LAND-USE CHANGES IN DARRANG DISTRICT, ASSAM

by

MD. HAFIZ ALI

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SHILLONG - 793014

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Phone :
Grams : NEHU

North-Eastern Hill University

Lower Lachumiere, Shillong-793001 (Meghalaya)

Department of Geography

This is to certify that the dissertation submitted by Md. Hafiz Ali for the Degree of Master of Philosophy (M. Phil.) at the Department of Geography, School of Environmental Sciences, North-Eastern Hill University, Shillong, Meghalaya, entitled " Land use changes in Darrang District ", is a bonafide study of the the author to the best of our knowledge and belief.

This study may now be placed before the examiners for evaluation.

R. Gopalakrishnan
Supervisor

Dr. R.K. Rai
Dr. R.K. Rai
The Head
Department of Geography
NEHU, Shillong - 14

Head
Geography Department
North Eastern Hill University
Shillong-793014

Dr. P. Gopalakrishnan
Reader
Department of Geography
School of Environmental Science
North Eastern Hill University
SHILLONG 793014

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Department of Geography
School of Environmental Science
North-Eastern Hill University
Shillong 793 014
Dated October 1984.

HAFIZ ALI
Md. Hafiz Ali
15/10/84

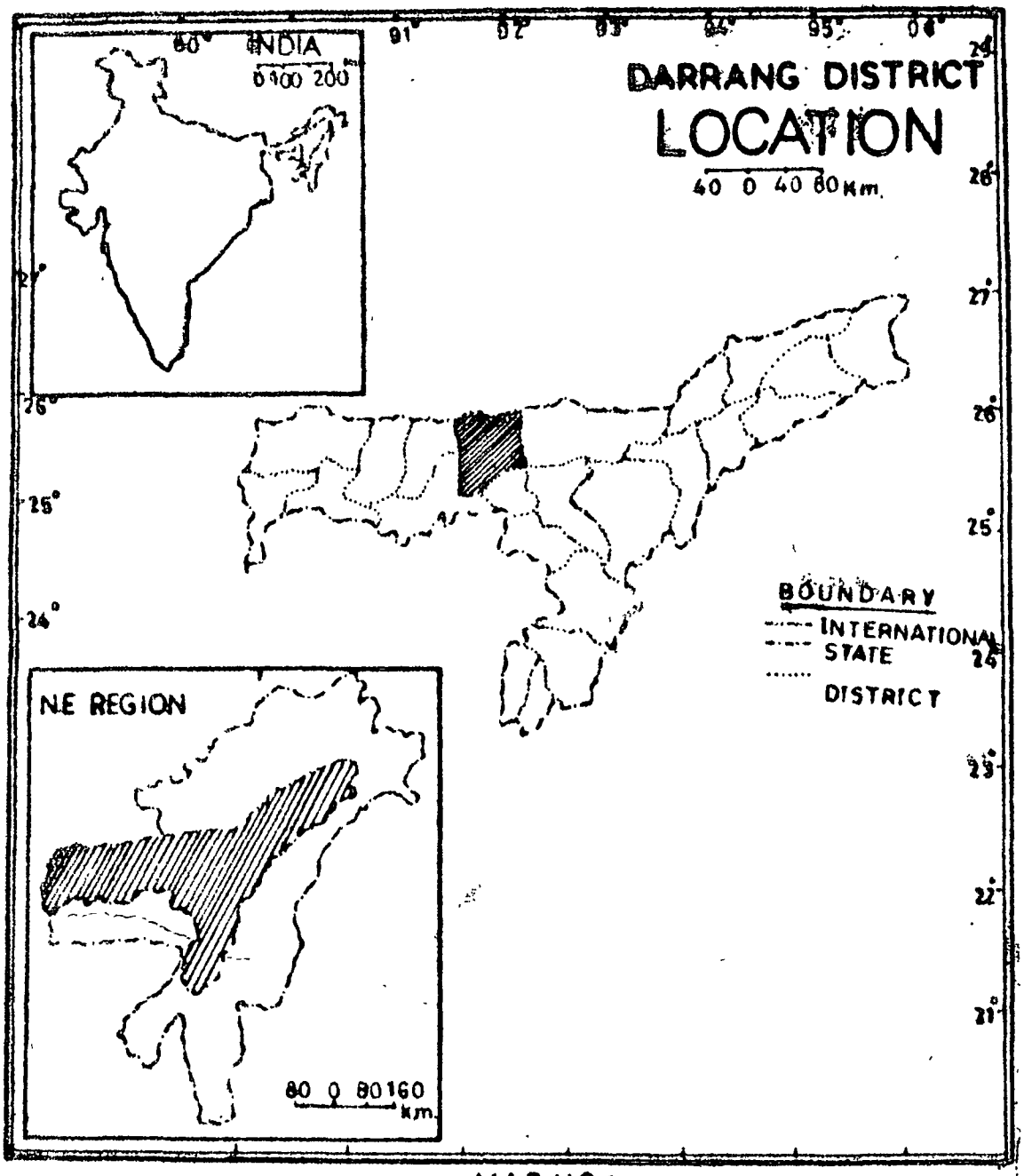
CHAPTER I

INTRODUCTION

Location:

The Darrang district is located between latitude 26°9' and 26°52'N and between longitude of 91°45'E to 92°22'E. It is bounded by Bhutan and the union territories of Arunachal Pradesh in the north; Sunitpur district in the east; Nowgong district and Brahmaputra on the south; and the Kamrup district in the west. River Brahmaputra flows on the southern side of the district. Thus, the Darrang district has a total area of 3465.3 sq. km. or 3,39,915 hectare with a total population of 8,51523 (1971 census). Mangaldai and Udalguri constitute the two subdivisions of the district.

Darrang district has six (6) development blocks these are (1) Khairabari, (2) Sipajhar, (3) Kalaigaon-Chapai, (4) Dalgaon-Sialmari, (5) Udalguri and (6) Majbat. These blocks were constituted between 1952 and 1961, Udalguri and Majbat community development blocks were created in 1952 while the remaining blocks were formed between 1957 and 1961, of the six blocks, Udalguri and Khairabari are dominated by the tribal population, while Dalgaon-Sialmari, parts of Majbat and parts of Kalaigaon


INDIA
0 100 200
DARRANG DISTRICT
LOCATION
40 0 40 80 Km.
BOUNDARY
INTERNATIONAL
STATE
DISTRICT
N.E REGION
80 0 80 160
km.

MAP NO-1

are inhabited by the immigrants population. Sipajhar block is dominated by the non-tribal population.

Area of the blocks varies from each other. Following (table-1) gives the distribution of area in the different blocks 1971.

TABLE-1

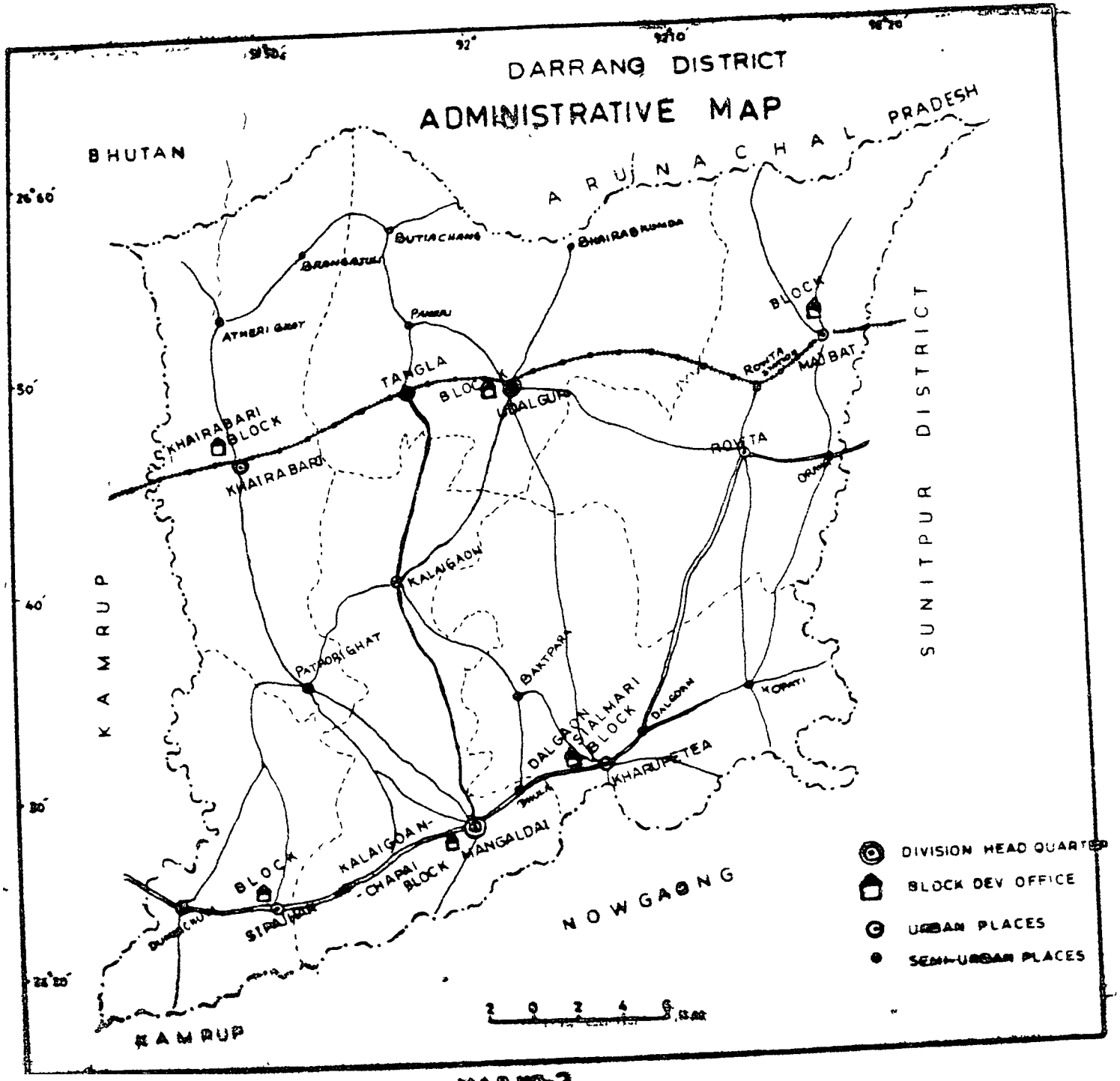
DISTRIBUTION OF AREAS OF LAND IN DIFFERENT BLOCKS - 1971 (In hectare).

Sl. No.	Name of blocks	Geographical area	Areas of Tea Garden	Area excluding Tea Gardens
1.	Khairabari	66,683(19.70) 56,204(16.67)*	5,857(1.76)	60,846 (17.94) 50,481 (14.91)*
2.	Sipajhar	40,146(11.77)	-	40,146 (11.77)
3.	Kalaigoan-Chapai	56,976(16.77) 67,341(19.80)*	76(0.02)	56,900 (16.75) 67,265 (19.78)*
4.	Dalgaon-Sialmari	57,361(16.86)	242(0.07)	57,119 (16.79)
5.	Udalguri	69,154(20.36)	8,441(2.49)	60,713 (17.81)
6.	Majbat	49,595(14.60)	7,214(2.12)	42,381 (12.48)
	Total	3,39,915(100.00)	21,810(6.46)	3,18,105 (93.54)

Source: Mangaldai, Statistical Office.
*Figures after 1968.

The Problem:

Agriculture is the main source of livelihood for the majority of the people living in the Darrang district.


DARRANG DISTRICT
ADMINISTRATIVE MAP
BHUTAN
ARUNACHAL PRADESH
SUNITPUR DISTRICT
KAMRUP
NOWGAONG
KAMRUP
BUTIACHANG
BHAIRABKUNDA
BRAHMAJULI
PANERI
ATHERI GHAT
BLOCK
TANGLA
BLOCK
MAZBAT
ROWTA
KHAIRABARI BLOCK
KHAIRABARI
KALAIGAON
PATAORIGHAT
BANTPAR
DALGAON
DALMARI BLOCK
KHARUPETEA
KOPATI
MANGALDAI
BLOCK
KALAIGAON-CHAPAI BLOCK
DIVISION HEAD QUARTER
BLOCK DEV OFFICE
URBAN PLACES
SEMI-URBAN PLACES

MAP NO-2

Nearly 88.21 per cent of the total working population are engaged in agriculture. The district shows two distinct patterns of agriculture. These are (1) Food crop production and (2) Plantation agriculture. Of the two, former contributes more than 60 per cent of the total income and employs nearly 88 per cent of the total work force of the district correspondingly, the share of the plantation agriculture (tea plantation) is about 11.15 per cent and 7.86 per cent respectively. The emphasis in the present study is given to the problems of land-uses with a major thrust on food crops land-use.

Of the total area of the district (339915 hectare) tea gardens occupy (21810 hectare). The area available for cultivation accounted for 64.2 per cent of the total area of the district, but the net area sown was only 59.16 per cent (1.9 lakh hectare). While nearly 5 per cent remained fallow, 2.87 per cent of the area was cultivable waste and hence there is very limited scope for expansion of agriculture. Indeed it can be said that the total croped area increased to 2.76 lakh hectare as a result of double and multiple cropping in the development blocks. Only Udalguri and Khairabari indicated a significant increase in the cropped area. Factors of relief, soil, supply of water, climate etc. are important variable in determining the percentage of sown areas in different blocks. However with the rapid increase of

population. Various steps were resorted to increase the area under cultivation. Some of these methods were construction of embankments, clearing of forest, draining of marshes etc.

The percentage of net cultivated area between the blocks varied from 54 to 70 per cent during the decade 1971 to 1981. The percentage of area sown more than once also had distinct variation between the blocks for it varied from 31 to 65 per cent. The low percentages were found in areas where soils were sandy marshy, lack of irrigation facilities and lack of significant inputs, etc.

The primary aim of the present analysis is the need for developing and understanding of the land-use changes in the district between 1961 and 1981. Further the author believes that although land-use situation varies between the blocks and through time they share principles that can easily be recognised and usefully applied in the analysis.

There has been significant progress and development of agriculture in the district after independence. However, this progress was over shadowed by rapid population growth. As a result the increasing population pressure has streched the distribution of land to the

maximum. At the same time it has also induced several changes in the district. Proper land-use planning thus becomes inevitable for the optimization of agricultural resources and income of the district. It is the characteristics of the district land-use that despite the non-availability of techniques and modernization of agriculture it has been able to absorb a comperatively large immigrant population. It is the contention of the author that after analysing the spatial patterns of land-use between 1961 and 1981, an adequate frame of reference can be developed for the land-use planning of the district.

Under such situation, it is highly essential to adopt a strategy aimed at ensuring a flow of new field tested technical knowledge relevant to small and holder's production for the successful. Agricultural growth and development of a region like that of Darrang. But here technology is not adequately available, even it it is available, it is not frequently applied because extension services, finance and marketing facilities are lacking. Availability of technology, research and demonstration on a local basis to facilitate adoptation are required in these areas. A constant flow of new field tested techniques relevant to present agriculture is a pre-condition for the success to rural development programmes and for

proper land-use in this area. Little research have so far been done to study the growth and development of land-use at a micro-level in Darrang district.

Significance of the Study:

Study of land-use changes and planning is very important for a district like Darrang which is dominated by agriculture. For such study will not only highlight the characteristic features of the land-use but will also provide necessary direction for introducing required changes in the land-use.

Such an analysis at a micro-level well provide the planners with necessary findings for making innovative changes in the agriculture practices in the district.

Objective:

The basic objective of the present analysis are (1) The analysis of land-use changes from 1961 to 1981 in order to reveal the static, semi-dynamic and dynamic process at work in the region, (2) to find out the correlation between the land-use changes and rapid population growth, (3) To find out the existing land-use that has resulted in agricultural backwardness in the district and (4) To suggest measures for introducing dynamic and innovative land-use changes that will be at par with the population growth.

Hypothesis:

(1) Significant changes in the land-use of the district has taken place between 1961 to 1981. As a result of which, there have been significant diversification of the cropping pattern in the district.

(2) Land-use particularly agricultural land-use has a definite relationship with the settlement pattern in the district (which is in fact a direct response of man to his immediate environment).

(3) That the disparities that exist within the population of the district and between the blocks of the district are by-product of the interaction between the physical milieu and land-use innovations.

(4) There is a significant correlation between the level of rural literacy and the pattern of land-use.

(5) The impact of modernization has had significant impact on the land-use pattern of the district.

Methodology:

The author has attempted to analyse the land-use changes between 1961 to 1981 of the Darrang district by following an emperial approach. The period 1961 to 1981 was selected in order to reveal the land-use changes

that the district had experienced in that period.

Data base:

The sources of information for this desertation, has exclusively been on secondary sources. Nevertheless there exists a wide variety of information, as each aspect in such a spatial frame of study as this, requires a separate base.

