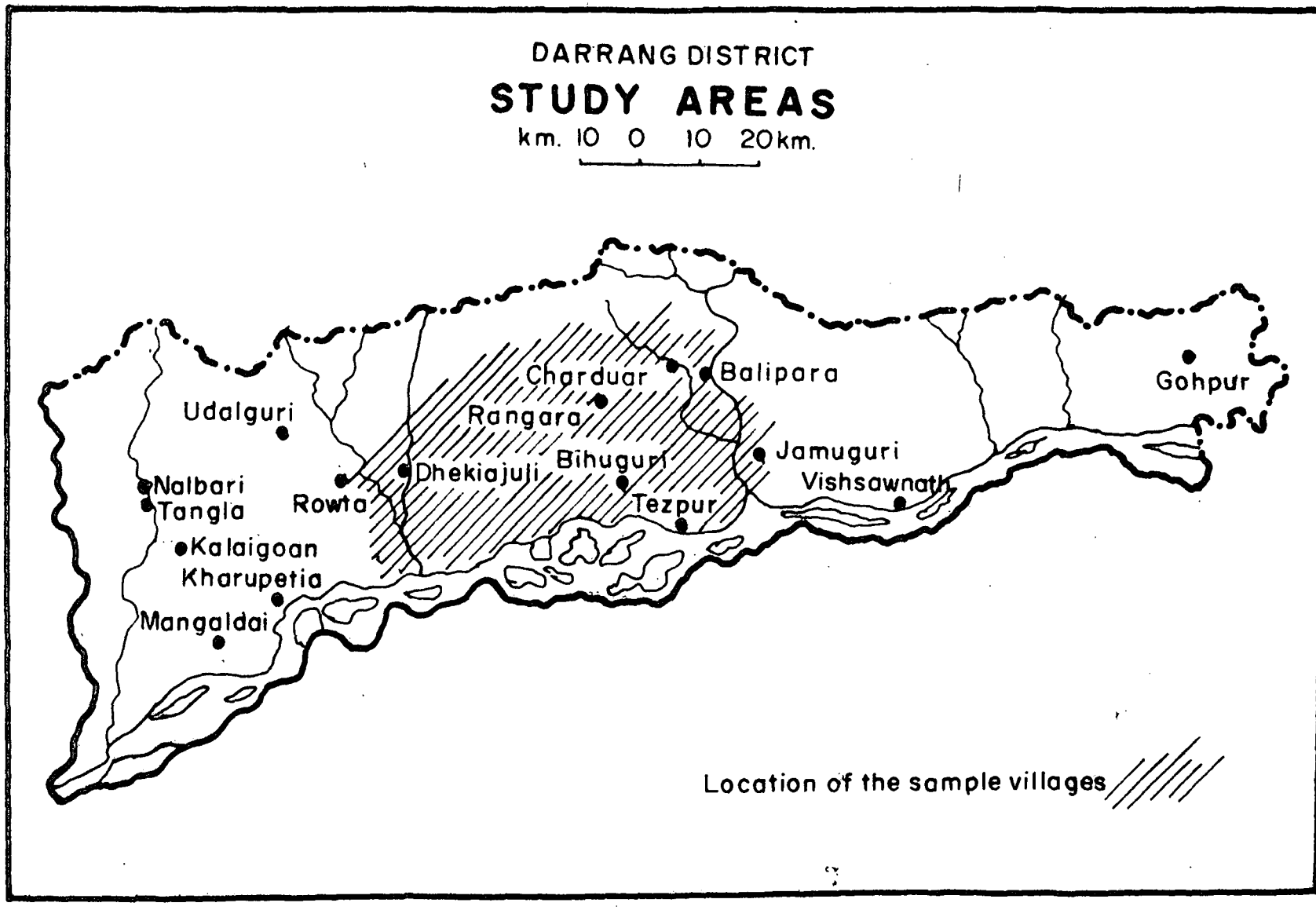
DARRANG DISTRICT
STUDY AREAS
km. 10 0 10 20km.
Charduar
Balipara
Gohpur
Udalguri
Rangara
Jamuguri
Bihuguri
Dhekiajuli
Vishsawnath
Nalbari
Tangla
Rowta
Tezpur
Kalaigoan
Kharupetia
Mangaldai
Location of the sample villages

Fig. 9.

DARRANG DISTRICT AND ITS AGRICULTURAL SITUATION: A CASE STUDY

The nature and structure of Geological formations have many indirect influences on agriculture development. Geological formations provide the basic materials and structures for the parent materials of the soil. Some aspects of Geology have however, an even more direct influence on agricultural activities, i.e.

(a) Engineering Geology

(b) Hydrology

(c) Environmental Geology

Geologically, Darrang District has Archean base from the oldest group of rocks to the youngest ones. The Archean rocks are in the form of metamorphic complex of gneisses and schists intruded by younger acidic and basic rocks in the northern part of Darrang.

Stratigraphically, the archaean group consists of bonded composite biotite sillimanite gneisses and schists, associated with feldspathic biotite, pyroxene, aplites. Younger coarse to fine-grained granite, gneissess intruded by massive perphytitic and coarse biotite granites, pegmatites and quartz veins unclassified older and newer alluvium comprising of high level terraces, the red and black soils and the recents alluvial deposits

is found in the Dalgaon-Sialmari and Kalaigaon and part of Majbat blocks. The new alluvial deposits get flooded in the rainy season and receive new fertile layers of silt. The newer alluvial soils consists of inundated yellowish to brownish or reddish clay with sand, gravel and boulder deposits in the lower course of the Brahmaputra areas as in northern part of Majbat, Kairabari and Udalguri blocks.

The district has a large potential for groundwater. The application of modern scientific knowhow and utilizing its immense potential for irrigation has greatly benefited the agricultural activity in the District.

Relief

The relief of a land surface affects agricultural landuse and development through altitude and slope. A high altitude and steep slope restricts the agricultural development.

The general relief of Darrang District is that of flat undulating plain with hilly terrain in the form of Himalayan foothills dominating the northern part of the district.

The general configuration of the district is that of a large open plain with a gentle slope towards the south. The south western part of the district low hills with a maximum elevation of 200 m. above sea level. The northern part of the

district is also characterised by the foothills region of the Himalayas. There is a sharp fall of the slope in the northern part of the Udalguri blocks than in the blocks of Khairabari and Majbat. Higher grounds extended over to 100 km towards north-west part of Udalguri and northern part of Khairabari and certain areas of Majbat. Besides these, all other areas have average elevation of about 100 m. Although it is a plain area, local difference in elevation are found in all the blocks. Among the blocks, Majbat experience higher, ground elevations and next to it is Dalgaon-Sialmari, part of Khairabari, Kalaigaon and Udalguri and the whole of Sipajhar have low ground easily prone to floods. The level plain is broken by sandy or coarse alluvium particularly in the Majbat and Dalgaon-Sialmari blocks. Higher grounds of old alluvium have covered some parts of Kalaigaon Chapari Dalgaon-Sialmari, Majbat, Udalguri and Khairabari blocks.

The relief of the northern part of the Darrang District 150m to 450 m within the boundary areas, it plays 450 m to 950 m and above. These areas are agriculturally not well developed due to the rugged terrain and slopeness character of soil. In the plain areas, relief is the important factor for agricultural development.

Climate

Climate is the one of the major factors in determining the pattern of agricultural development, for the capability of region to produce crops is directly dependent upon climatic and soil condition beside other factors. Climate introduces regional differences in the crop productivity and hence variation in agricultural landuse and agricultural activity.

The climatic condition prevailing in Darrang district is characterised by Tropical monsoon type with well defined seasonal variations. Heavy summer monsoon rainfall is followed by drought condition in winter. In between these two, pre-monsoon shower and retreating monsoon are interspersed. More than 80 p.c. of the annual rainfall occurs between May and September.

Along with the seasonal characteristic of the precipitation there are marked spatial variations within the district between the blocks and from season to season. Thus introducing latest features resulting in differential landuse within the district.

The average annual precipitation of the district is about 1943 m (average of last 15 years). The northern part gets substantially higher rainfall than the southern part. There is a marked difference in the variability of rainfall.

Degree of reliability of rainfall is very high in Khairabari block, high in Dalgoan-Sialmari, Kalaigoan Chapari and Sipajhar blocks. While it is average to moderate in Udalguri and Majbat blocks.

Some of the constraints that have been induced by the climatic region and hence on pattern of landuse are: (1) Heavy and delayed monsoon resulting in damage to standing kharif crops and delayed sowing of rabi crops. (2) Frequent and long interruption in the monsoon damaging the kharif crops, hereby indicating the need for irrigation facilities. (3) Heavy summer precipitation causing floods and soil erosion.

Temperature

Temperature is also an important factor for agricultural landuse and development. Adequate temperature is required to grow the crops. In the summer season the temperature increase upto 31°C. In the winter season it decreases upto 16°C.

Drainage:

In the drainage system of Darrang district the Brahmaputra river has the dominant role, offering an unique example, when considered along with the other rivers of Assam as well as India. The availability of water for agriculture is one of the essential bases for any region. The whole district is covered

with a network of drainage channels which flow from the northern hills towards the South to the Brahmaputra river. The important tributaries of Brahmaputra are Barnai, Nanoi, Saktola, Kuapari, Naopani, Bega, Galanadi, Sukhajam, Maradhansiri, Dhansiri, Panchnai. In the northern part the rivers are Sukla, Dinila, Kulsi, Lakhsmi, Chandana, Dalphang, Rowta.... In summer heavy rain occurs in the hilly region and rivers carrying boulders, sandstones, pebbles, sand come down with high speed and full volume. At that time water level goes up and down with rainfall variation. In the winter season most of the drainage channels are dry up except Dhansiri, Napani, Bornoi and Panchnai. Farmers are affected by the full volume of drainage water and also dry season. Besides drainage, some beds are located within the region but these are not useful for peasants. They are used only for fishing purposes. In winter season peasants use the beds for rabi crops, with the water lifted to the agricultural fields by power pump.

Dams are constructed in some rivers and streams for irrigating fields. Now on Dhansiri river, the biggest dam has been constructed for irrigating the whole Udalguri block and some parts of Majbat and Dalgaon-Sialmari blocks. In Sipajhar block only one dranage, Narikali, exists for outlet the water.

Soil

Soil in general terms, are that portion of the earth's surface consisting of disintegrating rock and humus content (organic materials). They are the combined result of geological parent materials, climate, topography, living organisms and time. The process of soil formation is slow, but soil degradation and erosion can be rapid. Herein lies the crux of soil management requirements to protect and save the soil as it is most difficult to replace.

In agricultural operation soil is of the utmost importance as it is the cradle for all crops and plants. Climate is one of the most effective factors in soil formation and its fertility. Soils and their properties are also influenced directly and closely by topography, relief, altitude, parent materials, living organisms and time.

Man uses the soils with the purpose of obtaining maximum profit and often without caring much about its future fertility. At present the importance of soils has been realised and therefore keeping the soils in sound health is the major concern of the farmers and soil scientists in the country.

Agricultural landuse

In agricultural practices land classification is a very recent method to modernise agriculture through the adaptation

of scientific methods to derive maximum benefits from every type of land whether agricultural or non-agricultural. Land classification for landuse planning and agricultural development should be based on soil fertility and characteristics.

In land classification two sets of factors are important, viz. the physical, chemical and biological factors on the one hand, and economic and social factors on the other. Soil results on account of the combination of the various physical factors which cannot be profoundly altered by man.

As far as the earliest investigations are concerned soils may be traditionally classified into five broad macro-regions related to major regional complexes - of climate and relief:- The alluvial soils, the sandy soils, the regur soils or the black soils, the laterite soils and the red soil.

The soils of the whole Darrang district is constituted by alluvial type of soil. The rivers have been carrying out various kinds of soil-forming materials from the Himalayas and depositing these year after year on the region from the foothills to the Brahmaputra. The river Brahmaputra also deposits huge amount of silt and sediments on the neighbouring areas towards the South of the district.

On the northern side, the district is constituted by rocky soil of big boulders and stones and are suited for

growing luxurious vegetation and valuable trees within these areas. Agriculture is not possible due to soil erosion and the rocky nature of the soil.

Geologically, the district is formed of the alluvium deposits of the Brahmaputra and its over twenty significant tributaries. The alluvium soils are divided into three groups:

a) Recent alluvial
b) Old alluvial (river ering)
c) Old alluvial (mountain valley)

The recent alluvial soils are confined in the low-lying tracts of the flood plains where tributaries carriages new silts are deposited in every year. These soils vary from sandy loams to silt and clay-loam, having less acidic contents. Recent alluvial soil is suitable for the cultivation of rice, jute, pulses, mustard seed, onion, potato and vegetables. These soils consist of phosphates, potash and calcium. This area also occupied by grasses and it is used for grazing cattle and buffaloes reared by the peasant and farmer.

