EMERGING PATTERNS OF AGRICULTURAL LAND USE IN KAMRUP DISTRICT

(1964-65 to 1974-75)

Abstract

AN EMPIRICAL STUDY OF THE SPATIO TEMPORAL VARIATIONS IN LAND USE PATTERNS

By

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THESIS SUBMITTED FOR THE DEGREE OF

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This is to certify that the thesis submitted by Sri Sumanta Chattaraj for the degree of Doctor of Philosophy (Ph.D.) at the Department of Geography, School of Environmental Sciences, North-Eastern Hill University, Shillong, Meghalaya entitled "Emerging Patterns of Agricultural Landuse in Kamrup District" is a bonafide study of the author to the best of our knowledge and believes. This study may now be placed before the examiners for evaluation.

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ABSTRACT

Agriculture is one of the most common and wide spread ways in which man gets his living, and the geographers are primarily concerned with man's varied impact on the earth's surface. A considerable amount of geographical research therefore needs to be devoted to the study of agriculture. In the case of Brahmaputra valley, it is even more pertinent, because still agricultural is most dominant sector in region's economy. It has claimed the best part of cultivators working hours. for centuries in the valley. The census of 1971 reveals that 85 per cent of the total rural population engaged primarily in the tilling of the soils yet the pace of development in agriculture has been a tardy one and inspite of the recent agricultural upheaval in an organised form during the last decades in all over the country, the agriculture in most of the valley is still essentially traditional bound. The agricultural operations, level of inputs, technology, tillage practices, mode of disposal and storing of crops are almost the same what they were about twenty years back. The agricultural landscape continues to be strinking characteristic of the oriental view point, and it is the traditional peasant proprietorship that enjoys all significant control over the agricultural pattern along any cross section.

In true speaking a very little transformation could take place in the agrarian sector of Assam which suffers from insubstantive research and inadequate methodology.

The present study in which a modest attempt has been made to integrate the physical, social and economic variables will point out a reliable picture of the prevailing agricultural land use of the region. The main objective of the study is to find out the patterns of agricultural land use and to aseertain the changes which have baken place in the pre and post Green Revolution period in the district of Kamrup. Secondl: it seeks an answer of the decision making processes of the farmers which ultimately shape the cropping structure of the region. Thirdly an attempt has also been made to identify the disparities within the region. Lastly an exhaustive enquaries have been made at the village and household levels to know the size of inequality in land holdings, the causes of unequal pace in the diffusion of innovations and disparity in the degree of cropping mosaic.

The study is divided into seven chapters. The study planned and designed within an environmental cum socia economic framework begins with an assessment of the physiographic background of the region. In chapter II a discussion has been made on the geographical background and the analysis of various complex problem. The basic logic of this chapter is how far the environmental factors are responsible for high intensity of landuse in one region and low intensity in another region.

In Chapter III an attempt has been made on institutional framework of agriculture, only to know how far institutional development has improved the land use pattern and yield rate in the region. This chapter also includes a section on land reform policy in Assam. The chapter ends with a discussion on the size of land holdings and its distributional pattern.

In Chapter IV the general landuse pattern and land utilization under Kharif and Rabi season has been discussed with the help of percentage of blockwise data. The location quotient method has been applied to ascertain the spatial pattern of rice concentration, which is the main field crop of the district. This chapter also deals with the changes of general and agricultural landuse during the Green Revolution period. To measure the changes of cropping pattern of the district, resulted from Green Revolution, simple growth rate has been calculated and the inter-relationship of the general landuse variables have been tested through bivariate correlation co-efficients.

In Chapter V an analysis has been made to find out the agricultural efficiency of the district. Weaver's Standard Deviation method has been applied to delineate the crop combination and levels of agricultural development of different community Development Blocks have been ascertained with the help of Kendalls composite indices.

The last two chapters are entirely based on field survey and deal with the study of land holdings and the extent of inequality and concentration among the several groups defined by the landsize classification in six sample villages of Kamrup district.

In the last chapter VII an attempt has been made to highlight the general and agricultural land utilization of the surveyed villages. It also analysis the distribution of land utilization under different land holdings, to ascertain the use and misuse of land in different size of farmers and the size of inter village inequality in a particular land-use pattern.