For instance, the physical aspect is based upon data provided by block development offices and department of agriculture and settlement offices. Data regarding population was collected from district census hand books. Other relevant data regarding land-use was collected from the agro-industries offices.

The base map of the district was prepared while keeping in view the physical and cultural factors. In addition topographic maps were consulted for preparing land-use maps. The data was computed statistically and various quantative technique are also used in the analysis.

Literature Survey:

As per the author knowledge there has been no systematic study of the land-use of the Darrang district so far. The author therefore had to lean heavily on the

literature available on the general field of agricultural geography and the various land-use studies that has been done in the country and abroad.

Though there exist abundance of literature starting from Von-Thunen's[1] contributions, systematic treatment of agricultural geography began in the 2nd half of the present century. Outstanding contribution in the field were made by eminent geographers like - Baker, Jonassan, Jones, Taylor and Valkenburg.[2] Their primary thrust was towards agricultural regionalization that clearly identified the spatial diversity of rural land-use.

Following them were the contribution of Whitbeck, Visher, Hettner, Mcttarg, and Gregor[3] emphasing the role of physical environmental condition upon man's activities in the rural landscape.

Haggett and Harvey[4] emphasised the problem of the scale in geography and suggested that collection of data and generalization on national regional farm and field

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[1]Von-thunen, 1826

[2]Baker, O.E., 1926; Jonasson,O., 1926-26; Jones, C.F., 1928-1930; Taylor, G., 1930; Valkenburg, S. Van., 1931-36.

[3]Whitbeek, 1926; Visher, 1932; Hettner, 1947; Mettarg, 1964 and 1966; Gregor, 1970.

[4]Haggett, P., 1965; Harvey, D.W., 1966 and 1968.

levels. Most of these contributions were based on weak conceptual or structural basis and hence often proved to be inadequate while dealing with land-use problems at micro level.

Kostrowicki[5] developed a pattern of land utilization based on agricultural typology regionalization and development. Block went further to include types of agriculture land-use and long-term rural prospective. Vink[6] considered the interaction of physical, biological and cultural factors in relation to rural land utilization with the help of systematic models and agricultural techniques.

Of recent geographers like Bunge, Buchanan, Blaut, Brookfield, Franklin, Harvey, Helburn[7] and others have strengthened the conceptual approach to the problems connected with rural land-use.

1) Some of the aspects are more of theoretical approach and less of concern with the uniqueness of geographical distributions;

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[5]Kostrowicki, J., 1964.

[6]Vink, A.P.A., 1975.

[7]Bunge, W., 1962; Buchanan, R.O. and Blaut, J.M., 1959; Brookfield, H.C., 1964; Franklin, S.H., 1962, 65 and 1969; Harvey, D.W., 1966; Helburn, N., 1957.

2) A retreat from the derminastic interpretation of phenomena to a probabilistic and behavioural approach;

3) Micro-level analysis in geographic analysis assuming greater significance. Agricultural geography also benefitted from the quantitative revolution of the 1950's as well as through computerization.

Following Von-Thunen models geographers like Hagett, Prad and Chorely[8] contributed the optimizer model; Hagerstrand and Bowden[9] contributed agricultural innovation diffusion model; Krumbein and Graybill developed probability model; Zipf, Simon, Berry, and Garrison[10] contributed mathematical model, other model builders were Harris, Dacey, Isard and Chisholm.[11]

In India most of the studies that were made was in the nature of the analysis the regional agriculture. It has close relationship with land-use study. S.N. Mishra[12] has studied the land-use in Khadar and ravines of the lower middle Gommati valley. P. Ayyar[13] had used quantitative

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[8]Chorely, R.J., 1964

[9]Hagerstrand, T., 1952; Bowden, J.M., 1965.

[10]Zipf, G.K., 1949; Simon, H.A., 1956; Berry, B.J.L., 1958.

[11]Harris, 1969; Dacey, 1963; Isard, W., 1960; Chisholm, M., and Hutchinson, 1966.

[12]Mishra, S.N., 1964.

[13]Ayyar, N.P., 1969.

methods to the study of crop - Combination region. According to Learmonth and Bhat[14], agricultural land-use has been studied in detail by several discipline but its sharp regional contrasts need spatial analysis which fall within the purview of economic geography. Ali Mahmood[15] has published his book 'Studies in agricultural geography in India' that dealt with land classification, crop combination, - agriculture efficiency and agricultural innovation, along with a number of case studies of agricultural situations of rural settlements in Uttar Pradesh. M. Shafi[16] has written many papers regarding different branches of agricultural geography. J. Singh's[17] 'An agricultural geography of Haryana' 'An agricultural Atlas of India', 'Green revolution in India' and many papers are some of the important contribution to the study of agricultural geography in India. Majid Hussain's[18] agricultural geography, G.S. Bhalla's 'Changing agarian structure in India' are also networthy works in the field of agricultural geography.

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[14]Learmonth, A.T.A., 1968; Bhat, L.S., 1968.
[15]Mahmood, A., 1976 and 1978.
[16]Shafi, M., 1960.
[17]Singh, J., 1974 and 1976.
[18]Hussain, M., 1979

Little works have been done in the field of agricultural geography in Assam. P.C. Goswami's 'The economic development of Assam', K.C. Mahanta's and A.K. Neog's - Agriculture and Animal Husbandry in Assam', M. Taher's physical basis for agricultural planning in the Brahmaputra valley', M.M. Das's[19] structural analysis of present agriculture in Assam', and other papers were the main works so far done in Assam.

Following Chapterization is made for the study:

Section (A) - General background, divided into two chapters namely - (1) Introduction to the problem, significance of the study, objective, hypothesis, Methodology Literature Survey. (2) Physical base - Geology, Relief, Climate, Soil, Drainage, Population Characteristics. Section (B) - Analysis of land-use - (3) General land-use land suited to cultivation and other uses, Reversible and irreversible uses, multiple land-use changes, agricultural land-use. (4) Cropping pattern, crop combination, Intensity of cropping, agricultural regions. (5) Changing pattern of land-use in Darrang district - population pressure on land, irrigation in land-use, mechanization, H.Y.V., Transport and market and conclusion.

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[19]Das, M.M., 1980.

CHAPTER II

GEOGRAPHICAL FRAME OF DARRANG DISTRICT

Physiographic factors such as relief, geology, climate, soils etc., play a vital role in land-use planning. The analysis of the influence of these factors in a dominantly rural landscape is a specific field of agricultural geography. "Of all the activities agriculture is probably one on which the phenomenon environment impingious most".[1]

Generally speaking the physical configration of the Darrang district is a large open plain with a general slope towards the south. The low hills which characterises the south-western part of the district has a maximum elevation of 200 m above sea level. Likewise in the northern part of the district, foot hill areas of Bhutan and Arunachal Pradesh emerge in parts of the region. The development blocks which stretches the foot hill areas are Khairabari, Udalguri and Majbat.

The slope in this district is steep as compared to other parts of the district. Average elevation in these bordering blocks is approximately 350 m above sea level.

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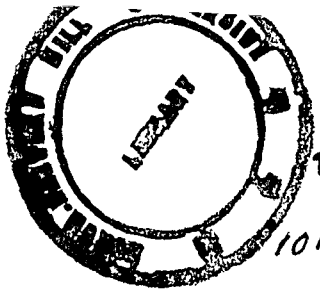
[1] Hurst - 1972.



There is sudden fall in slope in Udalguri block as compared to Khairabari and Majbat blocks. Areas with an elevation average 200 m and extends to about 10 km towards north-western Udalguri northern Khairabari and parts of Majbat blocks. Apart from these other block of the district have an average elevation 100 m about sea level. Besides local topographical variation the flat plain is interrupted by sandy or coarse alluvium as in Majbat and Dalgaon - Sialmari blocks. Old alluvium is found in parts of Kalaigaon, Chapai, Dalgaon Sialmari, Majbat, Udalguri and Khairabari blocks. Swampy condition are found in the south western parts of Sipajhar block. With the rapid increase of population swamps and low land areas have been reclaimed by constructing embankments along Brahmaputra and its tributaries.

Geology of Darrang District:

The nature and structures of geological formations have many indirect influences on agricultural land-use. Geological formation's provide the basic materials and structures for the parent materials of the soils. Some aspects of geology have, however, an even more direct influence on land use, i.e.,

(a) Engineering geology
(b) Hydrology
(c) Environmental geology[2]

[2]Flawn, 1970

Geologically, Darrang district has Archaean base and from oldest group of rocks to the youngest ones. The archaean 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 district.

Stratigraphically, the archaean group consists of bonded composite biotite, biotite sillimanite gneisses and schists, associated with feldspathic biotite, pyroxene, aplites. Younger coarse to fine grained granite, gneisses intruded by massive perphyritic and coarse biotite granites, pegmatites and quartz veins. Unclassified older and newer alluviums (Quaternary deposits) comprising of high level terraces, the red and black soils and the recent alluvial deposits is found in the Dalgaon-Sialmari and Kalaigaon and parts of Majbat blocks. The new alluvial deposits get floaded in the rainy season and receive new fertile layers of silt. (Generally in the river bank area). The newer alluvial soil consists indurated yellowish to brownish or reddish clay with sand, gravel and boulder deposits in the lower course of the rivers area as in northern parts of Majbat, Kairabari and Udalguri blocks.

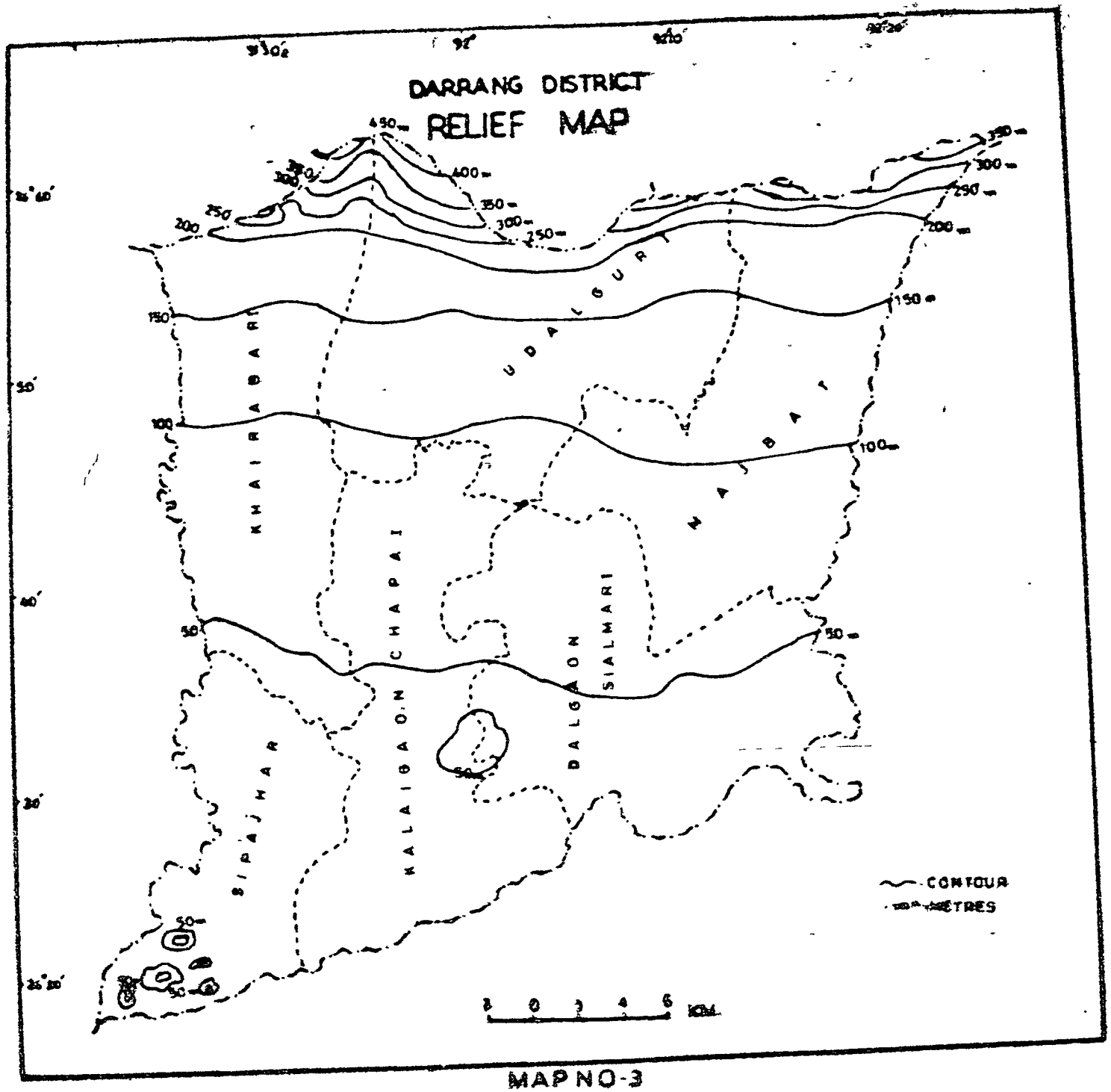
The district has a large potential of underground water. The application of modern scientific know how and utilising this immense potential for irrigation has greatly benefitted the agricultural activity in the district.

Relief:

The relief of a land surface affects agricultural land-use through altitude and slope. The affects of altitude is felt mainly indirectly, i.e., through climate, while slope controls are partly indirect through climate and soil, and partly direct, such as limitation of cultivation.

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 (see map No.3).

The general configuration of the district is that of a large open playing with a general slope towards the south. The south western part of thedistrict by low hills with a maximum elevation of 200 m. over sea level. The northern part of a district is also characterised by the foothills region of the Himalaya. There is a sharp fall of slope in the northern part of Udalguri blocks then in the blocks of Khairabari and Majbat. Higher grounds (200m) external over to about 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


DARRANG DISTRICT
RELIEF MAP
KHAIRABARI
UDALGURI
MAPAI
CHAPAI
KALAIGAON
SIALMARI
DALGAON
SIPAJHAR
CONTOUR
METRES
KMS

MAP NO-3

elevations of about 100 m. Although it is a plain area, local differences in elevation are found in all the blocks. Among the blocks, Majbat experiences higher ground elevations and next to it is Dalgoan-Sialmari, part of Khairabari, Kalaigoan and Udalguri and the whole of Sipajhar have low grounds easily prone to floods. The level plain is broken by sandy or coarse alluvium particucularly in the Majbat and Dalgoan-Sialmari blocks. Higher grounds of old alluvium have covered some parts of Kalaigoan Chapai, Dalgoan-Sialmari, Majbat, Udalguri and Khairabari blocks.

The relief of the northern side of the Darrang district 150 m to 450 m within the boundary areas, it plays 450 m to 950 m and above. In these areas agriculture is not developed due to rugged terrain and slopeness character of soil. In the plain areas relief is the important factor for agricultural land-use.

Climate:

Climate is one of the major factors in determining the pattern of agricultural land-use. For the capability of region to produce crop is directly dependent upon (Among others) climatic and soil condition. Climate introduces regional differences in the crop productivity and hence variation in agricultural land-use.

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 draught condition in winter. In between these, two pre-monsoon showers and retreating monsoon are interspersed. The latter are transitional in characteristics. More than 80 per cent of the annual rainfall occurs between May and September.

Along with the seasonal characteristic of the precipitation there are marked spatial variation within the district between the blocks and from season to season. Thus introducing latent features resulting in differential land-use within the district.

The average annual precipitation of the district is about 1943 mm (average of last 15 years). The northern part gets substantially higher rainfall than the southern part. There is a marked differences in the variability of rainfall. Degree of reliability of rainfall is very high in Khairabari block high in Dalgoan-Sialmari, Kolaigoan Chapai 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 land-use are -

(1) Heavy and delayed monsoon resulting in damage to standing Kharrif crops and delaying sowing of rabi crops. (2) Frequent and long interruption in the monsoon damaging the Kharif crops "there by indicating the need for irrigation facilities. (3) Heavy summer precipitation causing flood and soil erosion.

Temperature:

Temperature is also an important factor for agricultural land-use and agricultural development. Adequate temperature is required to grow the crops. In the summer season temperature is increased upto 31°C. In the winter season it decreases upto 16°C (within the Darrang district).