The old alluvial soils are found at tracts where these areas are free from floods. Old alluvial soils are divided into two types, i.e. (a) the soil which is confined in the mountain valley are covered by the old alluvial soils. These soils are found on the southern part and eastern part of Majbat

block and middle of Kalaigaon block. This type of soils are the medium content of chemical composition and favourable for ideal for rice, sugar cane, fruits and vegetable cultivation; but pulses and mustard seeds are not conducive. (b) The red soils are red-yellow loams. These are occurred on the sloping hill-side, differ greatly in fertility, but generally have low fertility rating. The rivers carry gravel and sand deposited within the wider areas. With these type of soil produce a number of crops and is also suitable for growing trees and plant and grasses, while some parts are used under irrigation. The crops like maize, Tapioca, pineapple and fruits are grown in these areas.

On the basis of soil formation the entire Darrang district on Brahmaputra river plain, landuse changes are varied from the point of agricultural practices. Though landuse practices within the valley region is very high, and agricultural practices is the main source of national income, which is 45 P.C. of the national income.[1]

Classification of land

Land classification is largely based on the quantity and intensity of the use of land. The total land area geographically accessible for major uses is classified into six broad categories (fig.) within Darrang district.

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1. Ali Mohammed. Studies in Agricultural Geography.

i) Net sown area

ii) Forest area

iii) Cultivable land

iv) Other fallow land

v) Present fallow land

vi) Others

Table 1: Area under land utilization 1980-81 in P.C.

Sub-Division	Net sown area	Forest	Cult. land	Other fallow	Present fallow	Others
Mangaldai	12.40	4.4	63.3	3.00	10.00	4.9
Tezpur	27.9	28.0	33.3	0.1	7.9	2.0

Source: District Statistical Office (Tezpur).

i) Within the Darrang District there are significant variations if we take P.C. of N.S.A. of the two sub-divisions. N.S.A. in Mangaldai is only 12.40% as compared to Tezpur where it is 27.9%. The total geographical area of Tezpur is also more than Mangaldai division. This shows that the net sown area in Tezpur sub-division is more than three times higher than that of Mangaldai.

ii) The area figures under grazing land or a crop within the forest area also included in the area under forests. Forested area is also higher than Mangaldai sub-division.

Forests occupy significant proportions in the uplands having favourable rainfall in Tezpur sub-division.

iii) Cultivable land area in Mangaldai sub-division is much more than in Tezpur sub-division Mangaldai sub-division is situated near the bank of the river Brahmaputra and the area under cultivation is more. The fertile land is available near the riverine area. The figure also shows 63.3 P.C. in Mangaldai and 33.3 P.C. in Tezpur.

iv) Other fallow land comprises all lands, which were taken up for cultivation but are temporarily unsown for a period of not less than one year and not more than five years. The reason for being long fallowing may be manyfold but the significant one are limited economic means of the farmers, restricted and underdependable supply of moisture and unremunerative character of agriculture. Other fallow land in Mangaldai sub-division is only 3 P.C.; within Tezpur it is very insignificant.

v) Present fallow lands which are left unsown during the current agricultural year only to regain fertility and also remained uncropped in the short-term for lack of moisture and economic reasons. Present fallow land is comparatively higher in Mangaldai sub-division than in Tezpur sub-division which is 7.9 P.C. and 10 P.C. respectively.

vi) Other land areas are land not available for cultivation, area under non-agricultural use and barren and uncultivable land. Area under non-agricultural use covers all lands occupied by settlements, roads and railways, beds of streams, ponds and canals. Other cultivable land includes, permanent pastures and other grazing lands, miscellaneous tree crops and groves, cultivable waste land.

Population

Rapid increase of population (both natural and otherwise) has brought significant changes in the rural landscape in the district. These changes are not only evident in the growth and development in agriculture but also in the cropping intensity and pattern of the population of the district has been increasing at the rate of 124 P.C. from 1951 to 1971. The following table No. 2 shows the population change in the district from 1951 to 1971. This rate of increase is higher than the entire state of Assam, which during the same period experienced a consolidated growth of 88.71 P.C. The causes of these increases can be broadly classified into large scale immigration into the state particularly from Bangladesh, and corresponding natural growth.

Table 2: Blockwise population increase in Darrang.

Name of the Blocks	1951	1961	1971	P.C. increase
Khairabari	59,958	95,891	1,46,270	142
Sipajhar	60,259	76,618	99,386	67
Kalaigoan-Chapuri	78,103	1,11,505	1,54,691	99
Dalgaon-Sialmari	83,735	11,400	1,55,244	86
Udalguri	54,772	90,661	1,63,132	199
Majbat	65,674	93,949	1,30,800	95

Census of India - 1951, 1961, 1971.

The population growth in Darrang district has been constantly on the increase between 1961 and 1971. The average growth rate was about 46.15 P.C. as compared to 4.95 and 24.80 p.c. for the state, and country respectively. In the corresponding period net sown area increase by 22.62 p.c. The man-land ratio was disproportionate as more than 88 p.c. of the district population area is predominantly rural in character. Thus this clearly indicates that with every growth in population there is a corresponding decrease of per capita holding of cultivable land. The period between 1971-81 does not present as very encouraging picture with regard to per capita land holding.

Table 3: Distribution of peasant population in Darrang District

Blocks	No. of peasants	Total peasant population	Rural population	1961 P.C. to rural population
Khairabari	15,107	71,757	78,483	92.30
Sipajhar	14,969	71,102	76,618	92.20
Kalaigaon Chapuri	19,256	91,466	1,02,245	89,22
Dalgoan-Sialmari	14,739	70,000	1,06,132	66.04
Udalguri	13,617	64,680	70,080	92.86
Majbat	1,484	67,374	84,525	78.81
	1971			
Khairabari	21,639	1,02,785	1,28,252	80.30
Sipajhar	14,774	70,176	99,386	70.89
Kalaigaon	23,488	1,11,473	1,42,216	78.16
Dalgoan	25,769	1,21,402	1,41,607	85.66
Udalguri	20,174	95,826	1,23,410	78.06
Majbat	19,234	91,789	1,17,828	78.00

Census Handbook Darrang District 1961/71.

The district as a whole presents 0.27 hectare of per capita cultivated area (1971) as compared to 0.16 hectare 0.29 hectare for Assam and India respectively. As the scope of employment opportunity is limited, the only alternative that seems to be available is the absorption of increasing

population in agriculture and allied activities. This consequently increases the pressure on cultivated land, and hence on agriculture; as well as the existing land-use pattern. This is clearly evident from the decreasing per capita holding of cultivated land from 0.34 hectare in 1961 to 0.27 hectare in 1971. Correspondingly the population density per hectare of gross area sown has increased from 14.3 in 1961 to 5 in 1981. Whereas the population density per hectare gross sown area in the country is only 3 p.c. Thus the availability of agricultural land in the district has become critical.

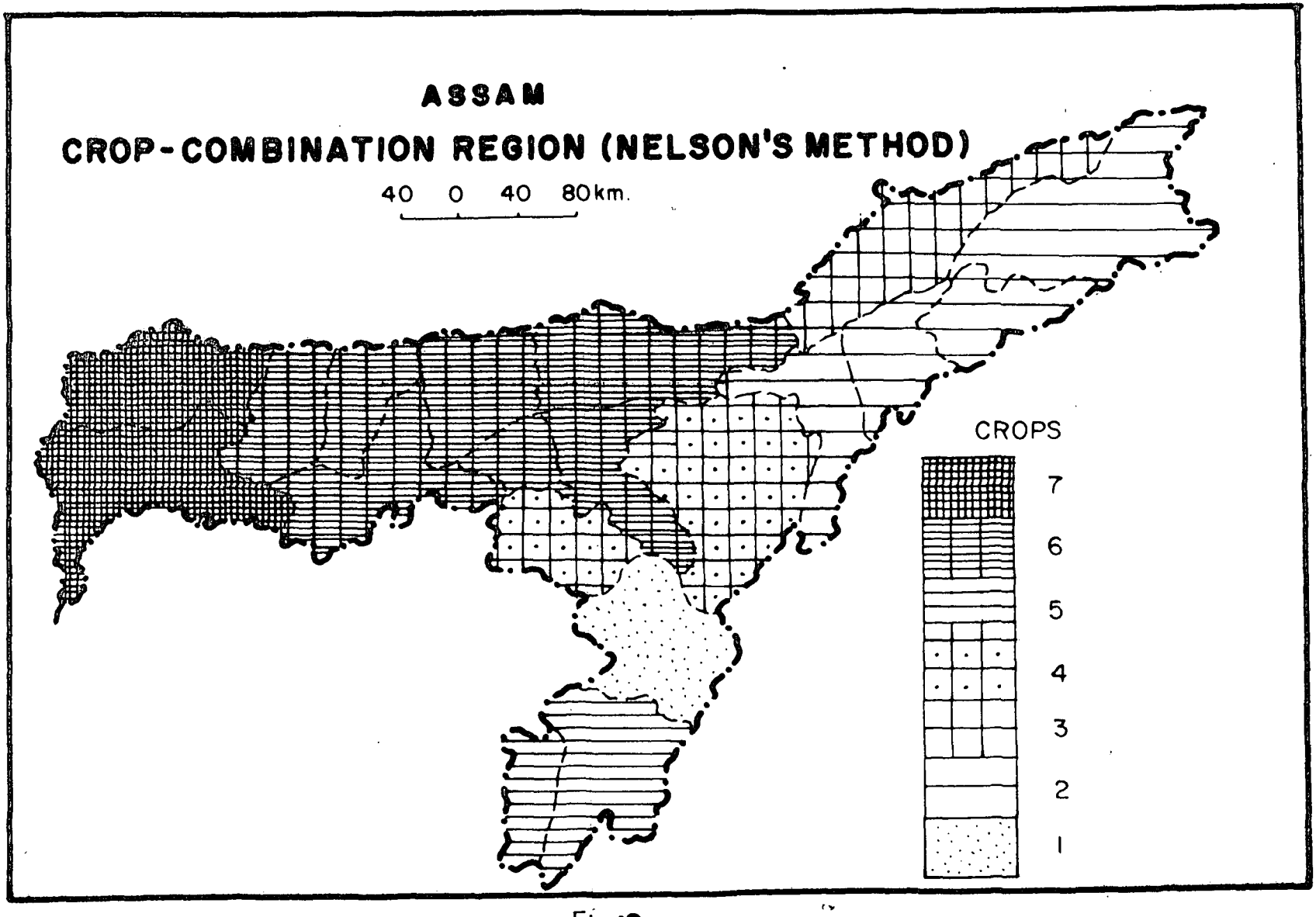
The p.c. of literacy in rural population indicates the possibility of changes in agricultural activities and diversities. But in this respect the district is backwarded. The p.c. of literacy rate in 1961 was 28.05 and 1951 was 11.82 p.c.

CROPPING PATTERN AND CROP COMBINATION

Cropping pattern

Cropping pattern means the proportion of area under different crops at a particular period of time. The gross area under crops in Darrang district increased from 1.88 lakh hectare in 1961 to 2.75 hectare in 1981, a 46.28% increase over the last two decades.

The cropping pattern changed in Darrang district due to the importance given to foodgrain crops that occupy a maximum


ASSAM
CROP-COMBINATION REGION (NELSON'S METHOD)
40 0 40 80km.
CROPS
7
6
5
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3
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1

Fig.16.

hectare-aga - in relation to total cropped area. In 1981, area under foodgrains was 1.981 lakh hectare (72.00 p.c.). Whereas in 1961, it was only 1.30 lakh hectare (69.15 p.c.) to total area. Crops like oil seeds covered 9.14 p.c.,jute 5.80 p.c., and other crops like sugarcane, potato, sweet potato, chillies and vegetables etc. were also found to be grown in lesser percentages.

Table 4: Crop Combinations 1961 - 1981 (Nelson's Method)

Blocks	Crop Combination											
	1961				1971				1981			
	1st	2nd	3rd	Total	1st	2nd	3rd	Total	1st	2nd	3rd	Total
Khairabari	-	-	RW, RS, S	3	-	-	RW,Rs P, S	4	-	S,M	Rs, W, P	5
Sipajhar	-	Rm,S	RW,P	4	-	Rs	RW,Rs, P, S	4	-	-	RW,W, P, S	4
Kalaigoan Chapuri	-	P,V	RW, Rm	4	-	P,J	RW,S	4	-	J	RW, W, P, S	5
Dalgoan Sialmari	-	Rs,Rm J, Se	P	5	W,Rm	Rs,J, Se	F	6	Rm	Rs,W, J,Se	P, V	7
Udalguri	-	RW	F,V	3	-	F	RW,V	3	-	Rw,F V, M	-	4
Majbat	-	Rs,F	J,S, V,Se	6	-	J,F	Rs,W, S,Se,V	7	-	J.F.	Rs,P, S,V,Se	7

Abbreviations: RW - Winter Rice, RS - Summer rice,
J - Jute, S - Sugarcane, V - Vegetable,
Se - Seramum, M - Maize, W - Wheat,
Rm - Rape & Mustard seed, P - Pulses,
F - Fruits.

Crop combination (regions) is an important aspect in agricultural geography. The crops are generally grown in combinations and in a particular time and particular place two or more crops are grown simultaneously. The distribution maps of individual crops are interesting and useful tools for agricultural geographers.[2]

For combination, different methods have been applied for analysis. There are minimum deviation method, maximum deviation method, quartile method, mean positive method, standard deviation method and variability choice methods, etc.