The study brings out several important findings, these are mainly;

a) The geology and structure of the district has a great bearing on the patterns and problems of landuse.

b) The region being an alluvial plain is characterised by an extremely flat surface except the northern and southern border and has given a wide opportunity to Kamrup farmers to extend their cultivable land

c) Though the development of agriculture in this district largely depends on the optimum utilization of drainage system, no serious attempt has been made to utilise the water resources of Brahmaputra and its numerous tributaries. So instead of helping the farmers it brings sorrow by causing floods.

d) Kamrup district falls within a zone of stable climatic limits which is of great significance to reflect the intensity of landuse. A meterological quantification with the data of annual precipitation and mean annual temperature change indicates that the water surplus in this region is much prominent than deficit.

e) Genesis of the soil, which is an important factor to influence the land utilization of Kamrup district is purely alluvial, except the northern and southern fringe.

f) Because of high pressure of population on land, several legislative measures in connection with the problem of land reforms have been enacted since 1947, so as to abolish the existence of intermediaries, to eliminate the fear of insecurity of tenancy, to consolidate the uneconomic fragmented holding and to distribute the surplus land among the landless cultivators and labourers.

g) In Kamrup district, 75.90 percent of the total holdings are in wholly owned group, 15.5 per cent are wholly rented group and the remaining 8.53 per cent are partly owned and partly rented category. In 1960-61, about 40 per cent of the holdings were below one hectare which rose to 52 per cent in 1970-71.

h) The temporal change occured in the general landuse pattern in 1964-65 and 1974-75. The proportion of net sown area and double cropped area increased substantially at the cost of fallow and cultivable wasteland due to increasing pressure of population.

i) A slow rate of change has been taking place, in the cropping pattern of the district. Wheat, the only Green Revolution's crop, recorded a simple growth rate of 88 per cent and rice 8.85 per cent in 1974-75 over the base year of 1964-65.

j) Cropping intensity increases in the district due to high growth of rural population (7.39 per cent)

k) The disparity in the spatial dimension of agricultural development is quite high.

l) Still, subsistance traditional agriculture is prevailing in the agricultural mosaic of the district. The overwhelming position of rice as a mono crop, reveals the backwardness of the agriculture.

m) Rapid urbanisation and/or intense urban influences bring forth an increased magnitude of inequality and poverty in the satellite points or in the rural fringes of these urban centres, as evidenced in the prevailing conditions of Sawkuchi and Kanaikuchi villages.

n) The households and the land belonging to the medium size group are the most productive among other rural land based classes, because of intensive cropping pattern and the economy of land-size utilizations, which has been witnessed in the agriculturally developed villages - Bangalpara and Barkura.

o) The pressure on land in the immigrant villages is commonly found to be very acute which results into the pre-dominance of the marginal and small size land-owning households in the total agrarian structure.

p) Rice is the main field crop, grown in all the villages by all size of farmers irrespective of their holding sizes, socio-economic background and cultural variation.

q) Jute is predominantly grown in those villages which are either exclusively occupied by the immigrants or coming in contact with the agriculturally development. The crop is totally absent in the indigenous Assamese villages.

r) Vegetables appear to be the most specialized but uniformly grown crop in all the villages.

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C O N T E N T S

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The views expressed in the study are entirely of the author and the views and opinions of other scholars are duly cited in the text. Needless to say that the omissions in the study are either of ignorance or of negligence and the mistakes, the sole responsibility of the author.

SHILLONG
the 30th June 1983

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CHAPTER - I

INTRODUCTION

In the recent decades, social scientists have been concerning themselves with the problem of food resources, food systems, malnutrition, and population pressure on arable lands. In fact, for survival, societies and nations must have adequate food supplies. The continued existance of most nations could become possible because of judicious use of land and successful agriculture, while many societies have perished in the past owing to inadequacy of food and mismanagement of their land resources. A significant land use planning in all the more important at the present time, especially in a developing country like India in which the frontier of arable land has been pushed almost to the limit and population is increasing at a geometric rate. If high rate of population growth continues in the coming decades, the gap between the quantitative and qualitative food requirements and food supply will be further widen which may lead to economic catastrophy.

Agriculture is an activity which has occupied the greater part of the humanity in the millennia and upon which still about half of the world's population depends. Agriculture geography dealing with the spatial organisation of crops and their concentration thus provides an interesting field in which geographer's can play a vital role for the well-being of the society.

Land is our ultimate asset. High agricultural returns can be obtained by its judicious use. Variation in the mode of land utilization in our country, which is the outcome of the Physico-socio-economic factors, have resulted into intricate patterns. Which demands definc-tion and geographical explanation. All our attempts for planning of a region will, therefore, be incomplete unless we identify the existing patterns of land use.