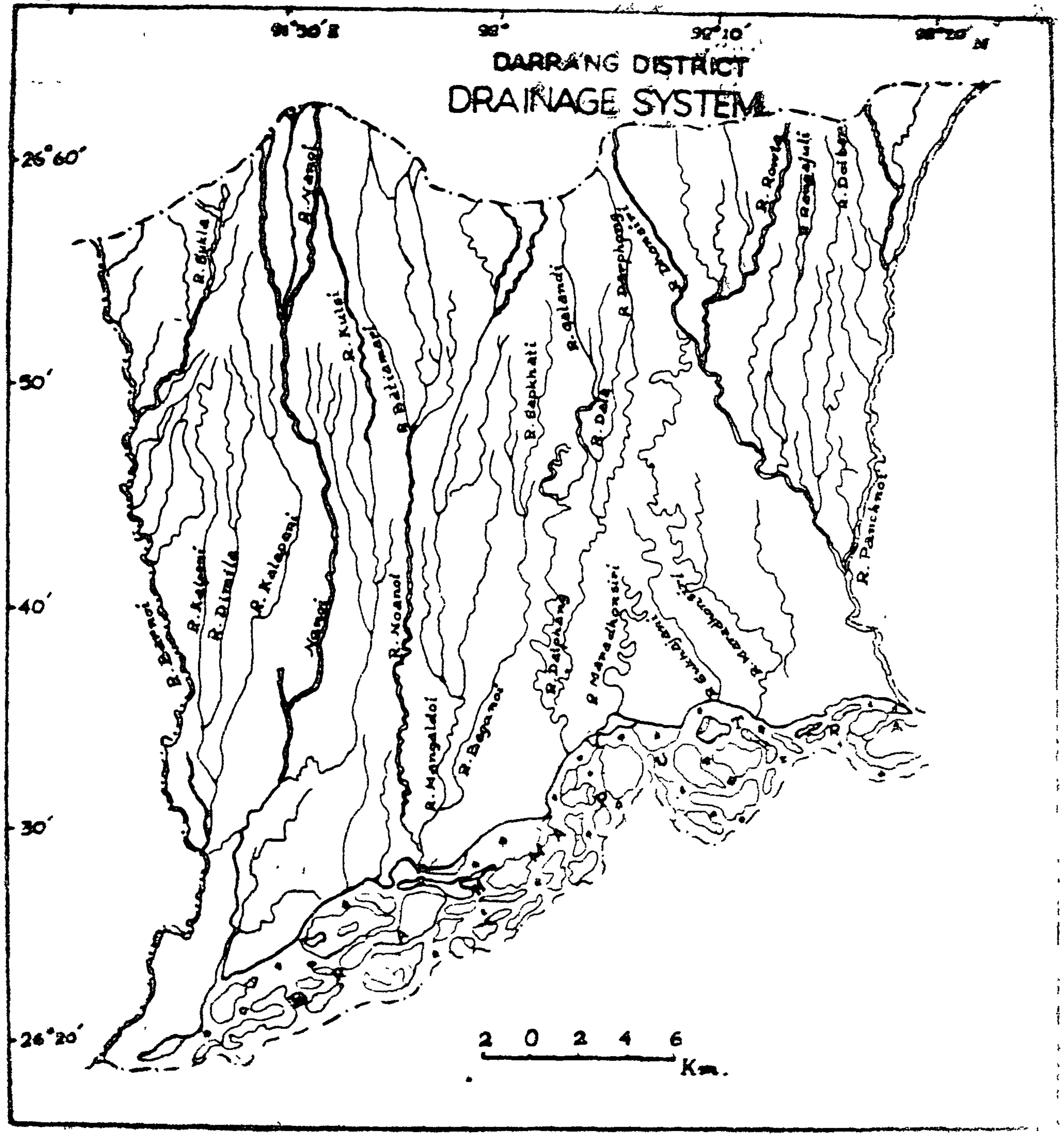
Drainage:

The drainage system of Darrang district the Brahmaputra river has the dominant role, offering a 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 net work of drainage and channels which flow from the northern hills towards south to the Brahmaputra river. The important tributaries of Brahmaputra are Barnai, Nanoi, Saktola, Kuapani, Noanai,

Mangaldai, Bega, Galandi, Sukhajani, Maradhansiri, Dhansiri, Panchnai are the main tributaries. In the northern part the river are - Sukla, Dimila, Kulsi, Lakshmi, Chandana, Daiphang, Rowta etc., (see Map No.4). In summer season heavy rain occurs in the hilly region and rivers carrying boulders, sandstone, sand comes down with high speed and full volume. At that time water level goes up and down with rainfall. In the winter season most of the drainage dry-up except Dhansiri, Nanai, Burnai and Panchnai. Farmer affecting by the full volumes of drainage water.

Besides the drainages some beds are located within the region these are not helpful for the peasants. They used only for fishing purposes. In the winter season peasants used the beds for rabi crops water lifted to the agricultural fields by power pump.

Dams are constructed in some rivers and streams for irrigating the fields. Now, in Dhansiri river biggest dam has been constructed for irrigating the whole Udalguri block and some parts-Majbat and Dalgoan-Sialmari blocks. In Siphjhar block only one drainage 'Narikali' for outlet the water.


DARRANG DISTRICT
DRAINAGE SYSTEM
91°50' E
92°
92°10'
92°20' N
26°60'
50'
40'
30'
26°20'
R. Gukla
R. Nanoi
R. Kulsi
R. Baliamari
R. Galandi
R. Darphang
R. Dhansiri
R. Rowta
R. Rangajuli
R. Dalbari
R. Sapkhati
R. Dala
R. Panchnoi
R. Barnoi
R. Kalapani
R. Dimila
R. Noanoi
R. Mangaldoi
R. Baganoi
R. Dalpang
R. Maradhansiri
R. Gukhajani
2 0 2 4 6
Km.
MAP NO. 4

Soils:

Soils in general terms, are that portion of the earth's surface consisting of disintegrating rock and humus content (organic materials). They are combined result of geological parent materials, climate, topography, living, organisms and time. The process of soil formation are slow, but soil degradation and erosion can be rapid. Herein lies the crux of soil - management requirements; 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 factor in soil formation and its fertility. Soil and their properties are also influenced directly and closely by topography, relief, altitudes, parent materials, living organisms and time - a great deal of time.

Man uses the soils with the purpose of obtaining maximum profit and many a time without carrying much about its future fertility. At present the importance of soils has been realized and therefore keeping the soils has been realized and therefore keeping the soils in sound health is the major concern of the farmers and soils scientist all over India.

Classification based on Land-use:

Agriculture:

In agricultural practices, Land classification is a very recent method to modernize agriculture through the adoptation of scientific methods to derives maximum benefits from every type of land whether agricultural or non-agricultural. Land classification for land-use planning and agricultural development should 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 can not be profoundly altered by man.

As per earliest investigations - soils may be traditionally classified into fire broad macro-regions related to major regional complexes - of climate and reglith; the alluvial soils, the sandy soils, the regur soils or the black soils the laterate soils and the red soils.

The soil of the whole Darrang district is constituted by alluvial type of soil. The rivers have been

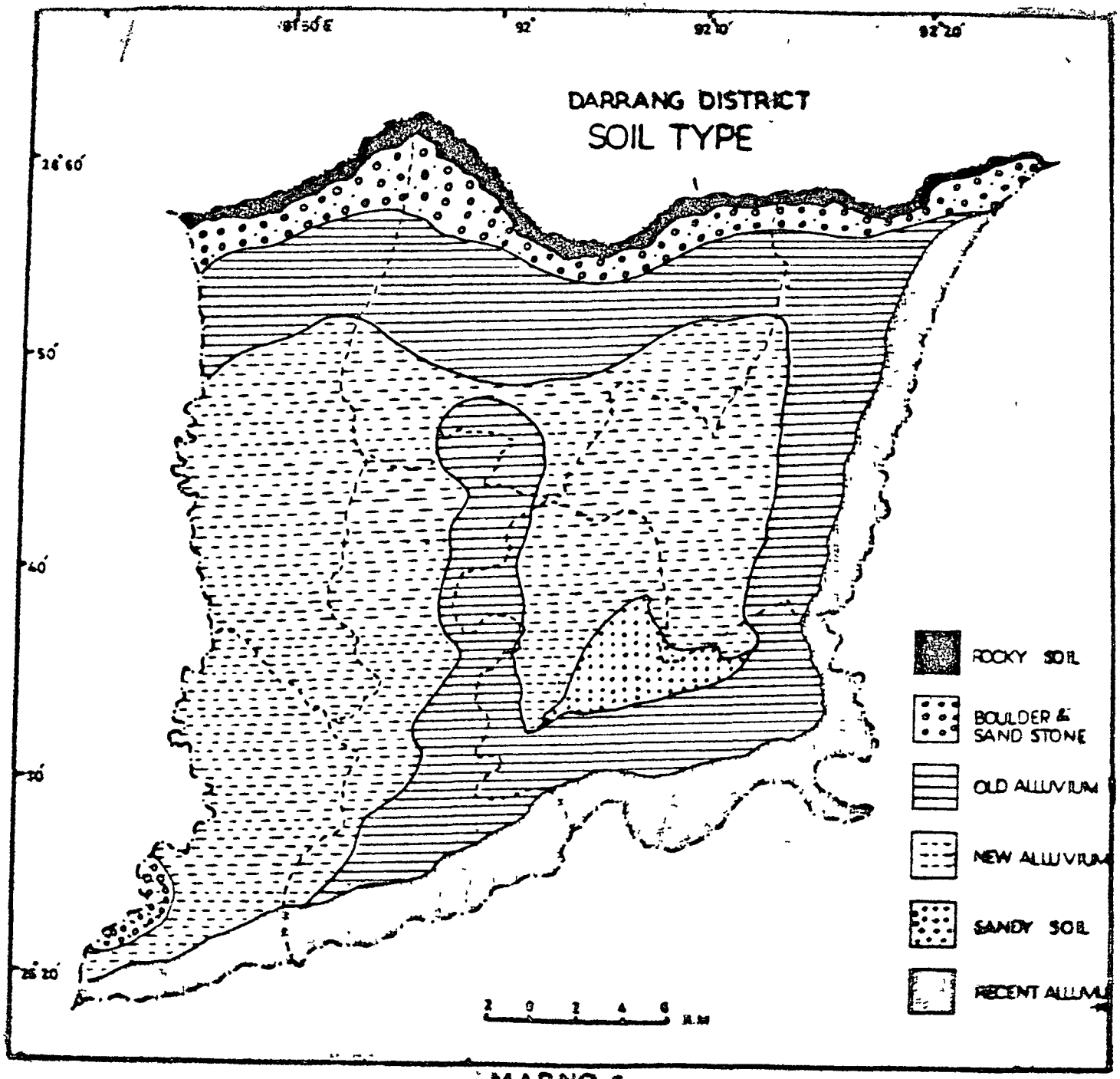
carrying out various kinds of soil forming materials from the Himalaya and depositing these year after year on the region from the foothills to the Brahmaputra. The river Brahmaputra also deposits huge amount of silts and sediments on the neighbouring areas towards the south of the district (see figure-5).

On the northern side of the district (covering 1 to 3 km in width) is constituted by rocky soil of big boulders and stones. These areas are suited for growing luxurious vegetation and valuable trees within these areas of land agriculture is not possible due to soil erosion and rocky nature of soil.

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

(1) Recent alluvial.
(2) Old alluvial (river line).
(3) Old alluvial (mountain valley).

The recent alluvial soils are confined in the low laying tracts of the floodplains where tributaries carriages new silts are deposited in every year. These soils vary from sandy loams to silt and clay-loam, having less acidic


DARRANG DISTRICT
SOIL TYPE
91°50'E
92°
92°10'
92°20'
26°60'
50'
40'
30'
26°20'
ROCKY SOIL
BOULDER & SAND STONE
OLD ALLUVIUM
NEW ALLUVIUM
SANDY SOIL
RECENT ALLUVIUM
2 0 2 4 6 K.M

MAP NO-5

contacts. Recent alluvial soil is suitable for the cultivation of rice, jute, pulses, muster seed, onion, potato and vegetables. These soils are consists of phosphates, potash and calcium. This area also occupied by grasses and it is used for cattle and buffaloes reared by the peasant and farmer.

The old alluvial soils are found at tracts where these area are free from floods. Old alluvial soils are divided into two types, i.e. (1) The soil which is confined in the mountain valley. These valley are covered by the old alluvial soils. These soils are found on the southern side, and eastern side of Majbat block and middle of Kalaigoan block. This type of soil are the medium content of chemical composition. These soils are favourable for rice, sugarcane, fruits and vegetable cultivation but pulses and mustard seed cultivation are not conductive. (2) The red soils are red-yellow loams. These are occur on the sloping hill-side, differ greatly in fertility, but generally have low fertility rating. The rivers carry gravels and sand of bigger size deposited within the (2 km to 4 km wider area). With these type of soil produce a number of crops and are suitable for growing trees and big plants and grasses and some parts also used under irrigation. The crops like maize, tapioca, pineapple and

fruits (see Map No.5).

On the basis of soil formation entire Darrang district on Brahmaputra river plain land-use changes are varies from the point of agricultural practices. Though land use practices within the valley region is very high, and agricultural practices is the main source of national income, which is 45 per cent of our national income.

Population Characteristics:

Rapid increases 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 the population of the district has been increasing at the rate of 124 per cent from 1951 to 1971. The following Table-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 consolidiated growth of 88.71 per cent the census of these increases can be broadly classified into (1) Large scale immigration into the state particularly the district from the neighbouring populous region for settlement and employment and (2) corrosponding natural growth.

TABLE - 2

BLOCKWISE POPULATION INCREASE IN DARRANG DISTRICT

Name of Blocks	1951	1961	1971	Percentage of increase
Khairabari	59,958	95,891	1,46,270	142
Sipajhar	60,259	76,618	99,386	67
Kalaigoan-Chapai	78,103	1,11,505	1,54,691	99
Dalgoan-Sialmari	83,735	1,14,00	1,55,244	86
Udalguri	54,772	90,661	1,63,132	199
Majbat	65,674	93,949	1,30,800	95
District Total	4,02,501	5,82,624	8,51,523	114

Source: Census of India, 1951,61,1971.

Table 3 and 4 represents the growth of rural population in the district in the census years of 1961 and 1971. Due to lack of availability regarding the number of agricultural family or individual land holding. An approximate estimation regarding the agricultural population of the various development blocks of the district has been made on the basis of over all average of the state.

The population growth in Darrang district has been constantly on the increase between 1961 and 1971 the

average growth rate was about 46.15 per cent as compared to 4.95 and 24.80 per cent for the state, and the country respectively in the corresponding period net sown area increase by 22.62 per cent the man-land ratio was disproportionate as *more than 88 per cent of the district population were 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 1971-1981 does not present very encouraging picture as regard per capita land holding.

TABLE - 3

DISTRIBUTION OF PEASANT POPULATION IN DARRANG DISTRICT 1961

Name of blocks	Number of peasant	Total peasant population	Rural population	Percentage to rural population
Kharirabari	15,107	71,757	78,483	92.30
Sipajhar	14,969	71,102	76,618	92.20
Kalaigoan-Chapai	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	14,184	67,374	84,525	78.81
Total	91,872	4,36,379	5,18,083	85.24

Source : Census Handbook Darrang District - 1961.

TABLE -4

DISTRIBUTION OF PEASANT POPULATION IN DARRANG DISTRICT 1971

Name of blocks	Number of peasant	Total peasant population	Rural population	Percentage to rural population
Khairabari	21,639	1,02,785	1,28,252	80.30
Sipajhar	14,774	70,176	99,386	70.89
Kalaigoan-Chapai	23,468	1,111,473	1,42,216	78.16
Dalgoan Sialmari	25,769	1,21,402	1,41,687	85.66
Udalguri	20,174	95,826	1,23,410	78.06
Majbat	19,324	91,789	1,17,828	78.00
Total	1,25,146	5,93,451	7,52,779	78.52

Source : Census Handbook Darrang District - 1971.

The district as a whole present 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 seem 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 aspect 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 grass area sown has increased from 19.3 in 1961 to 5 in 1981. Whereas the population density per hectare gross sown area in the country is only 3. Thus the availability of agricultural land in the district has become critical.

The percentage of literacy in rural population indicates the possibilities of changes in agricultural activities and diversities. From this point the district is backward. The percentage of literacy in 1961 was 28.05 with highest and lowest in Sipajhar and Dalgoan-Sialmari blocks which were 39.46 and 14.25 respectively. In 1951 the percentage of literacy was 11.82 per cent.

Out of 7,52,779 people living in villages only 1.77,669 were engaged in primary sector as compared to 4,150 in secondary and 18,034 persons in the tertiary sectors (Table-5) given the spatial distribution of the working population in 1961 and 1971.

The table indicates that 88.90 per cent of workers were in the primary sectors as compared to 2.08 per cent in secondary and 9.02 per cent in tertiary sectors. Percentage of cultivators to total workers in the district was 78.28 per cent and that of agricultural labour 9.90 per cent. The total

agricultural population accounted for 78.32 per cent of the total rural population in the district in 1971. Percentage of cultivators to total workers in 1961 was 84.32 per cent and these were very much higher than in 1971. Distribution of population belonging to different social groups as found in different blocks are approximately 50 per cent of the total population in Udalguri block consists of scheduled tribes and 35 per cent in Khairabari block; Dalgoan-Sialmari block is dominated by immigrant Muslim population; while in Majbat block was all the different social groups. Table-6 gives the major break of social groups.