In the present study of crops combination, standard deviation method has been used. This method was introduced by H.J. Nelson (1955). Nelson calculated the standard deviation and plotted in 3 degree of deviation from the mean for each fraction. Three degree variation are Mean +1SD, Mean +2SD, and +3SD. After that all the fractions are grouped together, and these over +1SD marked recalled as 1st over +2SD; 2nd and +3SD as 3rd. The p.c. of any fraction is less than 1 which are not counted or considered.

Nelson's ranking method is a suitable method for geographical analysis of any region. For the crop combinations based on this method is more objective, well defined and

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2. Hussain, M. Agricultural Geography, Agricultural regionalization, pp.120.

nearer the truth except for the shortcoming described in this case of Pownall's method (Siddqui 1967).

For finding out crop combination mean, standard deviation method has been applied and 11 crops are taken for study.

From the eleven crops, first, second and third rank are taken for crop combination. From the table, we can see that in 1961 there are no crops in the first rank in any of the blocks. Even in the second rank no crops are found in Khairabari block. Rape and mustard seed and sugarcane in Sipajhar block. Pulses, summer rice, rape and mustard seed, jute, seamum, winter rice in Kalaigoan Chapuri, Dalgoan-Sialmari, Udalguri and Majbat blocks. Vegetables and fruits are found in second rank in Kalaigoan and Majbat blocks.

The food crops productivity dramatically changed from 1961-81 period, while other crops like oil seeds fruits decreased by 15.82 p.c. to 12.00 p.c. from 1961 to 1971. This decrease was largely due to economic factors. But the production of oil seeds and fruits increased to 11.13 p.c. in 1981. The fibre crop production increased only in Dalgaon, Sialmari and Majbat blocks.

Within the Darrang District, rice is the dominant food crop. In all the blocks, bullocks are mainly used for ploughing

and levelling of the field. Such type of farming along with other traditional practices are evident in the district. Thus, cropping pattern is divided into two groups - Kharif and Rabi crop.

Kharif crops

Kharif is an important agricultural season and in the Darrang district. Where nearly three-fourths of the cultivated land is under cultivation, the principal Kharif crops are rice, maize, sugarcane, vegetables and oil seeds and others.

RICE CULTIVATION

Rice is the most extensively cultivated crop in the district. It is the staple food of nearly 95 p.c. of the population. Rice constitutes the largest area of 29.9 p.c. of the total geographical area of the district. It is grown in low-lying areas of Brahmaputra plains of heavy clays. It requires heavy rainfall and high temperature. So the district fulfills the norms of rainfall and temperature for rice cultivation.

Within the Darrang district, rice cultivation of three types are practised. i) Summer rice (Kharif season), ii) winter rice (Rabi season), iii) Autumn rice.

Summer Rice

Summer rice is cultivated mostly in the Mangaldai sub-division, about 73% of the district. The rice is sown in the

month of March and April, by broadcast method, and is locally called 'Ahu'. From the given table we can see the time period, and production of the summer rice cultivation.

Table 5: Summer Rice area and production

Distric/ Sub-Division	Area in hectare			Production in Ton		
	1978-79	1979-80	1980-81	1978-79	1979-80	1980-81
Mangaldai	74.74	72.19	72.46	76.09	67.59	73.54
Tezpur	25.25	27.81	27.34	23.54	32.41	26.66

Source: District Agricultural Statistical Handbook, Mangaldai.

The table shows that the percentage of area under summer rice cultivations remained more or less same in both the sub-divisions of the district. But there was a slight variation in the p.c. of the total production.

Rice covers 71 p.c. of the total cropped area during 1961 to 1981. The area under rice had increased from 69.34 p.c. to 71.00 p.c. of the total cropped areas. The reason for this increase was increasing pressure on land, that led to the reclamation of waste land, clearing of forests, etc. The increase was also due to introduction of multiple cropping by the immigrants from Bangladesh.

Overall increase in p.c. was found in Sipajhar, Kalaigoan-Chapari and Udalguri blocks, while there was a general decrease in other blocks. The area under rice cultivation

increased and the total production was also found to be high. There has been a constant effort by the farmers of the district mainly the immigrants to increase the hectarages production and productivity of rice.

Winter Rice

The winter rice which is a late maturing rice, covering an area about 20,000 hectares within the Darrang district. Two methods can be practised for its cultivation viz. Broadcasting and transplanting.

The seedlings are uprooted from the nursery where they are raised for about four weeks and transplanted in the well ploughed fields.

Table 6: Area and production of winter rice.

District/ Sub-division	P.C. of Area in Arc			P.C. of production			Average yield kg per hectare
	78-79	79-80	80-81	78-79	79-80	80-81	
Mangaldai	48.12	48.00	48.23	48.15	44.69	52.01	1,050
Tezpur	51.88	52.00	51.77	51.85	55.31	47.99	990

Source: Agricultural Statistical Handbook, Mangaldai.

The table shows that the Tezpur sub-division has a higher p.c. of area and production of winter crop than Mangaldai sub-division.

Autumn Rice

Autumn rice is known as Boro. This has been done by transplantation method. It grows only on the river banks and marshy areas in the months of March, April and harvested in the month of July-August.

Table 7: Area and production of Autumn rice 1978-81.

Sub-Division	% area in hectare			% of production in tonnes		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	42.31	33.33	41.09	25.20	37.36	41.47
Tezpur	57.69	66.67	68.91	74.79	69.14	58.23

Source: Agricultural Statistical Handbook, Mangaldai.

The production of this rice is higher in Tezpur than in Mangaldai. In 1978-79, the production is three times higher in Tezpur than in Mangaldai.

Wheat

Wheat is a rabi season crop, and recently introduced in the district. Its hectarage increased from 0.09 p.c. to 2.10 p.c. during 1961-81. The indigenous peasants of the district were not habituated in taking wheat products. After the introduction of high yielding varieties of rice which is an early maturing variety too, the fields lay vacant after the harvest. So wheat was introduced in the same plot of land. The high

concentration of wheat cultivation is found in Dalgoan, Sialmari, Majbat and Kalaigoan blocks.

Table 8: Area and Production of Wheat 1970-81.

Sub-Division	Percentage of Area in hect			Percentage of Production in tonnes		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	41.17	41.40	48.48	37.75	30.16	50.70
Tezpur	58.83	58.60	51.51	62.25	69.84	49.30

Source: District, Agricultural Handbook, Tezpur.

There is a decrease in Tezpur sub-division because of irregular distribution of rainfall and area for rabi crops' cultivation. Whereas in Mangaldai the production and areas are increasing which is due to reclamation of cultivable land; introduction of improved high yielding varieties of seeds and methods.

Rape and Mustard Seeds

These two are also an important crops of the district. They are cultivated for local consumption only. The total hectarage and percentage to total cultivation increased during 1961-81, is 12,893 hect (6.95%) in 1981. Percentage of increase to total cultivated area was found in Khairabari, Kalaigoan, Chapari, Dalgoan, Sialmari and Majbat blocks, but decreased in Sipajhar and Udalguri blocks.

Table 9: Area and Production of Mustard & Rape Seeds

Sub-division	P.C. Area in Hect			P.C. of Production in Tonnes		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	66.05	63.57	70.02	60.21	53.73	61.07
Tezpur	33.15	36.43	29.48	39.79	46.27	38.93

Source: District Statistical Handbook, Mangaldai.

In Tezpur sub-division, the areas under Mustard and Rape seeds are less than in Mangaldai sub-division. In 1978-79, area under these two seeds was 33.15 p.c. and the production was 39.79 tonnes in Tezpur but in 1980-81 the area and the production are decreasing in comparison to the previous year. But in Mangaldai both area and production are quite high, higher than Tezpur. This is due to the geographical factors and soil fertility. In Mangaldai during 1978-79, the area was 66.05 p.c. and the production was 60.21 tonnes but there is a high decrease in the year 1979-80 but again it picked up in the year 1980-81.

In comparison to area and production, Mangaldai sub-division's yield of rape & mustard seeds are more in Tezpur. Soil characteristics of Mangaldai is not favourable for those seed cultivation. But in Tezpur because of other cereal crops, specified area is limited for this cultivation.

Pulses

In the Darrang district pulses are sown in rabi season, in the month of October, December. The major pulses are black gram, green-gram, lentil gram, peas and kheswari etc. There was an insignificant increase in hectarage under pulses during 1961-81. But the p.c. of area to total cultivated area decreased from 5.83 p.c. to 4.20 p.c. in the same period.

Pulses are grown mainly in the river banks; plain areas and newly settled areas adjoining tributaries of Brahmaputra system. About 87% of the area under all pulses are occupied by the rabi pulses. The average hectarage under pulses in 1961 and 1981 are 10,520 (5.83 p.c.) and 11,344 (4.20 p.c.) respectively.

Crop hectarage-decreased in the Dalgoan, Sialmari and Kalaigoan-Chapuri blocks. Whereas it increased in Khairabari, Udalguri, Majbat and Sipajhar blocks. Moreover, yield per hectarage in this area is not good. Hectarage pulses increased in the northern parts of the district are quite significant.

Table 10: Area and production pulses cultivation

Sub-division	P.C. area in hect			P.C. Production		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	47.43	55.66	57.76	48.37	59.34	61.49
Tezpur	32.57	44.34	42.24	51.63	40.66	38.51

Source: District Statistical Handbook, Mangaldai.

There is a constant increase in area and production in Mangaldai sub-division and decrease in Tezpur. Every year Tezpur is getting damaged by the Brahmaputra floods; and on the other hand, Mangaldai is getting benefits from the floods which carry alluvium to the plains for cultivation.

Sugarcane

Sugarcane is an important tropical crop of the district. Sugarcane is quite adaptable to varying soil conditions but loamy soil, with good drainage and highly acidic to alkaline soil are best suited for this crop.

Although sugarcane is cultivated in all the blocks of higherpercentage are found in Sipajhar, Khairabari, Majbat blocks. Percentage of area under this crop decreased from 1.02 p.c. to 0.98 p.c. during 1961 to 1981.

The reason for decreasing area under sugarcane cultivation are - agricultural lands are more profitable for cultivation of cereals than sugar-cane cultivation.

Table 11: Area & Production of Sugarcane cultivation 1978-81.

Sub-Division	P.C. area in Hect			P.C. of production in tonnes		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	32.97	31.91	32.46	24.57	30.36	27.19
Tezpur	67.03	68.09	67.53	75.73	69.12	72.81

Source: District Statistical Handbook, Mangaldai.

Within the Mangaldai sub-division percentage of area under sugarcane cultivation is more or less same with those three years of data.

In Tezpur the production and area is more than the Mangaldai sub-division.

Jute Cultivation

Jute is the fibre crop of great use in the manufacture of Canvas, bags etc. The best fibre is obtained from the crop raised on loamy soil, while clay soil produces the highest yield. In the district of Darrang jute has attained a considerable importance when compared with state as a whole average of 16.52 p.c.

Jute cultivation within the Darrang district is done in Brahmaputra alluvial plain areas without irrigation facility. The higher concentration of jute cultivation is found in the blocks of Dalgoan, Sialmari, Majbat and Kalaigoan and Chapuri.

Table 12: Area and production of jute cultivation 1978-81.

Sub-division	P.C. of area in hect			P.C. of production in tonnes		
	1978-79	79-80	80-81	1978-79	79-80	80-81
Mangaldai	68.58	68.34	69.64	55.95	51.54	63.77
Tezpur	31.42	31.66	30.36	44.05	48.46	36.23

Source: District Statistical Handbook, Mangaldai.

In Mangaldai sub-division the area under jute cultivation is double that of the Tezpur sub-division. The production is more than Tezpur. From the table, it reveals that the production during 1979-80 is decreasing in Mangaldai, which is due to the affect and droughts. In 1980-81, again it is increasing upto 63.77% due to adequate climatic conditions and use of high yielding varieties and the facilities.

But the production and area under jute is quite low in Tezpur in comparison to Mangaldai. This is due to flood and low fertility of land.

Maize

Maize is also one of the staple food crops of the people of the Darrang district. For this crop well drained and light soils are the best suited rather than the heavy clay or clayey loam. Maize is not popularly grown in all the parts of the district. Areas generally inhabited by the ex-tea garden labourers and the Nepali farmers in the Khairabari, Majbat and Udalguri blocks are cultivable. Area covered by maize increased from 0.13 p.c. to 0.37 p.c. from 1961-1981. Northern most part of the district inhabited mostly by Nepalese and having marshy and sandy soils are suited for maize cultivation.

Agriculture has a wide activity within the Darrang district. The socio-economic and cultural constraints have

imposed varying limits on the agricultural use of land and the crops grown.

Within the Darrang district, the State Government has taken a lot of steps in increasing the production of agricultural products. The technological changes and implements of high yielding varieties of seeds are the main cause in agricultural development of the district.