Assam has a strong agro-climatic base yet its economy in general and agriculture in particular is not showing satisfactory performance. The retarded progress in the primary sector of the region has resulted into many socio-economic problems. The present political turmoil of the Brahmaputra valley also has, partly, its roots in the land tenure system and in the unwise use of land. In fact the average yield of cereal and non-cereal crops in Assam are much lower to that of other states; the technology deployed in agriculture is traditional and diffusion of innovations is insignificant. For example, the per hectare yield of rice - the single largest crop in Assam is below the national average or about half of the Tamilnadu, Punjab and Haryana.[1] Though Assam ranks seventh out of twenty two states of India in terms of per hectare productivity,[2] it is not an impressive record considering the potentiality of its arable land and natural endowment. About half of the total districts (Darrang, Goalpara, Kamrup, Nowgong, Lakhimpur and Dibrugarh) of Assam have very low productivity per hectare.[3] Looking at these statistics it can be said that the agricultural potentials of Assam is underutilised. If the growth rate is not stepped up, the level of standard and level of nutrition will go further down and may lead to even more serious socio-political consequences. At present, in Assam most of the good quality land is used for growing cereals, rice being the cheap source of human energy, so cultivation gives higher returns of solid food in terms of calories or energy, than the land used for producing fruits, plants, vegetables or other cash crops. The food problem is not a temporary disequilibrium between supply and demand, but it is a manifestation of under use and misuse of land. The present study has therefore been an attempt to examine the existing patterns of land use, emerged as a result of

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[1] India - A Statistical Outline (1974), Oxford and I B H Publishing Company, New Delhi, p.21.

[2] Ibid., p.21.

[3] Statistical Hand Book of Assam (1975) Directorate of Economics And Statistics, Government of Assam, Gauhati, p.39.

historical process, physical milieu and prevailing socio-economic conditions. More emphasis has been laid on the land use patterns in the pre and post Green Revolution periods. It has also been attempted to identify the areas of virgin land which could be brought under plough, after a reasonable investment and to define areas which are performing rather poorly in agriculture. The existing land use patterns of Assam have been examined to ascertain the emerging trends in land use and cropping patterns.

Agriculture is one of the most common and wide spread ways in which man gets his living, and the geographers are primarily concerned with man's varied impact on the earth's surface. A considerable amount of geographical research therefore needs to be devoted to the study of agriculture. In the case of Brahmaputra valley, it is even more pertinent, because still agriculture is most dominant sector in region's economy. It has claimed the best part of cultivators working hours for centuries in the valley. The census of 1971 reveals that 85 per cent of the total rural population engaged primarily in the tilling of the soils yet the pace of development in agriculture has been a tardy one and inspite of the recent agricultural upheaval in an organised form during the last decades in all over the country, the agriculture in most of the valley is still essentially tradition bound. The agricultural operations, level of inputs, technology, tillage practices, mode of disposal and storing of crops are almost the same what they were about twenty years abck. The agricultural land scape continues to be strinking characteristics of the oriental view point, and it is the traditional peasant proprietorship that enjoys all significant control over the agricultural pattern along any cross section.

Truely speaking a very little transformation could take place in the agrarian sector of Assam which suffers from insubstantive research and inadequate methodology.

The present study in which a modest attempt has been made to integrate the physical, social and economic variables will point out a reliable picture of the prevailing agricultural land-use of the region. The main objective of the study is to find out the patterns of agricultural landuse and to ascertain the changes which have taken place in pre and post Green Revolution period in the district of Kamrup. Secondly it seeks an answer of the decision making processes of the farmers which ultimately shape the cropping structure of the region. Thirdly an attempt has also been made to identify the disparities within the region. Lastly an exhaustive enquires have been made at the village and household levels to know the causes of unequal pace in the diffusion of innovations and disparity in the degree of cropping mosaic.

Literature Survey

The study of land use is as old as geographer's interest in the science of distribution. Substantial literature has been contributed by geographer in the field of land utilization and land use planning, the literature varies from topical to regional and form micro to macro levels. The use of emergence of landuse pattern began in the geographic literature as a simple analytical tool for the long run development. The process was further enhanced with the development of Von-Thumons 'Agriculture Landuse Model'. Von-Thumon advocated a crop land use and crop intensity theory. The main advantage of this model lies in economic analysis and planning, especially where prediction and forecasting of behaviour of the economy became a necessity.

The approach of land use study, was firstly adopted by Stamp in Britain in the thirties. Britain is the only country in which a land use survey at the National level has been completed. This was done under the able guidance of Stamp.

In the article entitled 'Nationalism and Land Utilization in Britain' Stamp[4] endeavoured to trace the

[4]Stamp, L.D., (1943), 'Land Utilization in Britain' (1937-43), The Geographical Review, Vol. 33, pp.523-544.

history of land use in Britain under the old policy of free trade from 1860-1932.

Land utilization survey of Britain an independent research organisation founded in 1930 with Headquarters at the London School of Economics and supported by voluntary contribution, including sums from the Rockefeller Foundation and the Pilgrim Trust, had as its primary aim the recording on maps on the use of euery acre in England, Wale and Scottland. The field maps were on the scale of six inches to one mile, and the primary survey, carried out entirely by volunteers drawn mainly from universities, colleges and schools, required 22,000 sheets. The results were edited and reduced to the scale in 1933. The survey work was quickly pressed into service in the Governments "Plough up Campagihn".[5]

In three phases they completed the whole work by 1942.