TABLE-6

PEOPLE OF DIFFERENT SOCIAL GROUPS - 1971 (IN PERCENTAGE)

Blocks	Total	Indegenous other than ST	Scheduled Tribes (ST)	Immigrant Muslims	Others	Total percent
Khairabari	1,28,252	40.00	35.00	2.00	23.00	100.00
Sipajhar	99,386	92.30	0.90	0.80	6.00	100.00
Kalaigoan-Chapai	1,42,216	65.00	11.50	13.00	10.50	100.00
Dalgoan-Sialmari	1,41,687	5.00	6.00	70.00	19.00	100.00
Udalguri	1,16,869	18.00	50.50	2.00	20.50	100.00
Majbat	1,17,830	28.00	22.00	20.00	30.00	100.00

Source: Statistical Handbook, Assam, 1980.
Census Handbook, Darrang District, 1971.

CHAPTER III

LAND CLASSIFICATION

The classification of land is quite essential and is a pre-requisite in any land-use planning and development. No planning can be done unless the use of a particular piece of land is known and is classified; hence it becomes an integral part of land-use planning. Land classification is based on their native and relative characteristics. It includes climatic factors, soil properties, water supply, soil erosion environmental conditions, etc. that affect land-use and productivity.

Land classification are presented in three (3) groups. First are those that deal with characteristics directly based on the land itself and not related to particular uses. They can cover systematically an entire area, be it a specific place, an entire country, or the world. The second group are those related in one way or another to particular kinds of land-uses, such as urban, agricultural, or different uses of forested lands. Third are the comination of first and second group in which both lands and use classification are combined in various ways to particular purposes.

Classification Based on the Land only

Land use is an essentially homogenous group as it includes item that give the land its basic and essentially permanent

characteristics. These are not influenced by people to any major extent. Classification can be applied systematically to an entire land area.

Weather and Climate

The weather at the earth's surface to which discussion is here confined, is extremely important in land use. Climate includes a number of measurable weather conditions. Climatic Extremes that occur only occasionally such as floods, hurricanes, tornadoes or extreme temperature are very significant, in any discussion or analysis of land-use.

General Land-Use

The general land-use and land-use patterns in the Kharif and rabi seasons have sificant characteristics. The land-use and cropping mosaic of any region are the outcome of geomorphic features. Climatic variables, pedological differences, historical processes and social and economic institutions. In a given physical milleu, man as an active agents modifies the landscape and uses it to fullfil his needs with the technology at his disposal or with techniques that are imported. Different types of living which are represented by social values and certain institutional controls tend to

create different patterns of land-use within the limits imposed by different agro-physical situations. The impact of physical factors is interwoven with socio-economic factors from whcih the farmer cannot be easily spared for geographical investigation of contemporaneous land-use pattern and changes therein. The general land-use discussion without proper understanding of different categories of classification cannot be a meaningful exercise and therefore, it is worthwhile to define the various categories of land.

The Minister of Agriculture in 1950 recommended a standard classification and uniform defination of the different categories of land to be adopted by states all over India. The defination and expansion have been further revised by the committee on improvement of agricultural statistics for the sake of clarity and workability. The land area as geographically accessible for major uses is classified into 9 (nine) broad categories:

(1) Area covered by forest: Forest cover any land classed or administrated as a forest under legal enactments. The area figures under grazing land area crop within the forest area are also included in the area under forest.)

2) Area under Non-Agricultural Uses: Covers all lands occupied by settlements road, railway, beds of streams, ponds and canals.

3) Barren and Uncultivable Lands: These are bare rocky out crops of hills, plateaus mountains desert etc. This land can under no conceivable circumstances be brought under cultivation, but at a very high cost, a very little production may be classed as uncultivable.

4) Permanent Pasture and other Grazing Lands: These embrace all grazing lands which may be permanent meadows and village common pastures.

5) Area under Miscellaneous Tree Crops etc.: It covers all cultivable land which is not included in the area sown, but is put to some agricultural use other than seasonal cropping.

6) Cultivable Wasteland: It denotes land considered by present judgements as cultivable but actually not cultivated during the current year the last few years or more in succession. It is left untilled on account of physical and socio-economic limitations. But some proportion of it could in no conceivable circumstances be brought under tillage without reclamation such as the water logged lands. Though different conditions prevail in different parts of India, tracts of

fertile soil have no land to cultivate except land already known to have been cultivated. Any cultivable land without physical defects would have been taken up for cultivation long ago because of population pressure in certain areas and low productivity of land in others.

7) Current Fallow: Means, the land left unsown for a period of not less than one year and not more than five years. The reasons for long fallowing may be manifold, but the significant ones are, limited means of the farmers, restricted and undependable supply of moisture and unremunerative character of agriculture.

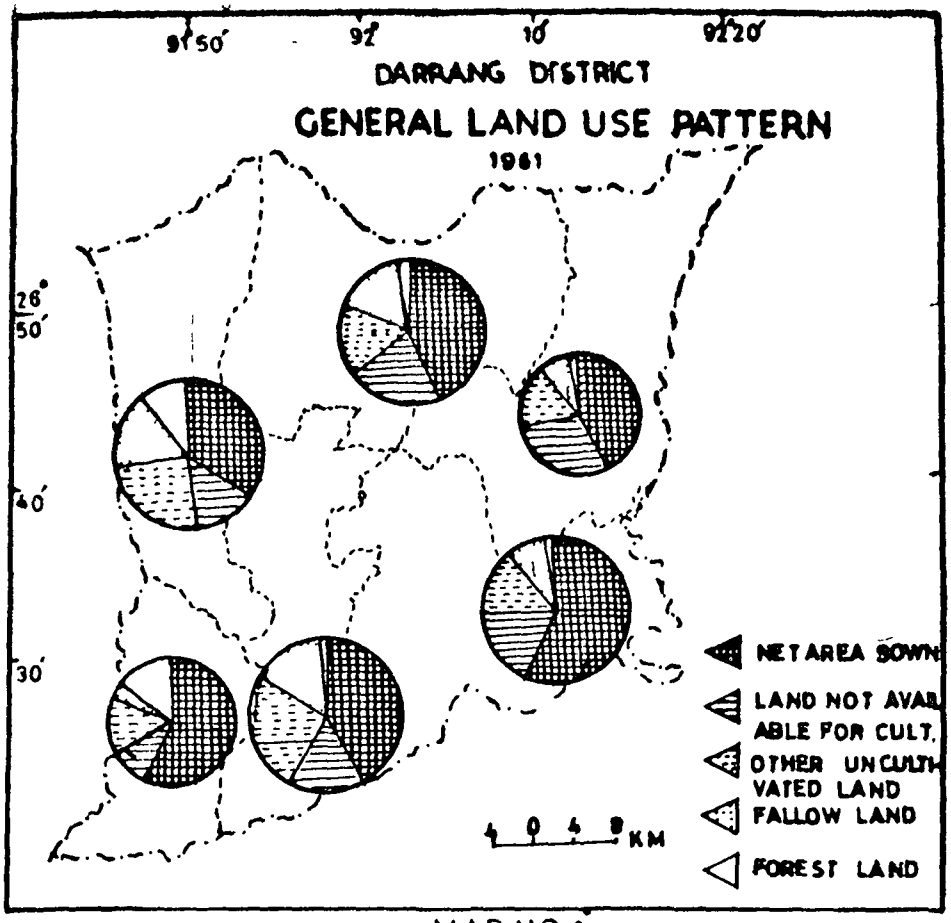
9) Net Sown Area: It represents the extents of cultivated area actually sown during the agricultural year. It may be referred to as net cropped area also. This represents the differences between the total geographical area and the sum total of areas under classes.

For the Darrang district land-use pattern are represented by pie diagrams. These are grouped in maps into five categories. These are as follows: (Fig. 6 and 7) 1961 and 1981.

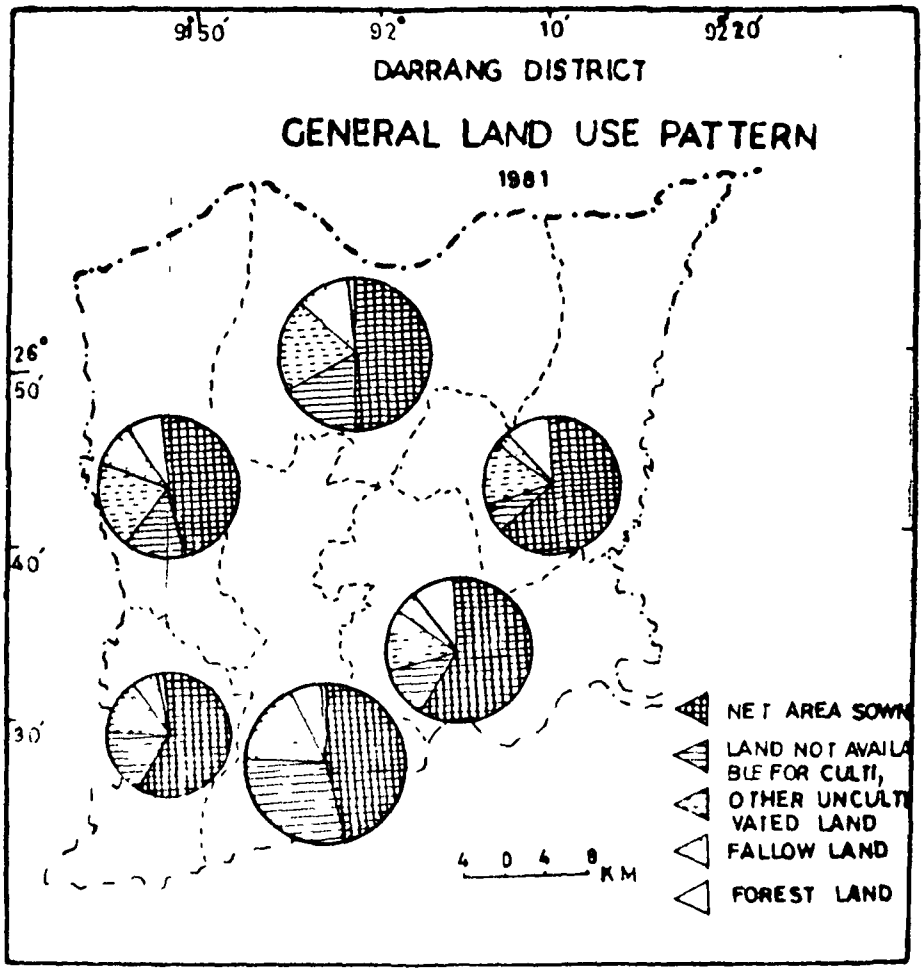
(1) Net area sown.

(2) Land not available for cultivation.

(3) other uncultivated land.



MAP NO 6



MAP NO-7

(4) Fallow land.

(5) Forest area.

In the district, out of the total geographical area of 3,18,105 hectare (excluding tea garden area) net sown area in 1961 was 1,39,368 hectare. In 1971 it rose to 1,70,889 hectare and in 1981 it went upto 1,88,178 hectare (43 per cent to 54, 59 per cent).

Table indicates net sown area as percentage to total area which was highest 57.78 percent at Majbat block and less in 36.08 per cent in Khairabari block in 1961. From 1961 to 1981 net sown area increased in all the blocks, Majbat got the highest position (67.12 per cent), and lowest position shifted to the Kalaigoan Chapai block. Other block also indicated changes in their net area sown due to population growth and use of advance techniques in agriculture by the peasant or farmers.

Cultivated area included the net area sown and fallow land. The net area sown and cultivated area are identical. By the changes of fallow land the net area sown increased due to population increase (clearing of forests etc.) and changes in the intensity of irrigation.

Fallow land remained static and in some blocks decreased

in Darrang district due to seasonal variation. In efficient irrigation facilities, large land holdings, unskilled labour, political and social disturbances.

In 1961, there was only 13 per cent of fallow land in the district - the fallow land was highest in Khairabari block and lowest in Majbat block. But in 1981 the fallow land decreases substantially in Udalguri block, while there was a marginal decline Dalgoan Sialmari block.

Forest area covered only 17 thousand hectare and of the total of 28.6 lakh hectare in the district. From the figure No. we can say that forest area within Darrang district is not sufficient for it was only 6 per cent in 1961. In 1981 it covered only 5.5 per cent. Among the various blocks of the district the Khairabari block had the highest next only to the Dalgoan Sialmari block.

Prior to 1947, the area under forest was substantially higher. But post-1947 period saw a large scale movement of population (immigrants) who cleared the forest cover in the district for settlement and for cultivation. Area under forest also declined due to population increase and thereby intensifying the pressure on land.

Other uncultivated area cover 20 per cent of the total area of the whole district in 1961. After that it gradually

decreased to 14 per cent in 1981 Khairabari and Udalguri blocks had the highest position 23 and 24 per cent in 1961 respectively. But within 20 years the percentage decreased to 15 and 20 per cent in the respective blocks. Other uncultivated land are less in Dalgoan Sialmari block.

Land not available for cultivation decreased from 18 per cent to 16.5 per cent (1961-1981) in the district. There was a marginal variations in all the other blocks. Highest per centage of land not available for cultivation was found in Kalaigoan Chapai block; lowest percentage fall was in Majbat and Dalgoan Sialmari blocks.

General Land-Use Changes:

As a result of geographical and socio-economic factors, there was a considerable variation in land-use patterns both in time and space in the district. The total area of the region was 3,18,105 hectares. In 1961, the area under forest, land available for cultivation, fallow lands, other uncultivated land, net area sown, were 20,283 hectares, (6%), 55764 hectares (18%), 39,382 hectares (13%), 63,308 hectares (20%) and 1,39,368 hecters (43%) respectively, which had corresponding area and percentage of 17,121 hectares (5.5%), 59,910 hectares (16.5%), 15,861 hectares (5%), 45,035 hectares (14%) and 1,88,178 hectares (59%) in 1981. The net area sown increased

substantially while other categories decreased during 1961 to 1981. The rate of increase was higher in Khairabari and Udalguri blocks while Kalaigoan and Majbat blocks were the least. Other blocks indicated insignificant change during 1961-81.

TABLE-7

Category	1961		1971		1981	
	Hectare	Percentage	Hectare	Percentage	Hectare	Percentage
1. Net sown area	1,39,368	43.00	1,70,889	54.00	1,88,178	59.00
2. Land not available for cultivation	55,764	18.00	53,201	17.00	51,910	16.51
3. Other cultivated land	63,308	20.00	51,985	16.50	45,085	14.01
4. Fallow land	39,382	13.00	22,709	7.00	15,861	5.00
5. Forest area	20,283	6.00	17,121	5.50	17,121	5.48
Total	3,18,105	100	3,18,105	100	3,18,105	100

Source: Block development offices

TABLE-8

NET SOWN AREA

1961-1981

Blocks	Total area (hectare)	1961		1971		1981	
		N.S.A. (hec.)	N.S.A. as p.c. to total area	N.S.A. (hec.)	N.S.A. as p.c. to total area	N.S.A. (hec.)	N.S.A. as p.c. to total area
1. Khairabari	60,846	21,949	36.08	23,558	46.65	29,516	58.46
2. Sipajhar	40,146	17,556	43,74	23,858	59.42	24,752	61.67
3. Kalaigoan Chapai	56,900	23,498	41.31	31,162	46.34	32,075	47.68
4. Dalgoan Sialbari	57,119	25,778	45.14	34,332	60.11	36,416	63.76
5. Udalguri	60,713	26,101	43.00	30,853	50.82	37,172	61.29
6. Majbat	42,381	24,486	57.78	27,126	64.01	28,447	67.12
Total	3,18,105	1,39,368	47.81	1,70,889	53.72	1,88,178	59.16

Source: Block Development offices and Statistics office, Mangaldai

Reversible and Irreversible Uses:

Irreversible and reversible land uses are important in land-use planning. By irreversible, it is meant that application of a particular land-uses changes or otherwise prumpts the original character of the land to such a degree that reversible to its former use or condition is impracticable if not impossible. In effect, such use is a one-way street, however the time scale is important.

Irreversible uses:

A classic example of very large scale irreversible land-use occured when the Europeans by permanent settlement supplemented the native Indians of North America. No change back to the essentially natural use of the land was possible. Ecological advocacy of returning to "natural" land-uses can sometimes reduce in effect to an argument that the land should revert to the original uses.

Cities, large towns and industrial areas by and large are never erased in any foreseable time although the particular kind and character of such uses can be changed. They constitute essentially irreversible land uses.

In the state of Assam, specially in Darrang district the watershed areas are another and very critical example. Once they are drained or filled, such areas can not be

restored to what they were, although the subsequent use may be changed to other uses. In Darrang district the agricultural land shifted to urban uses. The agricultural land decreased due to the emergence of secondary and tertiary sectors. These sectors emerged mainly in Kalaigoan and Udalgiri block, while in other blocks, these were insignificant.

The use of land for the major roads, highways, and railroads of a district is also irreversible. The linear nature, the disruption of the soil, and the persistance of established transportation routes makes the availability and suitability of such land for some other uses are unlikely.