SOCIO-ECONOMIC STUDY OF THE SAMPLE VILLAGES

The Lower Brahmaputra Valley has become a crucial region for its heterogeneity during the past 50 years. The main stream of immigration is due to the movement of East Bengal (Bangladeshi) Hindu and Muslim refugees from East Pakistan in 1947. The immigrants have permanently settled and thereby have given a heterogeneous characteristic to the population composition and socio-economic as well as to the cultural landscape of the valley. The valley itself is a mosaic of physical diversities, having complex socio-economic and cultural landscape with great economic potentialities.

The region has a humid monsoonal climate with extensive forest cover virgin land and the main valley is composed of rich alluvial soil. In fact, it is a land of promise providing extensive area for pioneer settlement and agricultural landuse.

An attempt has been made to examine the existing pattern of immigration to the Lower Brahmaputra Valley and its effect on the agriculture of the area. Also, it has been attempted from the geographical point of view to discuss the various spatio-temporal aspects of migration streams and changing character of the agricultural pattern of the valley. The prime concern of the study is on the concentration and combination

of the important crops and the agricultural productivity pattern of the valley.

To have a broad understanding of the pattern of development of agriculture and immigration in the Lower Brahmaputra Valley, in general, and Darrang district in particular, it is necessary to discuss the social, economic and cultural profiles of the farming community. The new innovations in agriculture concerning the introduction of HYV of crops, etc. may have different types of impacts depending upon the differences in the economic and socio-cultural characteristics of the community. The response of people to new ideas or innovations is basically conditioned by their culture.[1] The success of the introduction of innovations is, to a large extent, determined by the absence of inbuilt cultural resistances. If the technological innovations were capable of brining socio-cultural changes and needs were generated among the people where such changes were welcomed by them, it is imperative to have a prima-facia understanding of their socio-economic and cultural profile. The study of the sample villages has been taken with a view to understand their existing characteristics.

Education

Formal education plays an important role in communicating new ideas and information and therefore, it helps in the

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1. I.C. Rajagopalan and Jasbir Singh (1971). Adoption of Agricultural Innovations, Delhi, p. 13.

development of agriculture. Education is generally believed to be helpful in elimination of superstitions and widens the mental horizon of a person and thereby prepares or predisposes him to be receptive to new ideas.[2] Nevertheless, a lot depends upon the quality of education too. Quite often, mere literacy helps a person to be influenced by new ideas and enables him to read newspapers and other periodicals and also to keep his farm and household accounts.

The sample villages which have been considered are - Bhutpur, Gorsinghbihia, Borguri, Ghutlung, Tengabasti, Kurkuri, Uriamguri, Mora, Belsiri and Somdhara.

Villages dominated by immigrants and others dominated by natives has been selected to consider the specific changes in the pattern of agricultural activities. The above villages have been selected by keeping in view the need to observe various spatio-temporal aspects of migration streams and the changing character of the agricultural pattern.

Among the 324 households of the 9 sample villages surveyed 255 cultivators are illiterate and 2 are highly educated. The educated and illiterates have been given different weightage for the purpose of composite index. The scores have been calculated by assigning different weightages to the different levels of education such as primary, middle English, higher

secondary, intermediate, graduation and above. The weightage assigned to the various levels of education are presented in the table 1.

Table 1: Weightage assigned to different levels of education

Levels of education	Weightage
Illiterate	0
Primary	1
Upper	1.25
Middle English	1.50
Higher Secondary	3
Intermediate	3.5
University Education	5.5

The following table 2 emerges out of the arbitrary classification of the educational levels attained by the farmers of the sample villages of Darrang district of the Lower Brahmaputra Valley. This exhibits the fact that the maximum number of cultivators in the Darrang district fall within the illiterate and low categories of educational status. A number of cultivators are illiterate and fall under low and medium categories respectively. The number of highly educated farmers

receiving college education and more are just 2 persons among these 324 households.

Table 2: Frequency table showing the educational status of farmers from the 9 sample villages of Darrang District.

Class group of scores of education level	Frequency	Educational level	P.C.
Less than 1	110	Illiterate	110
1 - 2.5	189	Low	299
3.0 - 4.0	23	Medium	322
4.1 - and above	2	High	324

Education being a positive source of knowledge exposes a person to new ideas and makes it easier for him to understand the modern techniques involved in scientific agriculture. It shows that educated farmers will always have better output per unit area than the illiterate and relatively lower educated farmers. Bhatt[3] says - "technical knowledge itself is an important input. An investigation on the importance of technical knowledge among farmers who keeps up with modern ideas will have a better income than a neighbour who is in all other ways

3. U.N. Bhatt, 1975. Technical Knowledge as a determinant of farmers income. Economic Theory and Practice in the Asian Setting. Vol. 3. Economic and Agriculture (Edited) New Delhi, p. 45.

equally endowed but without upto date technical education. This indicates that technical knowledge is a real economic source."

In the sample 324 households it is found that 225 are illiterate. Therefore though there are lots of prospects to improve their agricultural pattern and productivity, due to lack of proper education they are not in a position to improve their agricultural activities. Till today farmers are using traditional implements. The HYV of rice is still not yet very popular among the farmers. Irrigation facilities are still lacking in the villages. Use of modern techniques like tractors and other improved seeds and implements are lacking in most of the villages. These are due to lack of education and awareness of agricultural programmes. This is also due to exploitation by the zaminders of the village. Most of the farmers are in neck-deep debt. They borrow money from money-lenders and zamindars during the off season. During harvesting season, the zamindars buy their crops at cheap rates. These happen due to lack of education.

Age

Age of the head of the household or the principal cultivator in the farm family seems to have had a considerable bearing on the adoption of innovations such as upto date methods

and techniques in agriculture. The hypothesis that the younger generation will be more enterprising and receptive to innovations in agriculture than that of their older counterparts can also be examined in case of the sample villages of Darrang district. It is seen that most of the cultivators from the sample villages are older in age. This also shows that the sample villages have no innovations in agriculture. There are very few households who were a little aware of innovations in agriculture and implements. Therefore, these villages do not show much progress in agricultural development.

Table 3: Frequency distribution of the age of the sample cultivators

Class group	Frequency	Cu. Frequency	P.C.	Cu. P.C.
Less than 30	27	27	8.33	8.33
30 - 45	192	219	59.25	67.59
46 - 60	72	291	22.22	89.81
61 - 70	28	319	8.64	98.45
70 - above	5	324	1.54	100.00

The above table reveals that, the age of the cultivators varies between 22 to 80 in the sample villages of the Darrang district. Most aged people working in very few villages like like Bhutpur, Ghutlung and Uriam Guri. The village Gorsinghbihia has the largest number of young workers whose age is below 30

(9 farmers). A substantial number of cultivators (59.25 per cent) are found within the age group of 30-45 years comprising 192 cultivators out of the 324 sample cultivators. As the class group of age goes on increasing the number of cultivators in the respective age groups shows a decreasing trend. The age group such as 61-70 and 70 above are 28 and 5 cultivators respectively. The oldest age group of farmers are only 5 in number; and also only 27 youngest farmers who were below 30 years of age. If 30-45 years age group is considered as the age group in which farmers are more enterprising, then it is noticed that 192 out of the 324 sample farm households are belonged to this group (59.25 p.c.).

This proves that most of the middle aged farmers are more enterprising in the sample villages. Most of them are going for innovations and feel the lack of irrigation facilities. The farmers of this age group are using HYV of crop for the cultivation. Quite a lot of improvements in agricultural production is noticed among these farmers. These show that the younger generation is taking over the agricultural developments of the country.

Table 4: Village-wise number of farmers in between the age-group of 30-45 years.

Villages	No. of Farmers
Bhutpur	13
Gorsingh Bihira	19
Borguri	22
Ghutlung	18
Tenga Basti	26
Uriam Guri	24
Mora Belsiri	19
Somdhara	24
Total	192

The districution again appears to have been biased against the villages of Mora Belsiri, Ghutlung and Bhutpur. These villages has large number of farmers in the age group of 45-60. The villages like Tenga Basti, Uriamguri and Somdhara most of the enterprising farmers are from the age of group of 30-45 years, which were followed by the villages of Borguri, Mora Belsiri, Gorsingh Bihira, Ghutlung.

The above analysis reveals that the Darrang district of the Lower Brahmaputra Valley specifically the Gorsingh Bihia, Somdhara and Bhutpur younger generation is making satisfactory headway as compared to their older counterparts

in adapting to the new varieties of rice in ttheir farm and improving the agricultural products. This fact can be substantiated and supplemented as well, when the productivity of HYV rice and other agricultural products in terms of yield in kg. per hectare is correlated with the age. This will lead us to know the position of the younger generation in terms of productivity in both the immigrants and indigeneous villages where number of immigration is insignificant. Earlier it has been specified that there are villages where immigrant farmers do not exist and some villages which is purely an immigrants village. Here the village like Bhutpur and Gorsingh Bihia are the villages where immigrant is insignificant. The villages like Somdhara, Borguri, Ghutlung, Tenga Basti, Mora Belsiri are dominated by the immigrant farmers. This has been discussed in the later part of this chapter.

Family size

In an agrarian society like India, the family and family size play an important role. It is noticed that Indian rural families are fast disintegrating from joint to nuclear characteristics. Rajagopalan and Singh,[4] are of the opinion that the traditional Indian society is characterised by its joint families which no longer exists.

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4. C. Rajagopalan and Jasbir Singh, Op.cit., p. 18.

This feature from India's rural society has disappeared because of the advent of the industrialization and urbanization. In the present case the nuclear families are predominant in the area under study, of the entire sample 90% farm households have a nuclear structure. This is mostly seen in the immigrant villages of the area. There are only 16 households which are structurally joint family. These families belong to the villages Bhutpur, Gorsingh Bihia, Borguri which were less populated by immigrants. But Ghutlung has as many as 9 households of joint family which is predominated by immigrants. But in Gorsingh Bihia, 3 and Bhutpur and Borguri have one each which is mostly dominated by indigenous farmers. Again it shows that the immigrant villages have a large size family. Because, they do not practise family planning programme and most of them are illiterate too.

It is noticed that family size also has its own economic implications. In the Darrang district, the villages where sample survey has been conducted found the family size varies from as low as 2 to as high as 25 persons. The village Bhutpur has a small family of 2 persons and the village Ghutlung (which is a immigrant dominated village) has a family of 25 persons. But both the villages lie in the different parts of

the Darrang district and have different constitution of people. The village Bhutpur has no immigration population, but the village Ghutlung is purely constituted of migrated people. Not only the village Ghutlung, but most of the immigrated villages have large size families.

This again can be noticed that the large families are not in a position to produce more or produce more surplus. Though their production is improving but there is hardly any surplus due to the increasing number of family members.

Table 5: Frequency distribution of family size in the sample villages.

Class group of family size	Frequency	Deg. of size	Cu. Frequency	P.C.
Less than 4	1	V. low	1	0.3
4 - 8	169	Low	170	52.16
9 - 12	114	Medium	284	35.18
13 - 16	32	High Med.	314	9.87
17 - 20	4	High	320	1.23
21 and above	3	V. high	324	0.92

The above table shows that as per as the categorization, the sizes vary from very low, low, medium, high medium to high and very high. The low and medium size families predominate in

the sample. Of the 324 families under study, 169 come within the size group of 4-8 members and constitute 52.16 p.c. of the entire sample. This is followed by medium family size between 9-12 members and accounts for 114 households of the sample. Then follows high medium with 30 households. There are 4 families which come within the high group and account for 1.23 per cent of the entire sample. However, the very high size group of families are only 3. The very low group family size contains one family only, accounting for 0.9 percent of the sample. To sum up, the low-sized families in the sample are many (i.e. 170 of the 324 families). This is again followed by the medium size group of families, accounting for 144 families of the total sample of 324 families. The large sized families are 9 out of 324 samples.

Table 6: The village wise distribution of the sample households.

Villages	Sizes						
	Less 4	4-8	9-12	13-16	17-20	21+	Total
Bhutpur	1	16	15	2	2	0	36
Gorsingh Bihia	0	22	9	4	1	0	36
Borguri	0	23	11	2	0	0	36
Ghutlung	0	12	11	10	1	2	35
Tenga Basti	0	19	13	3	0	0	35
Kurkuri	0	29	6	1	0	0	35
Uriam Guri	0	14	20	3	0	0	37
Mora Belsiri	0	13	18	6	0	1	37
Somdhara	0	24	12	1	0	0	37
Total	1	170	115	31	4	3	324

The respondents have been classified as per the various size groups of family in the respective family in the respective sample villages. It is seen from the above table that the village Ghutlung has the low; medium, high medium, high and very high sizes of families. Two large size and six medium size families are found in this village, Mora Belsiri also has one large family. The reason might be attributed to the Muslim culture which is a immigrant dominant village. On the other hand, most of the respondents are adopting and practising HYV of rice. In most of the sample villages medium-size families are predominant. Rajagopalan and Singh[5] are of the opinion that the size of the family is generally related to the type of family which is proved to be opposite in the present study, the nuclear families having more members than the joint ones.

Religion

"Religious belief has been a perpetual phenomenon in a traditional society specifically India. The significance of religion in life of the people - can be demonstrated by illustrating how religious beliefs and values condition social and economic behaviour."[6] Though the religious beliefs and their impact upon the agricultural practice have not been the concern of the study, yet there are numerous beliefs and superstitions connected with the agricultural practice. Right from

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5. C. Rajagopalan and Juspal Singh, op.cit., p. 10.
6. C. Rajagopalan and Juspal Singh, op.cit., p. 14.

the preparation of the land for a crop to be grown till its harvest, there were specific days of the week and time for their execution. Hindus are more inclined to these beliefs than the Muslims in the area under study.

The sample household of the Darrang district of the Lower Brahmaputra valley are constituted of mainly Hindus and Muslims. Of the 324 farm households the Hindu and Muslim families are 108 and 216 respectively. It is very much clear from the religion that the Muslim populated villages are dominated by the immigrants.

Table 7: The villages classified into their respective religions

Sample villages	Religion		
	Hindu	Muslim	Total
Bhutpur	36	-	36
Gorsingh Bihia	36	-	36
Borguri	36	-	36
Ghutlung	-	35	35
Tenga Basti	-	35	35
Kurkuri	-	35	35
Uriam Guri	-	37	37
Mora Belsiri	-	37	37
Somdhara	-	37	37
Total	108	216	324

It is seen from the religions table that the respondents from the villages of Bhutpur, Gorsingh Bihia and Borguri are all Hindus. And the rest of the sample villages, Ghutlung, Tenga Basti, Kurkuri, Uriam Guri, Mora Belsiri and Somdhara are Muslim dominated and immigrant villages. Though there are a few Hindus and other communities in the Muslim villages, they are not practising agricultural activities. It is proved that Muslims seem to be more progressive and hard working farmers in the adoption of innovations than the Hindus. This can be proved from the productivity patterns of rice and other crops, which has been used by these farmers. This is also one of the major look-outs of this study. The yield per unit area comes out to be more in the comparative study with the Hindu villages. But they have been still keeping a downtrodden (poor) standard of living, which can be due to the exploitation by the zamindars and money-lenders. Moreover, the growing population in the community.

Caste

Caste and profession still go together in Indian rural society. Casteism and hierarchy of castes have posed such problems that these have almost been a threat to the national development programme as well as to the emotional integration of the people. The preponderance of various caste groups are strongly

felt when the problem is viewed in a spatial context. Generally, the higher caste of people in the society enjoy all the accessibilities within their reach. For example, zamindars or money-lenders in the sample villages of Darrang district get maximum quantity of crops during the harvesting season. During this season zamindars buy all crops from the farmers at cheap prices. The poor farmers have no other alternatives besides doing this. On the other hand, money-lenders in return take crops during harvesting season when crops are cheap in cost. Though the diversity in occupation has undermined the occupational base of the caste to some extent. Specifically, in the areas having a touch of modernization. Nevertheless in many remote rural areas it has retained its position and direct linkage with occupation. The case in the Lower Brahmaputra Valley is no way different. Unlike other areas of India, the Brahmaputra valley has however no sharp distinction of various caste groups except Brahmins.

Though the farmers of the Darrang district are of different castes but agriculture is the main occupation. This is predominantly due to the favourable environmental set up of the area they live in. The Brahmaputra valley has a lot of advantage for the people of different castes to take up cultivations as their occupation down the ages.

Family Labourers

Family labour is considered to be an important economic input specifically for small and subsistence farmers of Darrang district, where most of the farmers are having small and subsistence farms. Though according to many authors it is difficult to measure this input reasonably, nevertheless there is a positive explanatory variable of productivity. "Apart from the family labourers relevance to small farmers, technological changes so far as they facilitate an increase in cropping intensity or multiple cropping might lead to a more intensive utilization of the services of the family farm workers or permanent farm servant and hence to a more even distribution of work put in by them during the year."[7] This study however, does not specify and measure the efficiency of the family labour categorically since it is a cumbersome task.

A recent study[8] on the marginal value productivity of human labour for Uttar Pradesh and Punjab, that the marginal value productivity of human labour is positive all along and generally above the wage rate. This phenomenon assumes added significance when the bulk of the labour is contributed by the farm family itself. One of his findings again suggest that the

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7. C.H.H. Rao. Op. cit., p. 119.
8. C.H.H. Rao. Op. cit., p. 212.

marginal value productivity of family labour especially of the small farmers corresponds to market wage rated vis-a-vis a general expectation on small farms where the farmer is much below the wage rate. The labour being supplied by the farm family itself with the intention of maximising the returns per unit area rather than at equating the value of the marginal products with an imputed wage rate.

The significance of family labour is well understood from the above discussion. The labour cost in general per hectare of cultivated land is the highest in the present study of Darrang district. Except a few households with relatively bigger farm size, all others in the sample villages of Darrang district are either medium or small farmers where family labour is a positive input factor. The relative significance of the per hectare labour cost for the cultivation of rice in the case of small, medium and large farmers has been discussed by simple comparison.

Table 8: Full time adult working members of each of the farm households.

Class group	Frequency	Deg. of Frequency	Cu.Frequency
Less than 3	109	Low	109
3 - 5	126	Medium	235
6 and above	99	High	324

It is seen from the adult working members table, that of the 324 sample farm households of Darrang district adult working members who work in the field for 8 hours a day varies between 1+ 0.6+ members. The table reveals that every household has an adult working member. There are 109 households who have less than 3 adult working members, and called as low category of household in terms of family labour. The medium category of households i.e. 126 out of 324 households have working members varying between 3 to 5 members. The rest of the 99 households have more than 6 adult working members and come under the high category in terms of family labour. The relationship between productivity per hectare of cropped land and the number of working members in the family will be discussed in the later part of this chapter.

Draught Animals

In a society predominantly agricultural in nature, the farm households are characterized by certain features such as agricultural implements, draught animals etc. In traditional farm households drought animals are considered as the major assets and the economic source as well. These animals are needed for various agricultural operations such as ploughing the land for cultivation, meeting the needs of carriage, and

so on. It will be worthwhile to discuss the possession of draught animals (specially bullocks) of the sample farm households in the Darrang district of Lower Brahmaputra valley. The following table shows the distribution of number of bullocks possessed by the farmers for their agricultural operations.

Table 9: Bullocks possessed by the farmers.

Class groups	Frequency	Cu. Frequency
Less than 3	124	124
3 - 5	100	274
6 and above	50	324

Table shows that the majority of the farm households of Darrang district have less than 3 animals in their possession. They constitute 124 of the total 324 households, which shows that most of the farmers are poor and having subsistence economy. There are 150 households who have in between 3-5 animals at their possession. Another 50 households have more than 6 draught animals.

Fragmentation

Fragmentation on the Indian agricultural scene seems to have posed a serious problem amongst many others. Cultivated land often gets divided owing to the death of the head of the family or to the breaking up of an extended family among the dissecting brothers. Irrigated agriculture is highly associated with fragmentation. Lands of different qualities therefore come under a single ownership. But sometimes commercialized and larger farms are less susceptible to fragmentation. Roy and Fligel[9] are of the view that fragmentation in land is related negatively with the value of agricultural products raised and also with commercialization index.

Fragmentation in the Brahmaputra valley has been long standing. Land holdings in the valley are fragmented into small pieces which stand as obstacles for farmers to go in for the introduction of innovations in the farms such as HYV of rice and other crops. The surveys of rural economic conditions conducted by the Government of Assam during the period 1948-49 revealed that the great majority of the holdings are in scattered fragments and a large number of households have a fragment of the holdings outside their villages. Dutta[10] is also

9. Pradip Roy and C. Fligel et. al. (1968). Agricultural Innovations Among Indian Farmers. NICD, Hyderabad, p.34.

10. N.C. Dutta, Land Problems and Land Returns in Assam, Delhi, Op.cit., p. 101.

of view that 81.70 p.c. of the holdings are fragmented and the average number of fragments for holding is 36 p.c.

Off-Farm Occupations

It is necessary to highlight the occupational status of the sample farm households other than cultivation in the study areas of Darrang District. Because it throws light on the financial capability of the farmers to go in for the cultivation of HYV rice and adopt innovations which are capital intensive in nature. Of the 324 households under study only 5 persons have achieved higher education, and engaged in different occupations like - Teaching, government services etc. There are 62 persons who are adequately literate and engaged in teachings and clerical jobs. Total number of people engaged in different activities are 67 in number. The rest of the illiterate mass (257 persons) are engaged in farm occupation. The village Uriamguri has 10 households out of 37 sample households being engaged in occupations other than cultivation. In the village Gorsing Bihia 9 households were having off-farm occupations such as teaching, clerical jobs, business and contractor etc. The maximum number of persons having such kind of occupation is 4 and minimum is one in the sample households. But, it is clear from this study that the villages under scrutiny are predominantly an agricultural in occupation.

Indebtedness and sources of Finance

Here an attempt has been made to ascertain how many households in the sample villages of the Lower Brahmaputra valley have resorted to borrowing money in the preceding agricultural seasons. The information and data collected at household levels reveals that as many as 215 households have borrowed money either from the money-lenders or financial agencies. It has also been confirmed from the individual farmers, while having personal interview with them, that even if most of the respondents are not indebted or have not borrowed money from any sources; nevertheless their financial situation is not favourable to go in for the adoption of scientific technology in their farm. The rate of interest of borrowing money is quite high, therefore farmers are not happy to be in debt. But since they have no other ways to meet their financial requirements for the season, they are bound to borrow money from the money-lenders. In return the farmers cannot repay the money and during the harvesting period money-lenders accept the crops at cheaper rates, which is almost double the value of the crop in comparison to the money lent to the farmers. Hence, the money-lenders become the principal sources of finance in need. This way, the farmers cannot save even a small amount of crops for their surplus.

Possession and use of advanced agricultural implements

So far possession and use of advanced agricultural implements among the sample households of Lower Brahmaputra valley is concerned it is noticed that, of the 324 households, 62 of them own advanced implements such as - diesel pump (through government), sprays, weeder, duster etc. Apart from these 62 households the rest 262 households do not own any implements except hoes and choppers for their various operations in agriculture. Of the 9 sample villages of Darrang district of the Lower Brahmaputra valley, the cultivators of the village Bhutpur and Uriamguri are introducing HYV of rice. Their farms and a variety of advanced implements such as diesel pump, weeder, thresher, sprayer etc. But most of the villagers are not in a position to have all these facilities. Most of them do not have irrigation facilities and other advanced implements. Therefore, the cultivators depends on seasonal rainfall. The natural hazards like floods and earthquakes also damage maximum amount of crops of the area.

Marketable surplus

So far as the marketable surplus of rice and vegetables and other crops are concerned, these are mostly consumed in the family and sold in small quantities to clear up their

debts, land revenue and to fulfill other needs. In the sample farm household survey in the Darrang district, only 62 households have surplus. The other 262 households of entire sample do not have any surplus. They live at the subsistence level or they depend on the market at the time of deficit or go for daily wage labourers or permanent agricultural labourers. It is also seen that a substantial number of farmers are having no surplus. They buy rice along with other essential commodities such as oil, sugar, dal, salt etc. from the market for rest of the season. The following table presents the frequency distribution of surplus of rice in kg.

Table 10: Frequency distribution of surplus of rice in kg.

Class group of rice in kg.	Frequency	Degree	Cu. frequency
Less than 80 Kgs	8	V. low	8
900 - 1600	9	Low	17
1700 - 2400	20	Medium	37
2500 - 3200	12	H. Medium	41
3300 - 4000	10	High	59
4000 above	3	V. high	62

Source: Field study

It is seen from the above table that 60% of the surplus producing farmers are from medium and high medium category which varies from 1700 to 3200 kgs. There are 17 households which falls under 800 to 7600 kgs. Medium and high categories of farmers in terms of surplus of rice accounts for 32 households of the entire sampling. The very high categories are 3 households only and it is in the village Uriamguri. The villages of Uriamguri and Bhutpur shows the highest and high catefories of surplus, which means the villages are specializing in high yielding varieties of rice and inclined towards mechanization of their farms. Most of the sample villages have achieved higher productivity per hectare because of a high dissemination of technical knowledge among them, but they do not have higher surplus because of higher growth of population and higher number of family members. Except Bhutpur these villages are mostly immigrant dominated.

The above discussion proves that the farmers adopting modernization in cultivation of rice is still below subsistence level. The improvement of the economic conditions of these farmers need attention of the government.

Nearest Market Centre

In an agricultural economy, market centres of daily, weekly and permanent transactions play an important role for

buying and selling the agricultural commodities. The landuse theorist Von-Thunen explained that the type of landuse[11] will vary with the distance from the market. In the present sample of 324 households taken from the 9 different villages of the Lower Brahmaputra valley, where rice is the predominant factor, it is noticed that the sample villages are either located near to a market[12] or the markets have developed of their own to meet the needs of buying and selling the agricultural commodities produced in the nearby villages.