The areas involved may not be relatively large, but they can nonetheless be highly significant because of the specific nature of such uses and the fact that may deeply affect land uses. This is particularly true of transport routes, which are strategically important in giving access to land (See map No.).

Reversible Uses:

Reversible uses include use of land in which the soil cover and landform have not been substantially changed.

In Darrang district (all the blocks) the agricultural cropland and improve pastures give good example of radily reversible land uses than can be and are often applied on a planned rotation basis. Land used for agriculture can revert back to forest or to natural grassland cover, large areas of marginal agricultural land have so reverted, temporarily or for long time periods.

Forested lands in Darrang district mainly in Majbat, Udalguri and parts of Khairabari blocks occupy very large areas, after under going number of reversible land-use.

They provide an extremely persistance and durable land cover that is relatively easy to reestablish either naturally or by seeding or planting where necessary. Forest help to clean the air, built and hold soil, and produce a wide variety of produce and services. In the practice of forest management, emphasis can be on timber production recreation, watershed, protection wild life, or grazing, depending on purpose and land suitability.

Within urban areas a rather large degree of reversibility is physically possible, but it may be highly expensive. In urban renewal, for example, a wide range of reconstruction work may be undertaken. In adequate housing

can be replaced with better and more efficient dwellings. As cities grow, age and change in economic direction and strength, both physical and social changes may take place.

The reason why large degree of reversibility is physically possible in urban areas is that the land functions primarily as a physical base and can support a wide range of urban services in the District.

Land Suited to Cultivation and other Uses:

Grouping of soil series are increasingly made to use soil information for agriculture and many other purposes. A major illustration, comprising and integrating a mass information, is the eight land capability classes established by "the U.S. department of agriculture"[24] which are applicable nation wide.

Land suited to cultivation and other uses are:

1) Have few limitations that restrict their use. Nearly level, low erosion hazard, deep generally well-drained and easily worked soil.

2) Have some limitations that reduce the choice of plants

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[24]Soil Conservation Service, 1966.

or require special conservation practice or both.

3) Have service limitations that reduce the choice of plants or require special conservation practices or both.

4) Have very severe limitations that restrict the choice of plant or require very careful management or both.

Land Limited in Use - Not suited to Cultivation:

5) Have little or no erosion hazard but have other limitations impractical to remove that limit their use largely to pasture, range, woodland or wildlife food and cover.

6) Have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland or wildlife food and cover.

7) Have very severe limitations that make them unsuited to cultivation and that restrict their use largely to grazing, woodlands, or wildlife.

8) Soils and landforms have limitation that preclude their use for commercial plant production and restrict their use to recreation and wildlife, or water supply or to esthetic purposes.

Multiple Land Use:

Multiple use is a land administration action policy and not a static concept.[25] Land resources are for use, and uses can change with need. Management for one use will protect and another use value in degree, or special management action.

The multiple landuse has been vigorously emphasized by Forest Service* and it has been divided into three parts. These are as follows:

1) Land can and do produce many goods and services, and often more than one of them can be obtained in various admixtures and combinations from a particular area of land.

2) Total net benefits, however, measured or determined, often can be increased and perhaps maximized through some judicious combination of two or more uses on a particular area of land.

3) Some compatible and hermonious combination of land uses, with flexibility for changes in the future and without significant impairment of the land, sis mandatory in the public interest.

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[25]Multiple Use Act in 1960.

*LAND USE, Davis, K.P.

In the Darrang district the Multiple Landuse changes more or less practised all over the blocks. The forest cover has been drastically changed to other purposes and uses. It may be of commercial uses or buildings or construction caused by rapid population growth. With it, many new landuse needs have developed, radiating out from growing population centres. Lands once away from such uses are now increasingly in urban spheres of influence.

By the destruction of forest cover for creating cultivable land for agriculture it does not mean that multiple land use has been followed. Multiple landuse is the management of forest resources which also includes use of the same for agricultural purposes wherever and whatever possible.

In the management of forest resource, it is also a national benefit for the multiple use. The plantation of tree is a multiple landuse. (the changes of land into forest area).

Agricultural Landuse:

The Darrang district like other parts of Assam produces a variety of crops such as food crops, fibre crops,

oil seeds, pulses, sugarcane, fruits, vegetables, etc. among which food crops dominate. Food crops like paddy occupied more than 69% of the total crop hectareage of the district in 1961 and 69.26% in 1981. Wheat 0.09% and 2.10% of the total croped area (1961 and 1981). Maize covered 0.13% and 0.57 in the respective years. Paddy consists winter rice, (Sali) summer rice (AHU) and spring rice (Boro).

Jute is the most important fibre crops of the district. It occupied 7.17% and 5.75% of the total cultivated area in 1961 and 1981. Other fibre crops are insignificant within the district. Oil seeds like rape, mustard, seasamum are the main food grains of the district.

Rape and mustard occupied 6.93%, 8.15% of the total croped area in 1961 and 1981. The Darrang district is very important for different varieties of pulses both in Kharif and rabie season. The pulses like Blackgram (Matikalai), Greengram (Maong) Lentil (Mosur) and other pulses, areas are occupied 5.83% and 4.21% of the total areas in 1961 and 1981. Sugarcane is grown in almost all the blocks of the district. Its occupied 1.02% and 0.96% of the total crop hectareage of the district in 1961 and 1981.

Different kinds of fruits like banana, coconut, orange, beetlenut, pineapple, lemon etc. are grown in the district. The fruit crops occupied 2.35% in 1961 and 2.80% in 1981 of total cropped area. The growth of fruits have been gradually, mainly adjourning the settlements.

All varieties of vegetables are grown in both seasons in the disgrict of Darrang. Vegetables occupied 2.44% and 2.15% of the total cropped area in 1961 and 1981 respectively.

CHAPTER IV

CROPING PATTERN

Croping 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=lakh hectare in 1981, a 46.28% increase over the last two decades.

The croping pattern changed in Darrang district due to the importance given to food grain crops that occupy a maximum hectarage in relation to toral cropped area. In 1981, area under food grains was 1.98 lakh hectare (72.00 per cent) whereas in 1961, it was only 1.30 lakh hectares (69.16 per cent) to total area. Crops like oil seeds covered 9.14 per cent, jute 5.80 per cent and other crops like sugarcane, potato, sweet potato, chillies and vegetables etc., were also found to be grown to less percentages.

The food crops productivity dramatically changed from 1961 to 1981 period. While other crops like oil seeds fruits decreased by 15.82 per cent to 12.00 percent from 1961 to 1971. This decrease was largely due to economic factors. But, the production of oil seeds and fruits increased to 11.13 per cent in 1981. The fibre crop production increased only in Dalgoan 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. These are (1) Kharif crop and Rabi crop.

Kharif crops:

Kharif is an important agricultural season of the Darrang district, where nearly three fourth's of the cultivated land is under cultivation. The principal Kharif crops are rice, maize, sugarcane, vegetables, oil seeds and others.

Rice (Oryza Sativa):

Rice has the distinction of being most extensively cultivated crops in the district. It is the staple food of nearly 95 per cent of the population. There are mainly three varieties are rice (1) "AHU" (summer rice, (2) "Sali" (winter rice) and (3) "Boro" (spring rice).

"AHU" is sown by broadcasting method in the month of February to April, and is harvested during May to July. Differences in time depends upon variety, some time it is delayed due to climatic factors. There are two prevailing methods of sowing the early maturing variety of rice in the

district i.e. the puddle cultivation and dry cultivation. The cultivation in the puddle system for "AHU" is very insignificant in Darrang district. In the dry cultivation the field is ploughed soon after the harvest of previous crop with the first rain (if possible). The ploughing are repeated at least 3 to 4 times, before the onset of the monsoon. The weeds are removed, burnt and manure is spread. After manuring, the field is once again ploughed after which they are considered to have been brought under proper With the first rain, the seeds are sown by broadcast methods or harrowed in. Broadcasting rice covers 0.84 lakh hectares.

The 'Sali' (Transplanting rice) cultivation in the puddle system is carried on in three different ways. In the first method, the seed is sown after seeds had sprouted a little. In the second, the seed is sown by broadcast, and the third, the seedling are raised separately in a nursery and then are transplanted in the puddle field, at an interval about 12 x 20 cm. However in all the methods preparation of the field is carried out in the same manner. Water is retained in the field with the help of (Ali, local name) small earthen embankments and the land is ploughed three or four times when it is still under water. Finally after harrowing, seedlings are transplanted. It is transplanted in the month of June and July. The harvesting period is September to December. It covers an area of 1.8 lakh hectare.

'Boro' (spring rice) rice is usually grown in clayey soil which is found in shallow depressions are around in in ponds. It is also cultivated by transplanting method in the months of December and January and harvested in the months of March-April. The position of the land in regards to drainage is just as important as the character of soil. The plant needs adequate supply of water until the end of October. Fields are levelled and surrounded by firm, and fairly water tight bands. The 'Boro' rice covers an area of 0.03 lakh hectares.

Rice covers 71 per cent of the total cropped area during 1961 to 1981 (20 years). The area under rice had increased from 69.34 per cent to 71.00 per cent of the total cropped area. The reason for this was increasing pressure on land, that lead to reclamation of waste land, clearing of forests etc. The increase was also due to introducting of multiple cropping.

Overall increase in percentage was found in Sipajhar, Kalaigoan Chapai and Udalguri blocks, while there was a general decrease in other blocks. The area under rice cultivation increased and the total production also found to be high. There has been constant efforts by the farmers of the district to increase the hectarages, production, and productivity of rice.

Maize:

Maize is one of the staple food of the people of the district. It can be harvested in a short time. It is therefore, of special value as one of the first crops available. Maize is sown generally after the first shower of the monsoon in early or middle of June. The crop matures in September, Excessive rainfall and floods damage the crop.

The crop is never sown in low lying fields. Well drained and generally light soil are best suited for maize cultivation rather than the heavy clay or clayey loam. Maize is not popularly grown in all parts of the district. Areas generally inhabited by the ex-teagarden labourers and the Nepalese farmers in the Khairabari, Majbat and Udalguri blocks cultivate maize. Area covered by maize increased from 0.13 per cent to 0.57 per cent from 1961 to 1981. Nepalese, ex-teagarden labour and others inhabit the northernmost part of the district where rocky and sandy soil is suitable for maize cultivation.

Jute:

Jute is an important cash crop of the Darrang district. The jute cultivation rapidly increased after partition of India in 1947, when incentives were given to the presents to grow more jute. The jute hectarage as a whole remained almost

static during 1961 - 1981. Although this crop is grown in all the blocks of the district, yet it's highest concentration is in Dalgoan. Sialmari, Majbat and Kalaigoan Chapai blocks. Jute occupies third position in respect of hectarage. Yet jute hectarage has been decreasing from 7.17 per cent to 5.75 per cent from 1961 to 1981. The causes of decreasing jute hectarage are -

(1) Fluctuation in market price

(2) Jute requires more labour for weeding thinning, harvesting, and rating process of the crop.

(3) The crop is generally grown in 'char' (recent alluvium area) and flood prone areas. But due to flood control measures, some jute areas do not receive adequate replenishment of silt and other ingredients that are deposited after the flood. Clayey and sandy soil are more suitable for jute cultivation. This type of soil is found in Dalgoan Sialmari, Majbat and some parts of Kalaigoan blocks.

Sugarcane:

Sugarcane is another cash crop of the district. The juice is extracted from sugarcane by a press and is used for preparing 'gur' or jaggery. The bagases are used as fuel and other purposes. The green leaves are used as fodder for animals.

Before sowing of cane, land is repeatedly ploughed and the soil is well manured and pulverised. Sowing begins, when temperature is sufficient for the growth of crop. Sugarcane requires constant attention during the first four to six months of its growth.

Sugarcane is quite adaptable to varying soil conditions but loamy soil with good drainage and slightly acidic to alkaline soil are best suited for this crop.

Although this type of crop is cultivated in all the blocks, higher percentage are found in Sipajhar, Khairabari, and Majbat blocks. Percentage of area under this crop decreased from 1.02 per cent to 0.98 per cent during 1961 to 1981.

The reason for decreasing area under sugarcane cultivation are (1) The plots of land where sugarcane is cultivated lasts for about 10 month to 12 months. (2) It requires sufficient amount of capital and labour. (3) Agricultural lands are more profitable for cultivation of cereals than sugarcane cultivation. (4) The crop is destroyed by animals such as foxes, monkeys, domestic animals etc., under these conditions the percentage of hectarages of sugarcane has been decreasing in the district.

Cropping Patterns in the Rabi Season:

Rabi is the other important agricultural season of the district. The major cereals of the district are wheat, pulses, rape and mustard seeds, potato, sensumum, vegetables, etc.

Wheat (Triticum Sativam):

Wheat is generally grown in the Rabi season. It was recently introduced in the district. Its hectarage increased from 0.09 per cent to 2.10 per cent during 1961 - 1981. The indigenous peasants of the district were not habituated in taking food from the wheat products. But now many of the indigenous peasants have realised the importance of wheat and its food value. The reason is that (1) Pressure of population on cereals food has increased. Due to the rapid increase of population, rice can not provide the required amount of food to the people. So in the process of growing alternative food crops wheat has become imperitive to the peasants. (2) After the introduction of early maturing and high yielding varieties (H.Y.V.) of rice, the rice fields lay vacant after the harvest. So wheat was introduced in the same plot of land. Thus wheat hectarage increased in all the blocks. The high concentration of wheat cultivation is found in Dalgoan Sialmari, Majbat and Kalaigoan blocks.

Pulses:

The major pulses are blackgram (matikalai), green gram (moong), lentil (mosur) gram, pea (matar) and kheswari etc. All the varieties of pulses are cultivated more or less in all the blocks. There was an insignificant increase hectarage under pulses during 1961 - 1981. But the percentage of area to total cultivated are decreased from 5.83 per cent to 4.20 per cent in the same period.

Pulses are grown mainly in river banks, plain area and newly settled areas adjoining tributaries of Brahmaputra system. About 87 per cent of the area undera all pulses was occupied by the rabi pulses. The area under pulses has been fluctuating from year to year. The average hectarage under pulses in 1961 - 1981 were 10,520 (5.83 per cent) and 11,344 (4.20 per cent) respectively.

Crop hectarage decreased in the Dalgoan-Sialmari and Kalaigoan Chapai blocks. Whereas it increased in Khairabari, Udalguri, Majbat and Sipajhar blocks. Moreover yield per hecter in this area is not good. Hecterage under pulses increased in the northern parts of the district, where pulses can be cultivated earlier and also in rabi season. High and rugged lands are preferred for cultivation of pulses.

Rape and Mustard Seeds:

Rape and mustard are also important cash crop of the district. The total hecterage and percentage to total cultivated area increased during 1961 - 1984 i.e., these were cultivated in 12,893 hectares (6.93 per cent) in 1961, which increased to 22,303 hectares (8.20 per cent) in 1981. Percentage of increase to total cultivated area was found in Khairabari, Kalaigoan Chapai, Dalgoan Sialmari and Majbat blocks, but decreased in Sipajhar and Udalguri blocks. Percentage increase of area was highest in Dalgoan - Sialmari block. It increased from 9.60 per cent to 16.30 per cent during 1961 - 1981: whereas in Sipajhar and Udalguri blocks, it decreased from 9.01 per cent to 6.81 per cent and from 4.62 per cent to 3.96 per cent respectively.

The reason for increasing rape and mustard seed cultivation are (1) Dalgoan Sialmari and Majbat blocks have sufficient higher grounds which are otherwise unfit for winter rice. This was used for rape and mustard seed cultivation. (2) In the northern part of Khairabari, Majbat and in some parts of Udalguri blocks, rape and mustard were grown after the Kharif crops. (3) Economic factor also affected the rape and mustard seed cultivation and production.

Other Crops:

Other crops like fruits, vegetables, sesamum etc., are the grown throughout the district. The percentage of area to

total area and the total crop under fruit hecterage increased 4,376 hectares (2.35 per cent) to 7,709 hectare (2.79 per cent) during 1961 - 1981; the percentage of area to total area under vegetables - decreased from 2.45 per cent to 2.17 per cent during the period (1961 - 1981); sesamum was cultivated in sufficient area in Dalgoan - Sialmari and Majbat blocks, other blocks had insignificant area.

From the above discussion (of 11 crops), it is clear that 'AHU' (summer rice), 'Sali' (winter rice), 'Baro' (spring rice), maize, wheat, rape and mustard seed, fruits have recorded an increase of hectarages and (also the percentage of area to total cultivated area) during 1961-1981 period. The crops like jute, pulses, sugarcane, vegetables had shown marginal increase of percentage in all the blocks, with decreasing hectarage in Dalgoan - Sialmari and Sipajhar blocks. So there was a net increases of 0.27 per cent of the area to the total cultivated area during the year (1961-1981).

Crop Combination:

Crop combination (regions) is an important aspect in agricultural geography. The crops are generally grown in combination. In a particular time and a particular space two or more crops are grown simultaneously. The distribution maps of individual crops are interesting and useful tools in agriculture geographers.