Major Socio-Economic and Cultural Correlations and Intercorrelations among the villagers

In the present sample study productivity of improved rice (HYV) has been considered as an indicator to understand as to how enthusiastically a farmer has adopted a new technological innovation with the existing socio-economic and cultural environment around him. It can also be hypothesized that better productivity in terms of yield in kg. per hect. is the outcome of a better organisation and utilization of farm resources. It also suggests that the farmers has a better socio-economic and cultural background which has helped them to achieve this

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11. Majid Hussain, 1979, Agricultural Geography, Delhi, p.159.
12. Ibid. pp.159-164. For detailed discussion on market and landuse relation in Von-Thunen's method.

goal. Apart from the purely economic inputs the socio-eultural factors play a vital role not only in achieving higher productivity but also in adopting innovations, as for example, introduction of HYV of rice. The adoption of this innovation will fast spread among the cultivators provided it does not receive any socio-cultural resistance. Of course the farmers have to be persuaded and convinced via different media, but an educated farmer will understand and adopt it faster than his uneducated and illiterate counterpart. A young enterprising energetic and educated farmer will be paying more attention towards scientific farming by introducing new innovations.

This is an attempt to assess the major socio-economic and cultural correlation of productivity of HYV of rice. It also finds out the inter-relationship among these socio-economic and cultural variables. In view of the above discussion it can also be examined that whether higher productivity is associated with positive socio-economic and cultural correlations or not. The following socio-economic and cultural factors have been taken into consideration in this study.

i) Holding size
ii) Education
iii) Age

iv) Family size

v) Religion

vi) Number of working members

vii) Yield of high yielding variaties of rice

Inter-correlation

A farmers social status is sometimes well conceived from his holding size. It will be worthwhile if the holding size as a social variable is correlated with education, age, family size, religion, family working members and the fragmentation of agricultural land. So far as the sample households in the present study is concerned it is interesting to note that holding size is positively related with the above variables. Meaning thereby, the holding sizes increase with the corresponding increase in education, age of the farmer, family size, religion working members of the family, etc. However religion as a cultural factor has been quantified by assigning scores such as 1.5 to Hindu and 1.25 to Muslim under the hypothesis that Hindus are socially in a more advantageous position than the Muslims.

But the relationship appears to be highly insignificant with education, age, family size, religion etc. However the size of holding and number of fragmented fields are significantly correlated. Coming over to the education of the farmers it is

notice that the farmer is negatively correlated with age, family size, number of working members etc. But with religion the relationship is positive. As the level of education increases the age of the farmers decreases and the same in the case with family size. It is obvious that young farmers are more educated than the older ones. In small families, it is financially easier to get education. In educated families members working in the field will be less as evident from the above correlation analysis. Since level of education and number of fragmented fields in the sample household are negatively correlated it can be inferred that educated families are not in favour of splitting up their cultivated lands. Education and religion being positively related, it can be said that Hindus among the sample households are more educated than the Muslims. So far as the statistical significance of the relationship is concerned it is observed that education and age are significantly related at 5 and 10 p.c. levels of significance. The relationship between education and family size is significant at all the levels. The same way, the number of working members, number of fragmented fields are also significant in all the levels.

Age of the farmers is positively related with family size, number of working members and number of fragmented fields,

but it has insignificant negative relation with religion. The relationship is highly significant for family size and for number of working members except the number of fragmented fields which is insignificantly related at all the levels.

Family size is positively related with number of working members and number of fragmented fields, the relationship being insignificant at all the levels for number of working members and at 4, 8 and 19 percent levels for number of fragmented fields. As the family size increases, the working members also increases simultaneously. Fragmented number of fields also increases with the corresponding increase in family size.

However, family size is negatively related with religion, the relationship being insignificant. However, it implies that family size increases with decrease in religion or vice-versa. According to scores assigned to the religion, Hindus have a smaller family size than Muslims (Immigrants) in the sample study.

Religion is positively and insignificantly related with number of working members and number of fragmented fields. But the number of working members in the sample households are positively related with the number of fragmented fields. The relationship is insignificant at all the levels.

Socio-cultural correlation and productivity

Since the productivity is the resultant of a series of socio-economic and physical factors, it will be meaningful if a relationship is established between the productivity of HYV of rice and its socio-cultural correlations. Here attempt has been made to know as to how socio-cultural factors influence the productivity and what is the degree of their relationship with the same. So far as the sample from households are concerned it is noticed that holding size has a positive relation with productivity of HYV of rice, the relation being significant only at 10 and 20 percent levels. Education and productivity are negatively and insignificantly correlated. Family size and age are also related insignificantly. Religion and productivity are insignificantly and negatively related. Productivity is again related with number of working members in the farm families and the number of fragmented fields positively the relationship being significant at 20 percent level for working members and insignificant at all the levels for number of fragmented fields.

It can be inferred from the above analysis that the socio-cultural variables cannot be considered good explanatory variables of the variation of productivity of HYV of rice. The impact seems to be insignificant on the yield pattern of HYV of rice in the study area.

CHAPTER - VII

IMPACT OF IMMIGRANTS ON AGRICULTURE AND CONCLUSION

Environment influences on man is inseparable from very history of humanity. It is the highest form of interaction between life in general and environment. In the similar way, impact of immigrants on the agriculture of the Lower Brahmaputra valley is very much there in the very history of the development in agriculture. It is highest form of interaction between immigration in general and agriculture.

The interaction of immigrants and the development in agriculture is closely linked with the problems of development in places which lag behind other economically, technically and culturally. This is an environmental problem. In the Brahmaputra valley the environment has a vital role to play in the development of agriculture. The environment itself invites people from all over the country.

During the last decade, the Brahmaputra Valley's population has increased from 10.8 million in 1961 to 14.6 millions in 1971. This increase has an effect on agriculture in the valley. The increasing population settled on arable and char lands of the Brahmaputra valley. The percentage of landless labourers and rural unemployment too increased which has resulted to socio-economic, cultural and political problems. The

present political turmoil in the Brahmaputra valley is the result of such a phenomenal increase of immigrant population. The rapid increase in population has reduced the arable land and land-man ratio on the one hand and have brought basic changes in the crop landuse and socio-economic structure on the other which is transforming the cultural values of the inhabitants of the region. Although net cropped area and gross cropped area have increased marginally during the last decades, the per capita share in each of the two categories of land has decreased substantially, because of growth of population. This not only a natural but maximum migrants from the Bangladesh and Nepal.

The Brahmaputra valley is surrounded by hills, therefore, encironment plays a vital role in agricultural activity. Agriculture largely suffers due to the frequent occurrences of natural hazards like large scale floods and water logging as the rainfall pattern is very erratic. Though flood is a serious problem, but it fertilizes the agricultural fields through silt deposits.

High growth of population due to continuous influx of migrants has created complex problems in the Lower Brahmaputra valley. As 70% of the household consists uneconomic holdings

and share croppers. The land per capita income comes to 0.5 hectare in the valley. But the available per capita agricultural land was 0.27 hectare in 1961 and it was decreased to 0.20 hectare in 1971 as against 0.30 and 0.25 hectare respectively for the country as a whole. The tragic part of the fact is that most of the local people are not in a position to compete with the immigrants who have tremendous ability for hard work. The hard working immigrant settlers from Bangladesh with abilities in the field of agriculture have attained much better production than the autonomous in the rural areas of the Lower Brahmaputra Valley. The poor section of the original inhabitants has gradually become poorer because of sole dependence on agriculture.

The pressure of population on land in rural areas of the Lower Brahmaputra Valley is increasing gradually due to immigrants from Bangladesh.

Another vital problem created in this region by the major section of the immigrants is that they do not like to be assimilated with the original inhabitants. By ignoring language and culture of the original inhabitants most of the immigrant settlers have arranged schooling of their children in their own language which hampered the process of integration. This may be viewed in the light of the fact that out of every five persons in the valley (1971) one is an immigrant.

Further the gradual increase of theft, social crimes like murder, arson etc. have some relations with the influx of destitute people from outside. Research studies reveal that major crimes in this region is committed by immigrants. This process which leads to disruption in the social set up in the region.

In the economic fields too, it is observed that the major part of the trade and commerce is in the grip of immigrant settlers. The migrants from Bangladesh have played an important part in the improvement of agricultural production but in the agricultural economy of the Lower Brahmaputra Valley. Due to over population of migrants the per capita consumption also increased.

In the case of agricultural production rate or the zone of high yield and high spread is considered the most efficient zone. In the Lower Brahmaputra valley rice is the high yield and important crop. Agricultural production can be increased to a considerable extent by increasing the use of high level of input to increase the per hectare production. But at the same time if the growth of population also increases, then the high per hectare production does not help in the countries economy. Immigrant is the main problem in

the valley where large number of immigrants from Bangladesh occupied the entire agricultural zone. There may be read in increase in production but it is quite insignificant in comparison to the population growth.

The net effects of Immigrants

Large scale immigration imposes shock demands upon the economy for in excess of the demands imposed by the rapid population growth resulting from a high rate of natural increase. The increase in aggregate demands that results from immigration is normally regarded as a cost of disadvantage of immigration even though it may be short term cost.

However, immigration was found to have widespread indirect effects throughout the economy. It seems likely that immigrants cause fundamental changes in the economy.

Consumption

Obviously, private consumption expenditure will increase as the population expands through immigration. However, this increase may be less than proportionate to increase in numbers because demand for such items such as consumer durables may only become effective after a period of saving and or if finance is available. Indirectly immigration may rise per capita

consumption by the existing population.[1] If immigration results in a higher level of economic activity, extra income will be available for consumption spending. Again, however, the actual increase in consumption depends on how much of the extra income is saved and or taxed away.

Private Investment

In the absence of unused productive capacity, the increased demand associated with immigration will be met by acquiring new plan and equipment. Immigration, by adding to the labour supply, allows increased production. However, unless productive equipment was originally under-utilized or investment is undertaken, the productivity of labour will fall as the existing capital stock is divided between more workers.

The actual increase in investment depends on whether productive resources can diverted from other forms of production. Immigration, by stimulating inverstment, reduces the average age of the capital stock. As investment embodies current technology this results in productivity gains.

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1. Peter, J. Brain, et.al. 1979. Population, Immigration and the Australian Economy, London, p.14.

However, by making labour easily available, immigration reduces the incentive to technical change. This is less likely if directly or indirectly immigration raises production costs. This would occur if increased demand result in a shortage of productive factors other than labour. It would also result from increased wage claims intended to compensate for price increases. Inflationary pressure may encourage the substitution of capital for labour thus resulting in the adoption of new technology, raising productivity and facilitating the payment of higher wages while maintaining profits.

Government Expenditure

As government expenditure varies with needs, it will increase with population growth. However, if immigration raises total current expenditure while preventing per capita expenditure from increasing, this reduces the increase in living standard. Current expenditure on education may be taken as an example.

Immigration added to the pressure on the education system but certainly did not create them. Immigration by encouraging economic growth and raising per capital income resulted in increased tax revenue which could have been used to finance increases in both aggregate and per capita government expenditure.

Population growth, especially through immigration, also results in the need for additional government expenditure on social capital. Again, the relevant question is whether immigration has retarded the increase in social capital per person.

Immigration problem of a Brahmaputra valley is generally confined to its socio-cultural and political aspects. But for a fuller understanding of the problem appreciation is necessary also of the socio-economic impact of immigration on the economy[2] of the state, particularly its rural economy. By the 1971 census, 91.9% of the population of the state is rural and 76.7% of the working force is engaged in agriculture. The corresponding national averages are 81.13% and 72.05% respectively.

While immigration into the fertile and resource-rich Brahmaputra Valley is a long historical process, it is since the beginning of this century that it started gathering pace and assumed unbroken continuity. The 1931 Census[3] described that the large scale influx of farm settlers from East Bengal as "The most important event in the state of Assam in the first quarter of the present century."

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2. Parameswar Sharma (1982). Immigration and its Impact on the rural economy of Assam: A socio-economical appraisal, p.
3. Census of India, 1961.

The immigrants from Bangladesh and Nepal account in the 1961 Census at 90% and 97% respectively. The largest concentration of them are in Goalpara, Nowgong, Kamrup and Darrang districts of Assam.

Immigration has contributed to the big spurt in population growth in two ways through direct addition to the population and by raising the natural rate of increase of population of the state through higher fertility rate and preponderance of persons of the reproductive age group in the age composition of the immigrants population. The fertility rate of Bangladesh is traditionally high.

The long continuous immigration of far labourers from Bangladesh is the result of the operation of several pull and push forces.[4] In the early stage of the process the low density of population in Brahmaputra valley abundance of virgin fertile land, open uncultivated char's and the benign land tenure system acted as powerful pull forces while mounting pressure on land, the oppressive zamindari system provided equally powerful push forces. As per the 1901 Census of Assam, the densities of population per square mile in the four districts of Brahmaputra valley which are presently most affected by

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4. Parameswar Sharma, Op.cit., p.

immigration were as follows: Goalpara - 117, Kamrup - 153, Darrang - 100, and Nowgong - 68. In Nowgong by the 1971 Census has the highest density in the state. The tagging of Assam to East Bengal in 1905 and the development of rail communication in this state increased spatial mobility and further speeded up the process of migration.

Whatever might have been the immediate impact of their arrival on the socio-cultural environment of the state, the early migrants from East Bengal had by and large made tangible contribution to the economy of the state as recorded in the Census of India, 1971 report on Assam. The mostly settled on the wasteland and brought about a degree of diversification in the farm output by introducing their two favourite crops - Aman and Jute. There was some increase in overall agricultural production, though achieved mostly through extensive agriculture. They popularised better grades of garden crop. Most of all, the larger chunk of these migrants like the tea garden labourers who had come earlier assimilated in the Assamese society.

Partition marked a watershed in the history of the immigration problem of Assam. Not only what previously had been internal migration took on due character of foreign

immigration the large scale influx of population from East Pakistan produced a steep rise in the population curve. Pressures built up in the major sectors of the economy. Especially marked is the impact on the agricultural sector. A major indicator of the mounting pressure in the sector is the rapidly tumblering land-man ratio. In a single decade 1961-71 the size of the per capita agricultural holding in Assam declined by 26% against the national average declined 16.7% during the same decade.

Relative position of Assam among the states in respect of average size of ownership holding and percentage of agricultural households owning no land.

State	Average size of ownership holdings (hect)	P.C. of household owning no land
Assam	1.26	27.77
Andhra Pradesh	1.84	6.84
Bihar	1.23	8.63
Gujrat	3.44	14.74
Maharashtra	3.57	16.03
Orissa	1.42	7.84
Rajasthan	4.98	11.84
West Bengal	1.08	12.84
All India	2.00	11.60

Source: National Sample Survey 17th round (September 1961 to July 1962).

The above table brings out the acuteness of the land problem in Assam. It spot-lights two revealing facts - the average size of the ownership holding in Assam was not only significantly lower than the national average but was one of the lowest among the states. The percentage of landless agricultural households was also not only more than double the national average but was the highest in the country. Incidentally there was practically no problem of landlessness among agricultural households in Assam before partition and the radical transformation in the position came about in less than a decade and half of freedom. The fact points to the rapid increase in the rate of immigration in the post partition decades.

Another indication of the moving demographic pressure on land is provided by the growth rate of density of population per 100 hect. of land under food crops. For the period 1961-71 as estimated by Dr. K. Alam of Gauhati University. This rate was 74% for Assam against 32% for the country as a whole. This rate incidentally was the highest among the neighbouring states. According to National Sample Survey 26th round, 82.60% of the operational holdings in Assam in 1971-72 were uneconomic. This figure which comes close to the estimate of the State Planning Board in the Draft Fifth Plan that 77.38%

of the rural population of the state lived below poverty line provides an unmistakable pointer to the extreme backwardness of the states agrarian economy.

In a revealing comparison of the growth rates of population and foodgrains output in Assam during 1951-68 in a paper entitled "Population and Foodgrain oust in India" (Economic Development in South Asia, Edited Robinson and Kidron, Macmillan, 1970), Ashok Mitra shows that while the annual compound growth rate of population in Assam during the period was 2.99% of the highest among the states, the compound growth rates of foodgrains and non-foodgrains out in Assam during the same period were 0.71% and 1.49% respectively, the lowest among the states. There findings are corroborated by those of K.N. Raj in his study "Some Questions Concerning Growth, Transformation and Planning of Agriculture in the Developing Countries" (ibid) for the same period. A recent survey by a researcher of the Gokhale Institute, Pune shows continuation of the trend.

As the combined result of the unrelenting pressue of population on land and lack of diversification of the rural economy, there has been a steady increase in disguised unemployment in the agricultural sector. An indicator of the trend

is to be found in the state government's evaluation report on SFDA/MFAL in the Nowgong district 1975. This district is a main seat of immigration from Bangladesh and in the 1971 Census it recorded the highest density of population among the districts of the state. According to the report during the period 1961-71, there had been a sharp decrease in the number of land owning and tenant cultivators, associated with corresponding increase in the number of landless agricultural labourers in the district.

With increase in surplus labour in Assam Agriculture, there has been corresponding increase in the unemployment rate. As calculated by A.K. Neog and M. Barkataky, the magnitude of unemployment in the rural sector in Assam has increased by an alarming 40% during the period 1951-71, which incidentally was the peak of the influx. A study of agricultural productivity per worker in Assam during the period 1951-52 and 1976-77 by Dr. K. Alam shows a continuous decline and a distinguished unemployment problem.

Whether evidence in suppor of the depressing effect of immigration on the agricultural economy of the state is to be found in the following result of a study by K. N. Nihan entitled "Agricultural labourers and Poverty" in Economic and

Political Weekly, July 10-17, 1982. The study reveals that during the decade and a half from 1956-57 to 1970-71, the per capita real income of non-cultivating wage earners recorded as 12% decline in Assam against varying degree of increases in all other states ranging from 8% in West Bengal, 34% in Orissa, 57% in Andhra Pradesh, 73% in Gujarat, 74% in Kerala, 90% in Punjab, to 109% in Rajasthan and a National average of 59%.

The depressing effect of immigration on farm wage is significantly most pronounced in areas where there is already a high concentration of immigrant population. In course of a socio-economic survey in the Goalpara district in 1975 the present writer noted in some villages in the Dhubri sub-division e.g. Solmari and Golokganj, the prevailing farm wage was as low as Rs. 1.50 plus the mid-day meal, against rates ranging upto Rs. 8 in parts of the state like the Sibsagar district when immigration is thin.

A further indicator of the growth retarding effect of explosive population growth since the sixties in the failure of the planning process to bring about the desired shift in occupational distribution from agricultural to non-agricultural occupations. During the first two decades of planning, the share of agriculture in the state income declined from 66%

(two-third of the total) to 49% (half), while the share of agriculture in the labour force increased from 7% to 77% . The trend also found expression in the decline in agricultural productivity, as pointed out in the Draft Fifth Plan for Assam. Between the two periods 1951-54 and 1969-72 the value of the agricultural output per worker at constant prices declined from Rs. 508.77 to 355.27, a 30.2% decline.

Another major area of the states economy in which exploding population growth by immigration was severly pressed on natural resources is the forestry sector. Once a heavily forested state, Assam has suffered rapid shrinkage of its area under forest as a result of the combined impact of encroachment depreservation and destructive exploitation of forest resources. The large scale occupation of forest land for agriculture is directly and indirectly the result of the demographic pressure generated by the influx. At present the total geographic area of the state only 21% is under reserved forest. This is very much below the national minimum of 33.3% under productive forest prescribed of the National Forest Policy.

Like the native population of the state, the immigrant population from Bangladesh and Nepal have an overwhelmingly

non-industrial background, and are mostly drawn from the rural proletariat. In consequence, their arrival has not brought any gains to the economy in either capital resource or accretion of higher skills, nor contributed to the creation of an environment of change essential to industrialization and modernization.

The relentless demographic pressure created by the large scale and continuing immigration has depressed the rural economy of the state resulting in intensification of the twin problems of poverty and unemployment among the rural masses. Superimposed on a situation of underdeveloped and stagnation, unrestricted immigration in the region, as observed by Dr. B.N. Ganguli in his "Population and Development" (S. Chand & Co. Pvt. Ltd., 1973) has produced a conflict situation, especially that immigration has carried with it the threat of upsetting the demographic balance and bring the ethnic or linguistic composition of the population. Even to stabilize the rate of population growth at a reasonably low level, indespensable to prevent the meagre gains of planning from being diluted by the humane tide, effective ways must be found to stop further immigration, rigorously enforce limitation of the size of the rural family and possibly also relieve the rural economy of its surplus manpower.

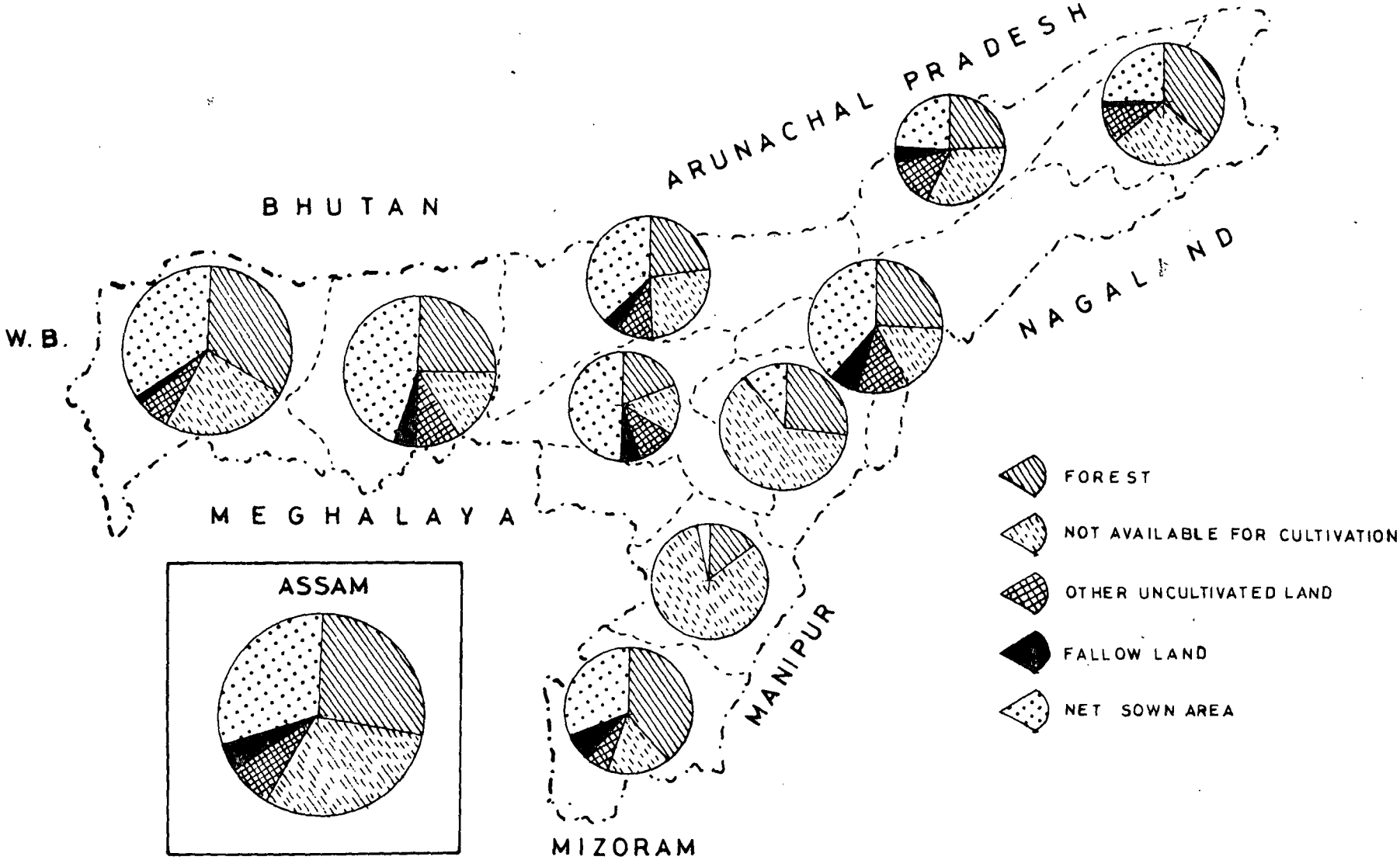

FIG. 11. ASSAM LAND USE PATTERN 1973-74

Landuse Pattern of Brahmaputra Valley 1970-71

State/ District	Total reported area	Forests	Area not available for cultivation	Permanent Pastures & other grazing land	Land under Misc. tree crops not included N.S.A.	Cultivable waste land	Fallow land other than current fallows	Current fallow	Net area sown	Area sown more than once
Assam	7,851,670	2,115,165 (26.94)	2,536,365 (32.30)	260,746 (3.32)	235,859 (3.00)	179,613 (2.29)	165,094 (2.10)	122,919 (1.57)	2,235,909 (28.48)	557,298 (24.92)
Goalpara	1,030,580	342,816 (33.26)	272,262 (26.42)	33,620 (3.27)	13,112 (1.27)	16,100 (1.56)	10,340 (1.00)	4,500 (0.44)	337,830 (32.78)	125,536 (37.15)
Kamrup	995,600	248,594 (24.97)	145,910 (14.66)	77,667 (7.80)	28,100 (2.82)	17,280 (1.74)	24,620 (2.47)	19,141 (1.92)	434,288 (43.62)	156,862 (36.12)
Darrang	872,050	193,032 (22.13)	233,182 (26.74)	33,648 (3.86)	30,408 (3.49)	22,392 (2.57)	20,426 (2.34)	24,231 (2.78)	314,731 (36.09)	56,798 (18.05)
Nowgong	569,800	113,101 (19.85)	93,578 (16.42)	30,380 (5.33)	23,078 (4.05)	25,389 (4.46)	14,776 (2.59)	13,250 (2.33)	256,248 (44.97)	61,870 (24.14)
Sibsagar	900,290	231,239 (25.68)	156,014 (17.33)	32,200 (3.58)	57,832 (6.42)	37,420 (4.16)	38,258 (4.25)	21,266 (2.36)	326,061 (36.22)	30,560 (9.37)
Lakhimpur	1,267,030	382,194 (30.17)	395,346 (31.20)	46,731 (3.70)	50,979 (4.02)	50,508 (4.00)	26,428 (2.06)	17,141 (1.35)	297,703 (23.50)	50,580 (16.99)

Source: Directorate of Economics and Statistics, Government of Assam.