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

In that 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 ploted in 3 (three) degree of deviation from the mean for each function. The three degree variation are Mean + 1SD, Mean + 2SD, and + 3SD. After that all the function grouped together, and these over + 1SD marked ranked as 1st over + 2SD, ranked 2nd and +3SD ranked as 3rd. The percentage of any faction is less than 1 which are not counted or considered.

Although, 'Nelson' ranking method is lengthy and consumes more time for calculating standard deviation for each unit. But it is a suitable method for the geographical analysis of any region. For the crop combinations based on this method is more objective, well defined and nearer to truth except for the short coming described in the case of pownall's method (Siddiqui - 1967).

For finding out crop combination mean, standard deviation method has been applied and 11 (eleven) crops are

taken for study (see table 7 and 8).

From the 11 (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, sesamum, winter rice in Kalaigoan Chapai, Dalgoan Sialmari, Udalguri and Majbat blocks. Vegetable and fruit are found in second rank in Kalaigoan and Majbat blocks.

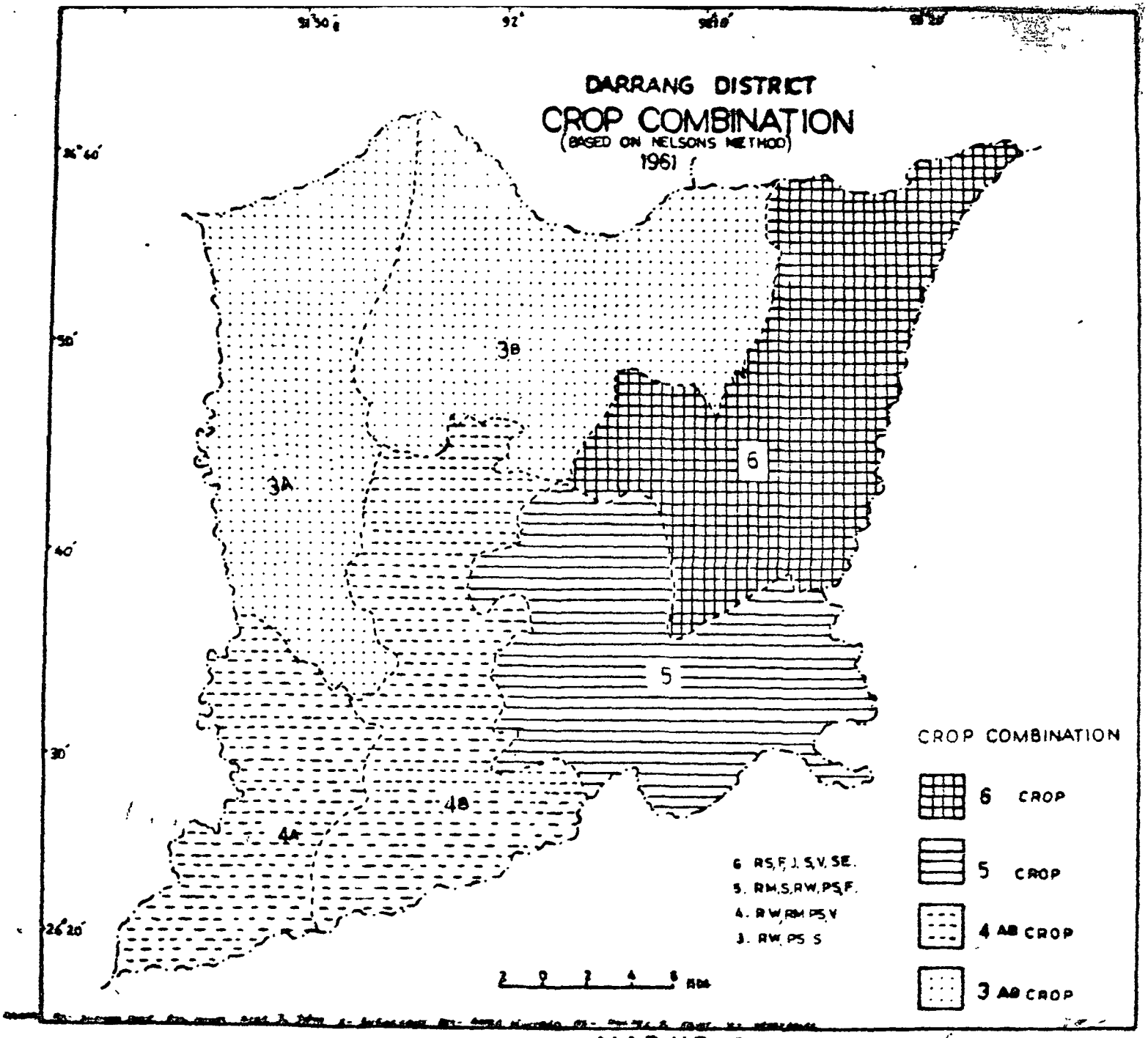
TABLE 10

CROP COMBINATION REGIONS - NELSON'S METHOD
1961 - 1981

1961			1971			1981		
Region	Block	Crop combination	Region	Block	Crop combination	Region	Block	Crop combination
i) 6-crop-combination	Majbat	6-Rs, F, J, S, V, Se.	i) 7-crop-combination	Majbat	7-J, F, Rs, W, S, V, Se.	i) 7-crop-combination	Majbat, Dalgoan Sialmari	7(A) J, F, Rs. P', S, V, Se 7(B) Rm, Rs, W, J, Se, P', V.
ii) 5-crop-combination	Dalgoan Sialmari	5-Rs, Rm, J, Se. P.	ii) 6-crop-combination	Dalgoan Sialmari	6-W, Rm, Rs, J, Se, F.	ii) 5-crop-combination	Khaira-bari Kalai-goan Chapai	5(A) S, M, Rs, W, P' 5(B) J, R, W, W, P, S.
iii) 4-crop-combination	Sipajhar Kalaigoan Chapai	4-Rm, S. Rw, P'. 4-P', V, Rw, Rm.	iii) 4-crop-combination	Khaira-bari Sipajhar Kalaigoan Chapai	4-Rw, Rs, P', S, 4-Rs, Rw, P', S, 4-P', J, Rw, S.	iii) 4-crop-combination	Sipajhar Udalguri	4(A) Rw, W, P', S. 4(B) Rw, F, V, M.
iv) 3-crop-combination	Khaira-bari Udalguri	3-Rw, Rs, S. 3-Rw, F, V.	iv) 3-crop combination	Udalguri	3-F, Rw, V.	-	-	-

Abbreviation: Rs - Summer Rice, Rw - Winter Rice, P' - Pulses, W - Wheat, S - Sugarcane, J - Jute, Rm - Rape & Muster Seed, Se - Sesamum, M - Maize, F - Fruit, V - vegetable.

Source : Calculated by the author.


DARRANG DISTRICT
CROP COMBINATION
(BASED ON NELSONS METHOD)
1961
3B
3A
6
5
4B
4A
6 RS,F,J,S,V,SE.
5. RM,S,RW,PS,F.
4. RW,RM PS,V
3. RW, PS S
CROP COMBINATION
6 CROP
5 CROP
4 AB CROP
3 AB CROP

MAP NO-8

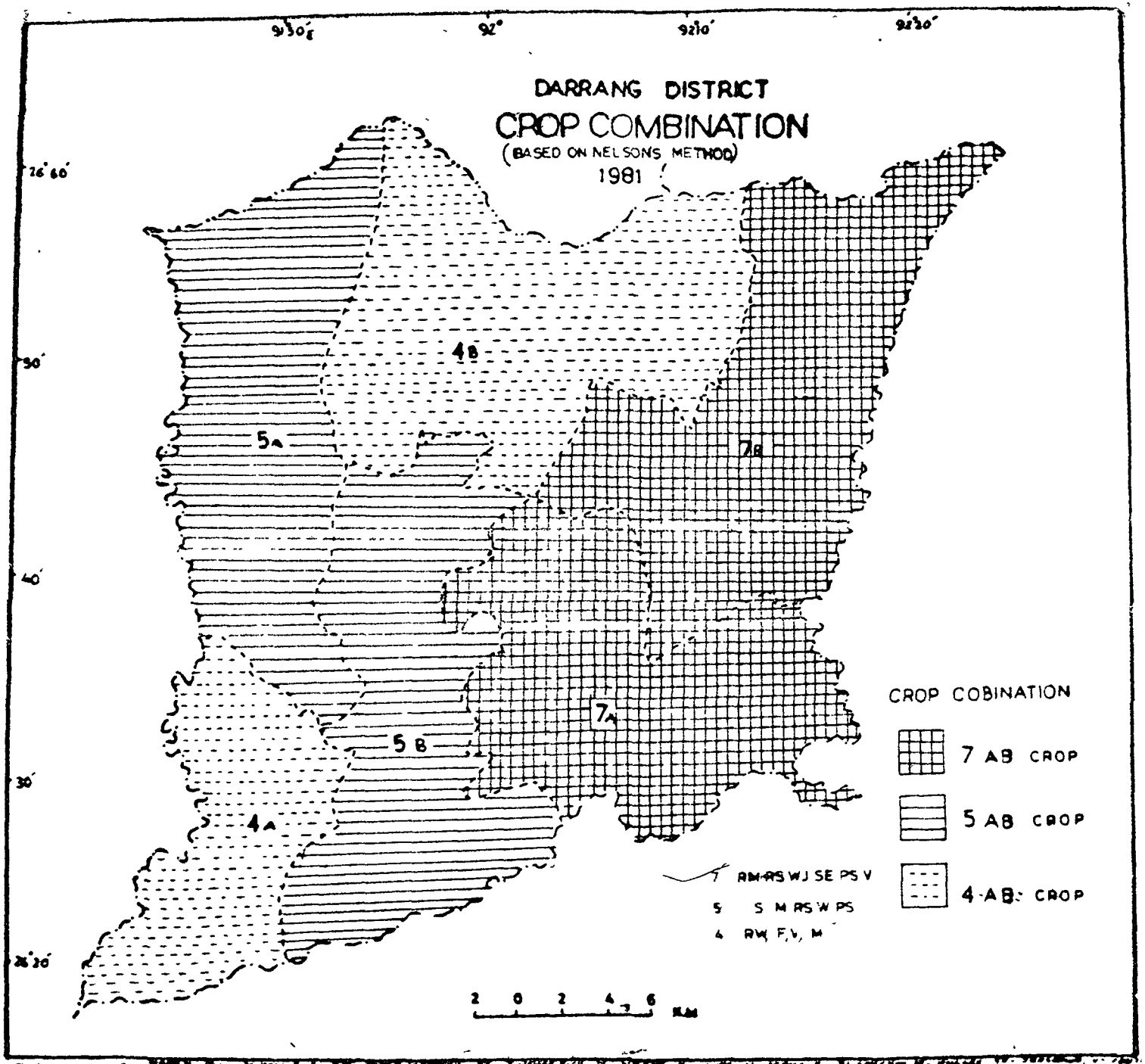

DARRANG DISTRICT
CROP COMBINATION
(BASED ON NELSONS METHOD)
1981
91°30'E
92°
92°10'
92°20'
26°60'
30'
40'
30'
26°20'
4B
5A
7B
7A
5B
4A
CROP COBINATION
7 AB CROP
5 AB CROP
4 AB CROP
7 RM-RS WJ SE PS V
5 S M RS W PS
4 RW F,V, M
2 0 2 4 6
KM

FIG NO: 9

In the 3rd rank only one crop - pulses, was found in Dalgoan - Sialmari block. Rape and mustard seed ranked 1st in 1971-81. Khairabari had no crops in 2nd position but in 1981, 2nd crops sugarcane and maize were in 2nd position. Dalboan block had 4 (four) crops summer rice, wheat, jute, and sesamum in 1981 as 2nd rank. Udalguri and Majbat blocks had 2nd rank the crops of winter, rice, fruits, vegetables, maize, jute in 1981. Sipajhar and Kalaigoan Chapai blocks had 4 (four) crops combination in 1981.

The crop increased during 1961 - 1981 in Khairabari, Dalgoan - Sialmari, Udalguri, Majbat and Kalaigoan blocks.

In Sipajhar block for the combination of crops remained the same. But in other blocks the crop combination had changed year after year. Following Table 9, 10 and 11, indicates the crop combination of Darrang district, as derived from the application of Nelson's method (see also figure Nos. 8 and 9).

Intensity of Cropping:

It denotes that the land-use efficiency and extent to which the net area sown in croped or resown. The total croped area as a percentage of net area sown gives the measure of land-use efficiency. The intensity of cropping refers to a numbers of crops raised on a field in an agricultural year.

If we take one crop in a rabi or kharif season the percentage will be 100 crop index and if we take two crop then it will be 200 per cent crop index, and it is also called double cropping. If more than two crops are grown then it will be called as multiple cropping. Higher index of crop intensity gives us higher land-use efficiency and lower index means the lower land-use efficiency.

Rapid increase in population pressure on land results in the decreasing per capita share of agricultural resources. But due to the limitation of land resources, it will only lead to the destruction of forests (apart from reclaiming fallow land) for agriculture. This suggest the distinct possibilities of intense agricultural activity for optimum utilisation and production. Therefore intensive utilization of net area sown is one of the effective measure of meeting the national food requirements.

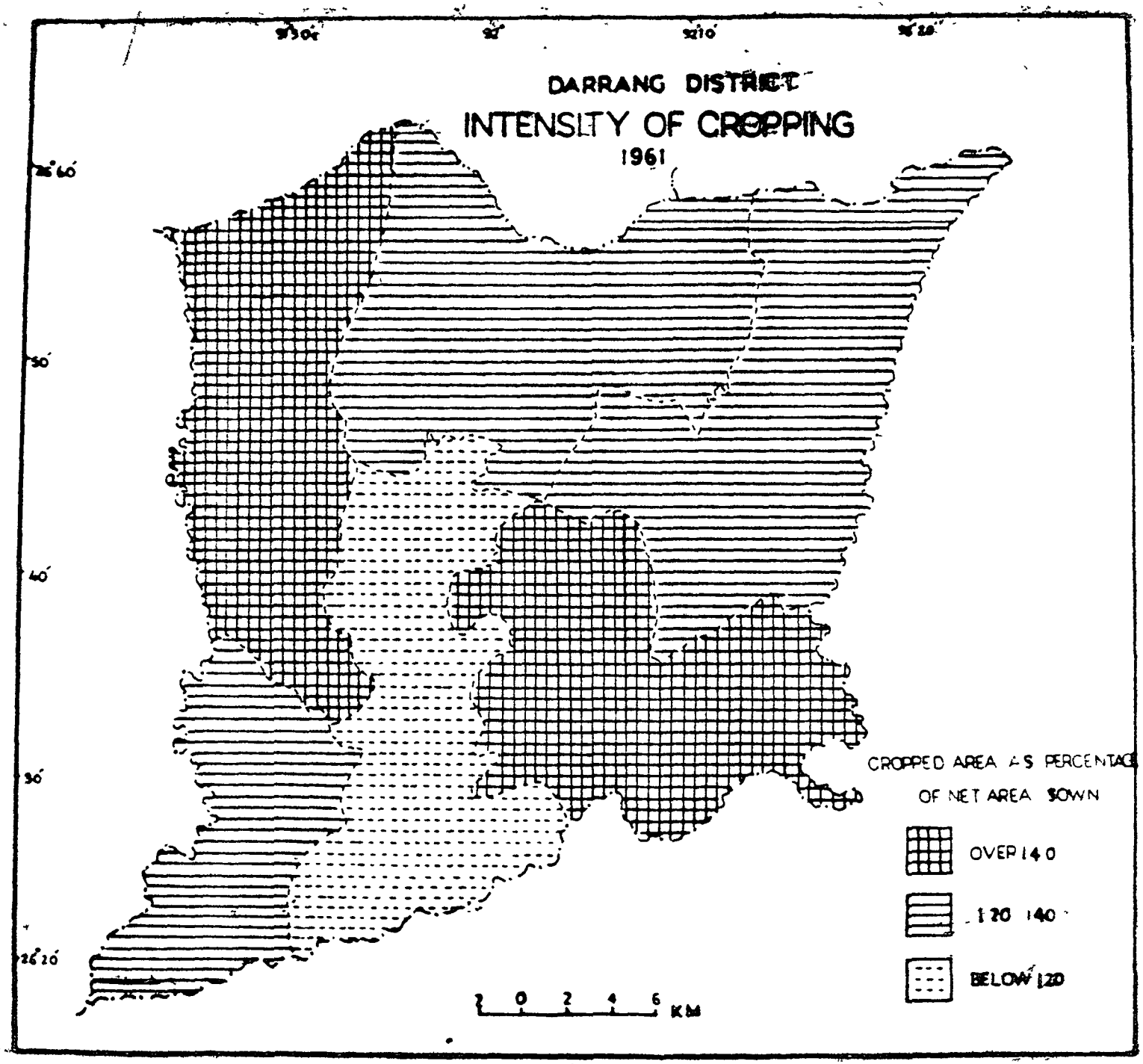
In the study of Darrang district, the area sown more than once was only 34.43 per cent of the net area sown in 1961, but it is increased to 43.03 per cent in 1981. The increase of net area sown was due to the application of advanced techniques and other facilities provided by the government in face of growing population. The net area sown in all the blocks was not uniform (Table 12). In Dalgoan Sialmari block, net sown area was the highest with 45.93 per cent and was

lowest in Kalaigoan block with 16.75 per cent in 1961. In 1981 the Sipajhar block recorded the highest with 65.08 per cent, while Dalgoan Sialmari block recorded lowest with 31.00 per cent. High intensity of cropping in Sipajhar was indicative of population pressure on agriculture as well as impact of innovative measures. It also indicated better irrigation facilities in the former block. The intensity of cropping increased in all the blocks except Dalgoan Sialmari block. Major portion are included 'char' area under Dalgoan Sialmari block and where there was no irrigation facility. (See Map No. 10 and 11 - Intensity of cropping 1961 and 1981).