Intensity of Cropping in the Brahmaputra Valley 1970-71

State/ District	Net area sown	Area sown more than once	Gross area sown	Intensity Index
Assam	2,272,758	558,832	2,831,590	1245.9
Goalpara	337,690	125,536	463,226	137.17
Kamrup	434,288	156,860	591,148	136.12
Darrang	314,731	56,798	371,529	118.05
Nowgong	256,248	61,872	318,120	124.15
Sibsagar	325,061	30,560	355,621	109.40
Lakhimpur	297,002	50,574	347,576	117.03

Source: Directorate of Economics and Statistics, Government of Assam.

(1) Dhekiajuli

Sl. No.	Village	Age	Education standard	Total crop area in bigha	Family size group
	(Dhekiajuli) Bhutpur				
1.		50	0	47	14
2.		25	1	62	9
3.		50	1	35	9
4.		60	1	55	20
5.		50	1	34	8
6.		40	1	47	9
7.		40	1	50	10
8.		45	0	61	5
9.		50	3	12	8
10.		60	1.5	19	8
11.		70	3	19	10
12.		70	0	17	19
13.		50	1	10	11
14.		47	3	5	7
15.		28	3	10	4
16.		35	3	18	6
17.		65	0	21	10
18.		70	1	10	2
19.		80	1.2	18	10
20.		57	1	20	8
21.		45	1	21	7
22.		40	1.5	19	8
23.		35	1.5	14	9
24.		30	3	10	10

Sl. No.	Village	Age	Education standard	Total crop area in bigha	Family size group
25.		70	0	40	11
26.		50	1	30	7
27.		40	1	31	6
28.		29	1	62	5
29.		60	0	60	12
30.		39	1	45	13
31.		57	1	60	11
32.		65	1	50	7
33.		77	0	34	10
34.		30	3	30	7
35.		29	3	35	5
36.		40	0	40	10

(2) Gorsingha Bihia

Sl. No.	Age	Education standard	Total crop area in bigha	Family size
1.	20	0	54	5
2.	70	0	33	19
3.	80	0	13	15
4.	60	1	9	8
5.	40	1.5	54	7
6.	25	3	8	7
7.	30	1.5	11	8
8.	35	0	8	7
9.	70	1.5	11	7
10.	25	1.5	4	5
11.	25	1.5	11	8
12.	24	0	4	10
13.	22	0	7	14
14.	25	5.5	1	10
15.	60	0	10	10
16.	25	1.5	7	9
17.	40	1.5	7	7
18.	33	3.5	13	5
19.	56	3	6	6
20.	30	0	5	15
21.	35	0	27	5
22.	40	0	54	10
23.	41	1	33	15
24.	32	1	9	9
25.	30	1.5	54	7
26.	70	0	8	8
27.	75	0	11	8
28.	40	1.5	8	9
29.	45	3	10	9
30.	25	1.5	11	5
31.	25	1.5	14	5
32.	30	0	30	6
33.	35	1	25	6
34.	30	3	30	8
35.	35	3	27	8
36.	40	0	30	10

(3) Burguri

Sl. No.	Age	Education standard	Total crop area in bigha	Family size
1.	50	0	8	6
2.	66	0	10	6
3.	60	0	60	13
4.	60	0	16	16
5.	40	1	15	4
6.	37	1.5	20	8
7.	40	1.5	22	7
8.	30	1	30	7
9.	45	1	30	8
10.	40	1	34	9
11.	70	0	40	10
12.	60	0	8	12
13.	80	0	7	12
14.	70	0	10	10
15.	45	1	0	8
16.	30	1	11	6
17.	35	1	14	7
18.	40	1.5	8	6
19.	34	1.5	9	6
20.	30	1.2	15	6
21.	40	1.2	20	7
22.	50	1	25	12
23.	40	1	30	10
24.	45	1	0	8
25.	45	1	0	9
26.	40	0	20	9
27.	30	0	30	7
28.	60	0	34	7
29.	50	0	30	10
30.	70	00	40	12
31.	29	1	25	5
32.	30	1	8	5
33.	34	1	7	6
34.	50	0	16	6
35.	35	0	11	7
36.	40	0	17	7

(4) Ghutkung

Sl No.	Age	Education standard	Total crop area in bigha	Family size
1.	32	1	8	6
2.	66	1	3	6
3.	70	0	0	13
4.	60	1	4	16
5.	60	0	0	4
6.	40	0	0	8
7.	34	1	16	7
8.	30	0	87	16
9.	45	1	22	8
10.	40	1	17	18
11.	80	1	8	12
12.	70	1	25	7
13.	60	1.2	16	9
14.	50	1.2	22	11
15.	70	1.2	11	5
16.	45	0	8	9
17.	60	1.2	12	12
18.	40	0	17	5
19.	65	0	60	22
20.	45	1.5	24	25
21.	60	1.5	132	7
22.	50	0	9	16
23.	65	0	9	13
24.	35	1.2	6	16
25.	50	0	12	13
26.	30	1	16	15
27.	35	1	20	10
28.	40	1	21	12
29.	45	1	11	11
30.	50	0	17	9
31.	30	1.5	22	7
32.	60	0	40	12
33.	45	1.5	10	15
34.	40	1.5	12	12
35.	32	1.5	10	7

(5) Tenga Basti

Sl. No.	Age	Education standard	Total crop area in bigha	Family size
1.	50	0	12	35
2.	40	1	11	40
3.	42	1	8	6
4.	40	1.5	6	10
5.	45	1	10	12
6.	50	0	10	40
7.	60	0	12	50
8.	70	0	13	40
9.	45	1	10	12
10.	50	1	13	19
11.	30	1.2	8	20
12.	35	1.2	7	25
13.	30	1.2	6	30
14.	32	1	6	18
15.	42	1	7	10
16.	45	0	8	6
17.	50	0	12	8
18.	30	0	6	8
19.	35	1	8	10
20.	40	1.5	8	10
21.	45	1.5	9	5
22.	60	0	15	5
23.	34	0	10	16
24.	35	0	6	15
25.	40	1	7	15
26.	42	1	6	10
27.	45	1	9	10
28.	28	1	6	18
29.	30	1	6	20
30.	35	0	6	20
31.	30	0	8	0
32.	35	0	10	8
33.	60	0	10	5
34.	50	0	12	35
35.	40	1	8	40

(6) Kur Kuri

Sl. No.	Age	Education standard	Family size	Crop Land
1.	30	1	6	5
2.	40	1	6	4
3.	50	0	8	13
4.	34	0	7	72
5.	40	0	7	50
6.	45	1.5	7	60
7.	42	1.5	8	30
8.	30	1	8	11
9.	34	1	7	17
10.	36	1	7	20
11.	50	0	6	30
12.	60	0	10	40
13.	29	1	5	11
14.	30	1	5	12
15.	40	1	6	15
16.	45	1	6	30
17.	35	1	6	30
18.	30	1.5	6	25
19.	40	1.5	7	10
20.	52	0	9	11
21.	60	0	9	15
22.	45	0	7	20
23.	30	1	7	10
24.	34	1	6	16
25.	45	1	6	11
26.	40	1	5	12
27.	42	1	5	15
28.	40	1.5	6	30
29.	30	1.5	8	32
30.	32	1.5	8	8
31.	35	1.5	8	7
32.	40	0	9	12
33.	50	0	12	30
34.	52	0	13	32
35.	30	1	6	11

(7) Uriamguri

Sl. No. of households	Age	Education	Family size	Crop land holding
1.	50	0	5	5
2.	20	0	4	4
3.	55	1	13	13
4.	42	3	11	72
5.	39	1.5	9	73
6.	45	1	9	50
7.	37	1.2	6	13
8.	40	1.2	9	16
9.	45	1.2	9	26
10.	45	1.2	8	52
11.	65	1.2	7	12
12.	60	1.2	7	99
13.	67	1.5	9	29
14.	25	1.5	10	30
15.	30	3	11	35
16.	35	1.2	8	40
17.	40	1	9	72
18.	70	1	10	70
19.	28	1	9	26
20.	40	1.2	7	27
21.	35	1.5	8	30
22.	30	3	9	14
23.	30	3	10	5
24.	32	3.5	7	10
25.	50	3.5	5	19
26.	40	5.5	11	18
27.	45	1.5	5	20
28.	70	0	12	50
29.	65	0	10	70
30.	50	0	11	65
31.	50	0	13	55
32.	35	1	8	19
33.	57	1	10	40
34.	35	1	9	40
35.	40	1.5	9	35
36.	41	3	8	50
37.	50	1	6	30

(8) Mora Belsiri

Sl No.	Age	Education	Family size	Crop land
1.	50	1	13	52
2.	35	0	10	10
3.	45	1	14	10
4.	45	0	9	14
5.	24	1.5	9	35
6.	45	1	6	11
7.	60	1	22	32
8.	60	0	5	27
9.	65	0	19	30
10.	60	0	13	36
11.	60	1	7	36
12.	50	0	13	6
13.	29	1	10	27
14.	30	1	12	30
15.	40	1.5	13	10
16.	50	0	11	10
17.	45	1	10	12
18.	35	1.5	9	13
19.	30	3	8	50
20.	28	1	7	10
21.	60	0	8	55
22.	50	0	10	30
23.	56	0	12	40
24.	40	1	11	29
25.	45	1	9	35
26.	40	1.5	13	30
27.	30	3	6	14
28.	35	1	7	14
29.	30	1	9	18
30.	40	1.5	9	10
31.	40	1.2	10	15
32.	50	0	10	15
33.	50	0	8	45
34.	55	0	8	50
35.	40	1	11	30
36.	30	1	11	19
37.	28	1	10	20

(9) Somdhara

Sl No	Age	Education	Family size	Crop land
1.	35	1	7	30
2.	31	1	6	10
3.	40	0	10	10
4.	29	1	5	11
5.	50	0	12	40
6.	45	0	8	42
7.	35	1.5	8	8
8.	28	1	5	0
9.	60	0	13	40
10.	30	1.2	5	27
11.	32	1.2	8	30
12.	34	1.2	10	15
13.	40	0	10	40
14.	45	0	12	44
15.	41	1	7	30
16.	44	0	7	35
17.	50	0	10	20
18.	52	0	11	20
19.	55	0	9	22
20.	29	1	5	30
21.	30	1	5	35
22.	31	1.5	6	35
23.	35	1	6	40
24.	28	1	5	30
25.	27	1.5	4	27
26.	30	1.5	5	15
27.	40	1.5	6	16
28.	41	1	6	20
29.	50	0	7	40
30.	60	0	10	50
31.	45	0	11	45
32.	44	0	9	30
33.	34	1	8	31
34.	36	1	7	40
35.	40	0	8	15
36.	50	0	9	10
37.	44	1	8	12

QUESTIONNAIRE FOR AGRICULTURAL SURVEY

1. Name of the Block:
2. Village:
3. Name of the Head of the family:
4. Age: _____ Sex _____ Male/Female
5. Marital Status: Married/Unmarried
6. Religion: Hindu/Muslim/Christian
7. Caste:
8. Tribe:
9. Educational Status of the respondent.
10. Types of Educational Institutions attended by the respondents.

    a) b) c)

11. Occupation of the respondent:
12. Total members of the family:

    Male Female

13. Area under the crop:

Rice HYV	Rice local	Maize	Wheat	Gram	Jute	Sugarcane	Others
1	2	3	4	5	6	7	8

14. No. of fields:

No.	Area
1.	
2.	
3.	

15. Practice of Cultivation:

    Share Cropping/Leaseholder/Ownfield

16. Inputs supplied: Fertilizers, Pesticides, Insecticides

    Any other.

17. Agricultural Implements: Tractor, Thresher, Harvester,

    Others:

18. Irrigation Facilities: Tubewell/Tank/Any other

19. Irrigation of crops with number of times:

    Rice HYV | Rice Local | Maize | Wheat | Gram | Jute | Sugarcane | Others

20. No. of times fertilizers given.

    Rice HYV | Rice Local | Maize | Wheat | Gram | Jute | Sugarcane | Others

21. Varieties of HYV Grown:

    Rice | Maize | Wheat | Sugarcane | Gram | Jute | Others

22. Approximate expenditure:

    Seeds

    Fertilizers

    Irrigation

    Implements

    Labour

    Others

23. Financial Source: Bank/Money lender/Cooperative Bank/ Other sources

24. Total return in Quantity:

Rice HYV	Rice Local	Wheat	Maize	Gram	Jute	Sugarcane	Others

25. Surplus (Sale or Purchase):

Rice HYV	Rice Local	Wheat	Maize	Gram	Jute	Sugarcane	Others

26. Dissatisfaction caused if any:

a)

b)

c)

d)

27. No. of fields with physical characteristics:

Foil	Texture	Level of the fields	Any other

28. Total Production:

Rice HYV	Rice Local	Wheat	Maize	Jute	Gram	Sugarcane	Others

29. Nearest market centres in Km

1.

2.

3.

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