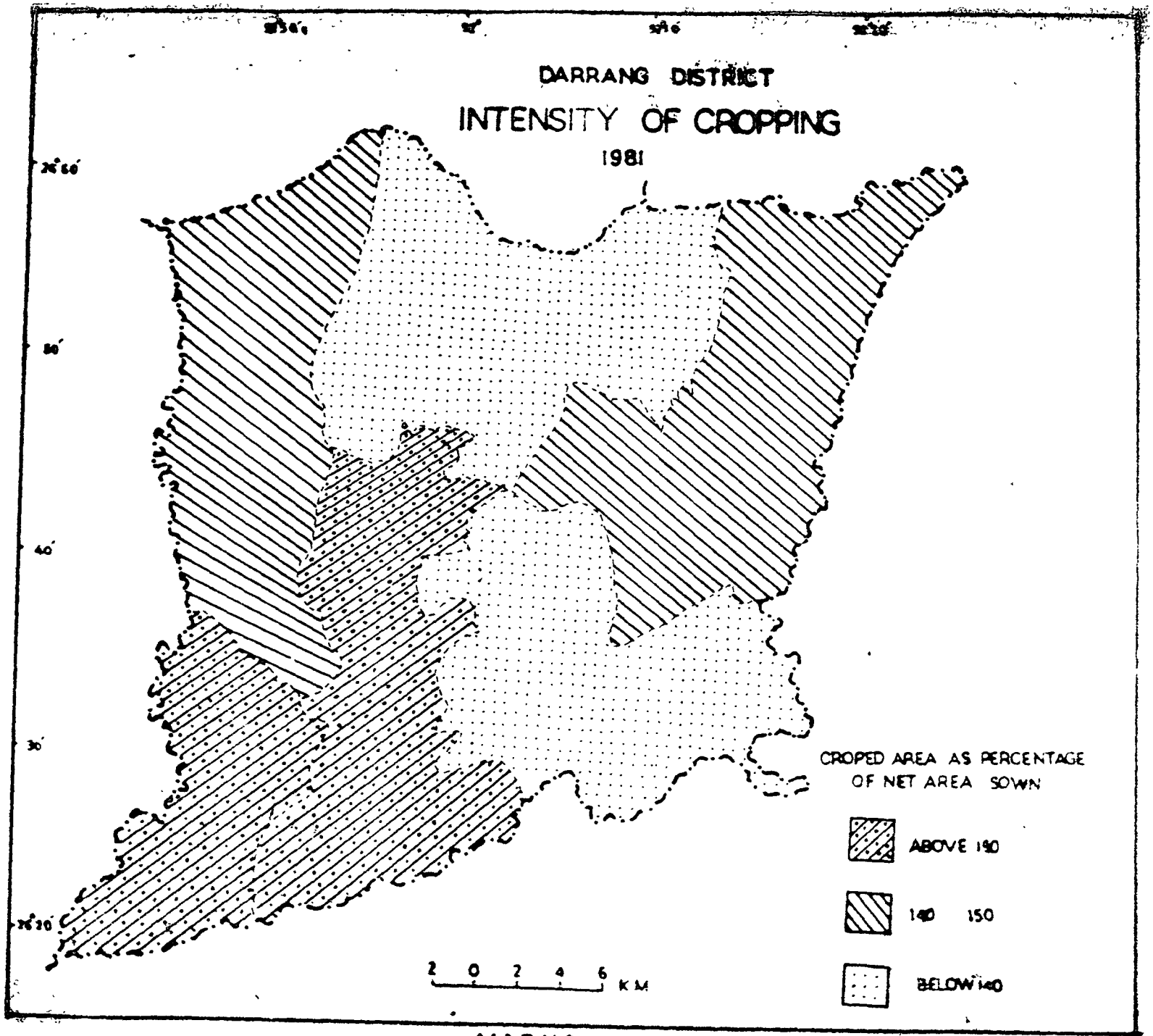
TABLE 12

Blocks	Croped area as percentage of of net area sown Intensity of cropping			Increase/Decrease of intensity of cropping during 1961-81
	1961	1971	1981	
1. Khairabari	143.71	149.37	149.22	+ 5.42
2. Sipajhar	135.82	160.70	165.09	+29.26
3. Kalaigoan Chapai	116.76	127.89	156.57	+39.80
4. Dalgoan-Sialmari	145.93	126.67	131.00	-14.86
5. Udalguri	131.48	144.02	139.11	+ 7.89
6. Majbat	132.46	144.26	142.26	+ 9.81
Total average	134.36	140.37	146.25	+12.84

Source: Block offices and Mangaldai statistical office.


DARRANG DISTRICT
INTENSITY OF CROPPING
1961
26°60'
50'
40'
30'
26°20'
CROPPED AREA AS PERCENTAGE
OF NET AREA SOWN
OVER 140
120 140
BELOW 120
0 2 4 6 KM

MAP NO-10


DARRANG DISTRICT
INTENSITY OF CROPPING
1981
26°60'
30'
40'
30'
26°20'
CROPED AREA AS PERCENTAGE
OF NET AREA SOWN
ABOVE 150
140 150
BELOW 140
2 0 2 4 6 KM

MAP NO-11

Agricultural regions:

Hussain (1979) has pointed out that on agricultural regions is thus an extensive area of land with broadly similar conditions and pattern of agricultural practices, distinctive from those of the adjacent areas, while Kostrowicki (1968) pointed out that type and region are two different sorts of nations. Type is based in similarities between the objects with respect to some attributes, but region is a unique area "characterised by a particular set of characteristics different from all others", and unlike type is a spatially continuous. About 'regions' different authors gave different interpretations. However in agricultural regions, it could be the measurement of level, of agricultural development, agricultural diversification, and agricultural resource and planning regions.

For the study of agricultural regionalization in Darrang district, spearman's rank correlation technique[1] was adopted. From the table 10, 11 and 12, it was found that Khairabari block had first order linkage than all other blocks in 1961 and 1981.

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[1] $Rs = \frac{1-6 \quad d^2}{3_{n-n}}$

Rs = Rank Spearman's technique; n = number of crops
d = Sq. of difference.

Sipajhar block has 1st order linkage with Kalaigoan block in all three years; in 1961 with Dalgoan-Sialmari and Udalguri and in 1981 with Majbat block. In 1961, Kalaigoan had first order linkage with all the blocks, in 1971 with Majbat and in 1981 Dalgoan-Sialmari and Majbat blocks, in 1971 with Majbat and in 1981 with Dalgoan-Sialmari and Majbat blocks. In 1961 Dalgoan-Sialmari had first order linkage with all the blocks and in 1971 and 1981 with Majbat blocks. Udalguri block had first order linkage in all the years with Majbat block. In 1981 Sipajhar had second order linkage with Dalgoan Sialmari block. Kalaigoan block has first order linkage with Udalguri and Dalgoan Sialmari blocks.

Linkages of different orders first to third are found out. This was done on the basis that when the correlation of co-efficient value is greater than or equal to 0.85 then it will be first order linkage, and when the value is greater than or equal to 0.75 then it will be second order linkage. From the values of co-efficient of correlation of the major crops grown in different blocks. If the values made by one block is same as other blocks then it forms one region. Applying this technique in the Darrang district in the year 1981, and found that Khairabari block has first order linkage with all other blocks.

Similarly the Majbat block had first order linkage with all other blocks. Blocks having second order linkage are Sipajhar with Dalgoan-Sialmari, Kalaigoan with Udalguri and Dalgoan-Sialmari with Udalguri. On the basis of the major common crop grown in the blocks which have both first and second order linkage. Regionalization is made with four regions marked as (I, II, III and IV) (see figure 13).

TABLE 13

AGRICULTURAL REGIONS 1981

Regions		Blocks	
1.	Region with summer rice, winter rice, rape and mustard pulses.	1.	Sipajhar
2.	Region with winter rice, summer rice, rape and mustard, jute, pulses and sugar cane	2.	Kalaigoan Chapai, Khairabari
3.	Winter rice, summer rice, rape and mustard, jute.	3.	Udalguri and Majbat
4.	Regions with summer rice, winter rice, rape and mustard, jute and pulses.	4.	Dalgoan-Sialmari.

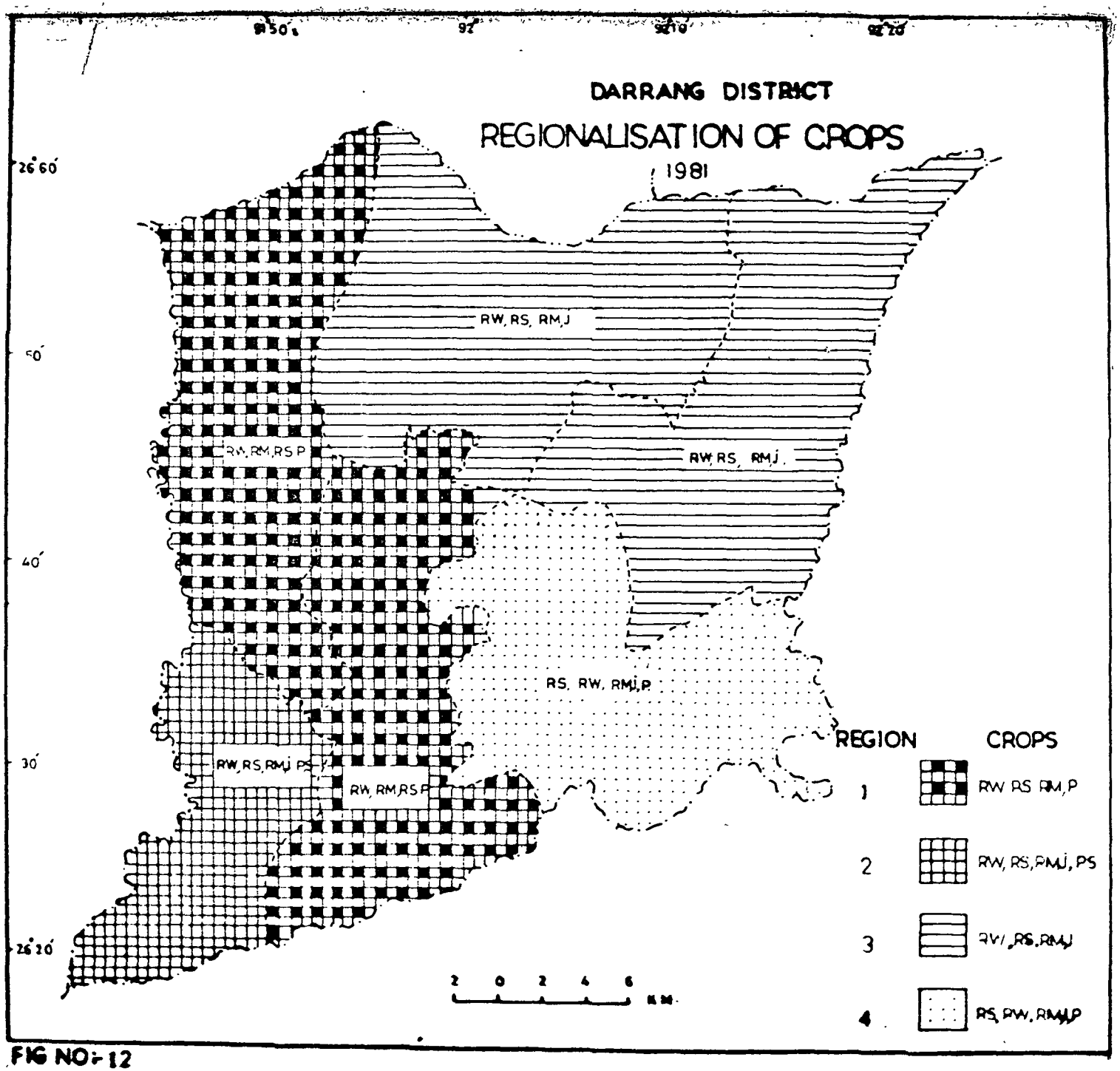
DARRANG DISTRICT
REGIONALISATION OF CROPS
1981
26°60'
50'
40'
30'
26°20'
RW, RS, RM, J
RW, RM, RS P
RW, RS, RMJ
RS, RW, RMJ, P
RW, RS, RMJ PS
RW, RM, RS P
2 0 2 4 6 KM
REGION
CROPS
1
RW RS RM, P
2
RW, RS, RMJ, PS
3
RW, RS, RMJ
4
RS, RW, RMJ, P

FIG NO:-12

CHAPTER . V

CHANGING PATTERN OF LAND USE IN DARRANG

Land use is a way of managing a large part of the physical environment (particularly land) in order to obtain benefits for man. Development of land use often leads to diversification of the cultivated area; whereby the impact of ecological conditions lead to a suitable and feasible way of obtaining high production. New varieties of crops, such as H.Y.V. of rice wheat etc. largely contributing to the development of land use.

The primary objective of land use planning for the Darrang district in the coming decades is to meet the demands for food and for other essential crops for rapidly increasing population. The various types of integrated rural development programmes are geared towards an increase in agricultural output as well as establishing agro based industries in the rural areas.

After independence particularly the last two decades (1961-81), there has been considerable change in almost all the parameters of agriculture in particular and the rural landscape in general in the country. In order to meet the

growing demand, agriculture has been intensified and diversified on the one hand and on the other, attempts have been made to bring more and more areas under H.Y.V. cultivation. The net area sown more than once and irrigated area have increased substantially. Wastelands, other fallow lands and cultivable wastes have been reclaimed as well as areas under forest brought under cultivation particularly in Darrang district. As a result of which croping patterns have also been constantly changing. Cultivation of H.Y.V. (High Yielding Varieties) of crops has also introduced changes in croping pattern. The changing nature of land use has highlighted the emergence of physical and socio-economic conditions; while changes in agriculture scenario has not been uniform either spatially or temporarilly in the district. Since independence, many studies have been conducted about the land use pattern and its changes in rural landscape of the country. Such study, propagates an idea that the growth of input and output in an agricultural region or district during a period of time can be measured by the changes in area cultivated, and the change in yield per unit area spatially and temporarilly.

TABLE 15

MATRIX OF SPEARMAN'S RANK-CORRELATION FOR THE CROP-HECTARAGE OF THE DARRANG DISTRICT

Blocks	1961						1971						1981					
	A	B	C	D	E	F	A	B	C	D	E	F	A	B	C	D	E	F
1. Khairabari	1.00	-	-	-	-	-	1.00	-	-	-	-	-	1.00	-	-	-	-	-
2. Sipajhar	0.90	1.00	-	-	-	-	0.92	1.00	-	-	-	-	0.85	1.00	-	-	-	-
3. Kalaigoan-Chapai	0.91	0.95	1.00	-	-	-	0.95	0.98	1.00	-	-	-	0.97	0.89	1.00	-	-	-
4. Dalgoan Sialmari	0.89	0.87	0.93	1.00	-	-	0.79	0.69	0.72	1.00	-	-	0.85	0.76	0.89	1.00	-	-
5. Udalguri	0.92	0.88	0.88	0.95	1.00	-	0.89	0.84	0.81	0.61	1.00	-	087	0.60	0.78	0.76	1.00	-
6. Majbat	0.93	0.81	0.89	0.89	0.90	-	0.92	0.83	0.85	0.86	0.85	-	0.95	0.95	0.92	0.90	0.92	-

First order linkage when the correlation (rs) coefficient 0.85

Second order linkage when the correlation (rs) coefficient 0.75

or

(0.85 rs 0.75)

Source: Calculated by the author.

Accordingly Rao[1] postulated that the major cause of inter-state variation in crop output is the difference in the growth of irrigated area within and among the states. Shangari and Gupta supporting Rao, further added the specific role of supplementary inputs such as fertilizers, high yielding varieties and mechanization which require irrigation facilities adding to the region's potential for area under cultivation and production, spatially and temporally.

Baruah further pointed out that the relative importance of modern technology in the development of land use in general agricultural growth in particular as in Punjab and Haryana. He emphasized that the role of technological factors was more than that of environmental factors in determining the agricultural growth or vice-versa. As the author feels particularly where Darrang district is concerned, this has the effect of complementarity. This effect to some extent was observed by the author in Mangaldai and other areas in the district.

For the analysis of the land use pattern in Darrang district a 20 years span of time was selected; viz. 1961, 1971 and 1981. Eleven principal crops were selected for growth, development, and analysis as well as utilization of

land. The crops occupied 86.81 percent of the total geographical area of the District in 1981. The percentage of the net sown area and the area sown more than once to the total geographical area was 59.59 percent, and 27.23 percent respectively in 1981. In 1961 percentage of areas under cultivation 60 percent 44.45 percent, and 15.04 percent in 3 times variables as land was used for different purposes. Thus, during the 1961-81 land began to play a more diversified.

The changing nature of general land use in the district along with other socio-economic factors, indicated considerable variation in both space and time. The changing pattern of the land use has only indicated the fact of growing diversification involving urbanization and rural development projects in the district, has led to awareness of the need for intensifying the existing agricultural practices with the newer innovations so as to support and and to compensate the growing pressure on land.

The average area under various crops and other used land use changes in the region and their percentage to total area during the agricultural years of 1961 and 1981 indicate that corresponding to total area 3,18,105 hectares of the district. The area under forest was 20,283 hectares

(20 percent) and the net area sown was 1,39,368 hectares (43 percent) of the land in 1971. The changes that occurred in 1981, were area under forest 17,121 hectares (5.5 percent), area not available for cultivation 51,910 hectares (16.5 percent), area under fallow lands 15,861 hectares (5 percent), area under other uncultivated land excluding fallow lands 45,035 hectares (14 percent) and the net area sown 1,88,178 hectares (59 percent). The increasing trend of changes in the land use was found only in net area sown in 1981, while in other categories changes were marginal. In the district, increasing change in the land under net area sown was found in all the blocks in varying degrees. In Khairabari and Udalguri blocks higher rate of change was found as compared to other blocks. Volume and quantity of change under net area sown to the total area as shown for the district during the last 20 years, was substantial when one compares the corresponding increase in population of the district (between 1951-71) ... increase of 167 percent. This suggests that cultivable wastelands were reclaimed and were under cultivation by the additional settlers to this area. In Udalguri block the volume of changes during 1961-81 in the correspondent net area sown to the increase of population to level of 128 percent. While in other blocks the net area sown changes was

in accordance with the increasing population. With the increasing population in all over the blocks land use changes to agriculture and other purposes such as growth of urban centres, growth of industies (small scale) and other institutions was in consonance with increasing population pressure and corresponding diversification and intensification of agriculture.

Population Pressure on Land

The total population of the district in 1951 excluding tea garden and the town was 3,64,052 person, with a density of 112 per square kilometer. The population of Darrang district increased from 5,18,083 in 1961 to 7,52,779 in 1971. The density of population showed a corresponding increase from 163/sq. km. in 1951 to 237/sq. km. in 1971. Density of population per hectare increased from 1.63 to 2.37 in 1961-71. In 1981, the density was found to be 6.38 person per hectare of the net area sown (projected figure 1981). The density of population was 372/sq. km. per net area sown in 1961 and 441/ sq. km. per net area sown during 1971. During the period population increased by 44.23 percent, but net area sown increased only by 22.5 percent. Due to minimum increase in net area sown, and higher percentage of population increase, rural landscape was dominated by the

multiple cropping. The farmers practised modern techniques in order to increase the crop. There appears to be a growing imbalance between the number of population and the land resources of the district. It is seen in the table that due to the increase of population and limited scope for the extension of cultivable land, per capita land holding decreased from 0.31 hectares in 1961 to 0.29 hectare in 1971. This amounted to 1.55 hectare and 1.45 hectare per family of five members in 1961 and 1971 respectively. The net area sown in 1981 was 1.88 lakh hectares. In 1981 land holding per family decreased to 1.10 hectares. Thus indicating that, with increasing population pressure on cultivable land, only alternative is to resort to intensive land use planning. Land available per capita and per family of 5 members of some countries are given in Table 13.

TABLE 13

AVAILABILITY OF LAND IN SOME COUNTRIES

Country	Per Capita Land Available (Hectare)	Land Available per family of five members (Hectare)
India	0.29	1.45
U.S.A.	0.89	4.45
U.S.S.R.	1.03	5.15
Argentina	1.25	6.25
Canada	2.12	10.60
Australia	3.39	16.95

Source: Population Geography by Negi.

From the table it is clear that among the countries listed in the table, per capita (for a family of five) availability of land available in India is the lowest. The increasing population thus makes it imperative to resort to crop diversification, multiple cropping and intensive land use planning.

Development in Agriculture:

Land use development with the help of irrigation facilities along with the use of modern techniques is essential. The other factors that affect the land use changes are, rural electrification, fertilizers, introduction of H.Y.V. seeds, mechanization, pesticides and insecticides, agricultural marketing transport and communication and industrial support etc.

Irrigation in Land Use:

Irrigation is indeed the life breath of agriculture. It plays an important role in the selection of crops to be sown, in cropping pattern, in intensity of cropping and crop combinations that are introduced. A number of analytical studies have proved that India can increase the agricultural production to a large extent if adquates and assured (among others) irrigation facilities are available. Farming with

out irrigation is not conducive and if the rainfall decreases to less than 30 cm. agricultural activity is not possible in any region.

Rainfall in Darrang district is erratic and unpredictable. So irrigation is essential even during monsoon period. Irrigation started in the region only in 1958. In 1961 only 3 (three) blocks - Kalaigoan, Dalgoan, Sialmari and Majbat had 2.42 percent of the total net sown area under irrigation. Irrigation was extended to Udalguri block, and parts of Khairabari blocks. Altogether 13.53 percent of the net area sown of the district was under irrigation in 1970-73. A medium size project is under construction on the Dhansiri river of Bhairabkunda about 18 km. north of Udalguri. After the completion of the project, it will irrigate an area more than that of the Udalguri and Majbat blocks (see table 14). Intensity of cropping is gradually increasing through the years. Double cropping has also been extended to cover as much cultivated area of the district as possible.

TABLE 17

IRRIGATED AREA TYPES 1981 (in Hectare)

Types	Khairabari	Sipajhar	Kalaigoan	Dalgoan Sialmari	Udalguri	Majbat	Total with per-cen-tage
1. Govt. Surface Flow (canal)	9,400	-	9,450	2,450	360	945	22,605 (83.05)
2. Govt. Lift Irrigation	200	-	1,200	250	953	30	2,633 (9.00)
3. Ground water Lift Irrigation	-	-	126	126	150	-	402 (1.40)
4. Govt. deep tube-well and shallow tubewell	790	-	[illegible]	710	16	-	1,516 (5.40)
5. Institutionally	3	59	35	86	-	27	210 (0.70)
Total	10,393	59	9,811	3,622	1,479	1,002	27,366 (100.00)

Source: Irrigation Department Office, Mangaldai.

Mechanization in Land Use:

For the development of agriculture of the district, different kinds of implements have been used by the farmers. The iron based machine have been used in all the blocks of Darrang district. The implements are sugarcane crusher, power tillers, foot sprayers, seed bins, dusters, power sprayers, seed drills, power pump, garden rack etc. The iron based machine are largely used by the immigrants. If the use of the machinary excepting the spades are considered, the position of Dalgoan-Sialmari block is very encouraging, because almost all the iron implements have been diverted to the Udalguri, Khairabari and parts of Kalaigoan blocks (Tribal area). Dalgoan-Sialmari and Majbat block have the advantage of using machinary than other blocks of the district.

High Yielding Variety (H.Y.V.):

High yielding variety of seeds were introduced in the district for the first time in 1961. The quantity of H.Y.V. seeds have been gradually increasing. The use of H.Y.V. seeds without irrigation and other inputs in agricultural field have sown only a marginal increase in productivity while in areas under irrigation they have shown substantial increase in productivity. In some blocks as in

TABLE 18

HIGH YIELDING VARIETY SEEDS AND HECTAREAGS

Blocks	1961			1971			1981		
	Seeds Kg	Area Hec-tare	P.C. of area to N.S.A.	Seeds Kg	Area Hec-tare	P.C. of area to N.S.A.	Seeds Kg	Area Hec-tare	P.C. of area to N.S.A.
Khairabari	2,350	1,520	6.93	3,960	2,015	8.55	5,230	5,657	19.18
Sipajhar	2,572	1,678	9.56	2,850	1,880	7.88	3,070	2,472	10.00
Kalaigoan	3,130	1,850	7.87	7,535	4,878	15.66	8,600	6,450	20.12
Dalgoan-Sialmari	5,748	2,480	9.62	12,250	10,530	30.67	15,113	12,790	35.12
Udalguri	3,610	1,980	7.59	5,250	3,050	9.89	6,590	6,800	18,38
Majbat	4,230	2,060	8.41	7,820	4,825	17.79	8,580	4,072	14.53

Source : Agricultural Office.

Dalgoan Sialmari block, even double cropping have brought very encouraging returns. The H.Y.V. seeds used in the district are 'Ahu', sali, jute, wheat, potato, pulses, maize, peas onion, vegetable seed, etc.

In 1961, only 8.33 percent of the total net area sown of the district was covered by H.Y.V. seeds. It rose to 15.07 percent in 1971 and 19.55 percent in 1981. The highest use of H.Y.V. was in Dalgoan Sialmari block, and lowest in Khairabari block. The use of H.Y.V. seeds in the district is shown in Table 18.

a) Fertilizers: Fertilizers are used almost in all the blocks of Darrang district. The fertilizers used are mainly Ammonium Sulphate, Super phosphate, Urea, and the Murate of Potash. Majority of the people depend upon the natural fertility of the soil. Cowdungs and burning of plants fertilizers are largely applied during the rabi season. Use of fertilizer is highest in Dalgoan-Sialmari block. In Darrang district the fertilizer consumption per hectare of cultivated land varied from place to place. H.Y.V. crops responded well to the use of the fertilizers.

b) Pesticides and Insecticides: The seedling of crops are highly susceptible to pests, diseases and infestation by

insects. The H.Y.V. varieties can not resist the insect diseases that are prevalent in the district. The pests and diseases seriously damage the crops. The problem of crop diseases and infestation by insects can be overcome if a timely and effective application of herbicides and pesticides is made. In 1961 very small area of 0.64 percent of N.S.A. was sprayed with pesticides, but in 1981 it rose to 11.5 percent of the net sown area. The highest amount of pesticides and insecticides was in Dalgoan Sialmari block.

Transport, Communication and Market:

Transportation and communication is a necessary ingredient of nearly every aspect of economic and social development. It plays a vital role in agricultural production. In storage, marketing, and distribution of the agricultural commodities. Many a time the non-availability of these facilities damages the produce. Although a railway line crosses the district in a west-east direction (see figure No. 2) through 3 northern blocks, but there has been no major impact on agriculture by the railway line. The most important system of transportation are the metalled roads, gravel roads, cart tracks, kutcha roads and footpaths etc. In 1981 there was 161 km. road length per one lakh population

in Darrang district, but the P.W.D. road length was only 99 km. per one lakh population. It was insufficient to have had a significant impact. Now it is extended to all over the district.

Marketing is also an important factor for the development of agriculture of the district. Of course, marketing is linked with transport system, marketing facility was not adequate before the formation of the development blocks. In 1961 there was only 22 weekly and bi-weekly markets and 7 daily markets. In 1981 it increased to 66 weekly and bi-weekly markets and 25 daily markets.

Thus as a result of inadequate facilities of transport and market, a lot of the produce is wated and the fluctuations in price reduce the margin of profit of the farmers, which may discourage crop diversification and production.

CHAPTER VI

CONCLUSION

The present study of changing pattern of land use in Darrang district from the geographical point of view can be summerised as fallows. Before the analysis can be summerized it is necessary to emphasise that the present district was a sub-division in Tezpure district prior to 1983, the district was bifurcated into - 1) Sunitpur district with Tezpur as headquarters and 2) Darrang district with Mangaldai as headquarters.

The Darrang district is richly endowed with resources. It is largely a valley region with a hilly periphery in the north. The soil of the district is alluvial and fertile. The region is criss-crossed by northern tributaries of Brahmaputra, which lies in the southern part of the district. Agriculture is the main stay of the district, supporting more than 90 percent of the total population of the District.

The region has been one of the important areas for the large scale immigrants population. Consequently

the population increase in the district between 1951 and 1971 was 114 percent. Corrospondingly the net sown area increased by 22.62 percent in the same period. This increase in the availability of cultivable land was largely due to clearing of forest, draining of swamps, marshes and reclamation of permanent fallow land.

The rapidly increasing population had resulted in reduction of agricultural lands, thus decreasing per capita land holding as well as large scale changes in the land use pattern. The proportion of cultivable area (as sown earlier) per capita decreased from 0.34 hectare in 1961 to 0.27 hectare in 1971 and to 0.20 hectare in 1981 (for 1981 it is estimated) During the same period literacy percentage increase from 11.82 percent in 1951 to 28.05 percent in 1971. Of the working population 88 percent worked in primary sectors 2.08 percent in secondary and 9.02 percent in tertiary sectors. The distribution of different social groups is not equal in the district; so are the facilities of irrigation, marketing transportation, etc.

On the other hand response to modernization in agriculture has not been the uniform in all the blocks. Hence, the changing pattern of land use in Darrang district has to be

analysed from the framework of physical-social economic background.

Under such circumstances, it can be said that the land use changes in the district after 1961 was closely related to socio-economic condition of the inhabitants (particularly the rapid increase of literacy percentage in the district among others). The earlier scene of the district was completely rural in character, use of traditional implements in agriculture lack of irrigation facilities and transport network were some of the major characteristics. Moreover the rural landscape was completely dominated by the physical environment and the resultant production was just above self sufficiency.

With the onset of independence and implementation of plan programme the district, as did the others in the state, progressed. With the creation of the new district in 1983 the development activities in the district was farther accelerated.

The district had made a substantial progress in area sown more than once - the hectareage increased from 34.33 percent of the net sown area in 1961 to 46.03 percent in 1981.

These increase has been largely due to adoption of modern techniques, farm technology, better irrigation facilities and access to the market. Corrospondingly the increasing population pressure on land had compelled the introduction of crop diversification. So that the intensity of cropping increased from 134.33 percent to 146.13 percent between 1961 and 1981. At the same time the population increased by 137 percent in the same period; the density of population increased by 0.70 per hectare of net sown area. This indicated increasing pressure on land and alternative uses of cultivable land that were needed for settlement rural industrialization, etc.

This leads to an observation that there had been a considerable change in the land use pattern of the district. These observations are:

1) That with the construction of embankments along the rivers much of the tureat post by floods in the rainy season has been restricted to a large extent. Thus providing a greater relief to the farmers and ensuing and uninterpreted production and cultivation of agricultural produce.

2) To offset the dry season the development of variation irrigation schemes had assured constant supply water

resulting in two or three crop production in an agricultural year in the district.

3) Use of modern implements, fertilizers, pesticides has substantially increased in the district. This has resulted in larger productivity greater intensity of cropping and crop diversification in the district. So much so that the land use has almost completely changed in 1981 as compared to 1961 or earlier.

4) That blocks which once indicated the domination of one or two crops now indicates the prevalence of 4 or 5 dominant crop in a year.

5) With the process of urbanization in the district the transportation and communication network have played a major role in the land use change. For this had provided greater accessibility and better marketing facilities.

6) The implementation of social-development plans, rural electrification, and other such programmes including rural small scale development will enhance the socio-economic condition of the inhabitants. These will have direct and indirect influences on land use in the district.

7) With the creation of the new district, there are greater possibilities of intensive implementation of development

programmes in the Darrang district.

8) The IRDP, DRP and NRP have now greater possibilities of effecting a wider impact in the development of the district. This will lead to further diversification and changes in the land use.

In this study the author could not cover all the aspect of land use in the Darrang district, because of limitation of time. For further research work the author suggests that the work should be carried out on the following lines:

1) Land evaluation.
2) Land and soil suitability.
3) Ecological impact of land improvements.

The analysis of the three aspects will lead to greater understanding about the land use pattern and changes of the Darrang district of Assam.

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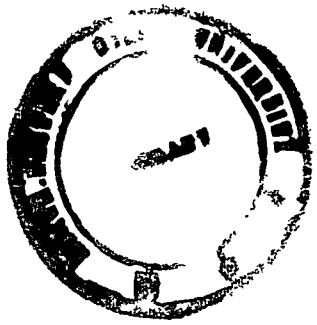

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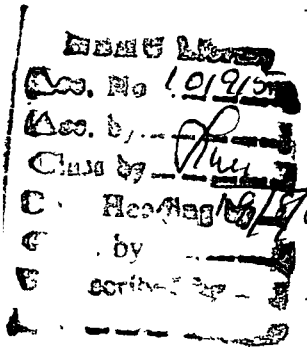

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