(i) The classification of land

(ii) The Grass land survey of England and Wales (1939-40)

(iii) The Farm survey (1939-42)

At the end of the survey Stamp says,

"The landuse pattern of Britain is the resule of millenniums of settlement, of trial and error. It has been constantly changing and

[5] Stamp, L.D., Op.cit., pp.523-524.

> evolving and varies markedly from one part of the country to another. In future there will be change in the relative importance of arable and grass, a change in details of field shapes and sizes, possibly a realignment and organisation of farm units, but the process of change is likely to be one of evolution rather than of revolution. The essential pattern of landuse is likely to remain substantially unaltered."[6]

Realising the use and importance of earlier national survey, Great Britain was again put in the forefront of the nations for five landuse mapping in 1960 and the subsequent years, under the guidance of Coleman.[7]

The landuse survey in U.S.A. can be traced first from Beker's[8] article on 'Land Utilization in the United States Geographical aspects of the Problem.' He assessed the trends and changes in land utilization and emphasised the need of land classification and surveys. In his paper Baker stated "The first goal of landuse survey is to complete data on dimensions and locations of every use of land in the country, to classify the kinds of use and assemble them into a landuse map."[9]

United State's Agricultural Department has done

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[6] Stamp, L.D., Op.cit., p.39.

[7] Coleman, A., (1961), 'The Second Land Use Survey Progress and Prospects', Geographical Journal Vol.(xxvii(2))

[8] Baker, O.E., (1940), 'Land Utilization in the United States', Geographical Aspects of the Problem.

[9] Baker O.E., (1940), Op.cit., p.29.

substantial work of agricultural landuse mainly for planning on comprehensive scale. The programme of landuse survey was started in summer of 1935 and it was properly executed only after 1938. A detailed study of landuse including map making was undertaken and their analysis led to recommendation as to change in the kind of forming and size of farms in each landuse area, what land should be recovered for forestry or wild life or for recreation and in what area settlement should be discouraged or encouraged.[10]

Unit area approach to landuse survey has extensively been used in United States. Under this approach the entire area of survey is divided into several blocks which are further divided into small units. This approach recorded present as well as potential use of land. Under this survey three major landuse surveys are :

i) Michigan Land Economic Survey.

ii) Survey of the Tenessee Valley Authority.

iii) Rural Land classification programme of Pucrto Rico.[11]

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[10] Hillman, A., (1957), Community Organization and Planning, Macmillan, New York, pp.44-48.

[11] Majeed, A., (1981), Approaches to the Land Use Survey: A Global Perspective', Perspective in Agricultural Geography, Vol. III.

Landuse planning in the Socialist countries introduced in much more rational, scientific and systematic manner and it took place under the direct Government supervision. Buck[12] adopted random sampling approach for the land utilization in China in 1929. For her vast area and due to lack of skill resources the selection of sample study took place.

The basic purpose of the monumental survey was to make available knowledge about China's agriculture for its improvement and as a basis of national agricultural policies. After the independence the provincial Land use Survey Committee have been formed in all the provinces and started a rigorous task from 1968.

Poland conducted her landuse survey in 1953 under the direction of Kostrowicki and Dziewouski.[13] This survey has followed almost the same principles as those of land-use survey in Great Britain thus adopted the same census approach.

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[12]Buck, J.L. (1931), Land Utilization in China, University of Nanking, China, pp.8-11.

[13]Dziewonski, K. (1951), 'Detailed Survey of Land Utilization in Poland', Proceedings of International Geography Seminar, Aligarh, pp.562-66.

Probably no country has taken up the more enthusiastically than Japan. Land use survey in Japan attracted the highest priority in their post world war renaissance to support 90 million of population on the small area of cultivated area.[14]

Landuse surveys are equally in progress in some of South American, African and middle east countries, among them Mexico, Venezuela, Brazil, Chili, South Africa, Saudi Arabia and Iraq are doing in a real sense, land use surveys.

Indian Geographers have long been attracted to study the problems of land use in the country with a view to finding out ways and means for scientific utilization of land.[15] An achievement in land use study in India is probably due to pioneer work done by the late L.D. Stamp in Great Britain. Indian land use studies first came into the picture at the 1941 session of the Indian Science Congress held at Madras, there S.P. Chatterjee pointed out the necessity of undertaking land use survey in Great Britain. After that a vast work has been contributed in this field of agricultural geography, from regional to local studies. A critical review of land use surveys indicates that there are mainly four approaches to it.

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[14] Prasad, N. (1980), Some Aspects of Land Utilization Recent Trend in Geography, Vol. II, p.275.

[15] Shafi, M., (1972) 'Land used Studies', Survey of Research in Geography, ICSSR, p.19.

They are as follows :

i) Landuse problem, planning and methodology.

ii) Land use (Case studies).

iii) Changing land use pattern.

iv) Modern techniques in land use.

Land use planning and methodology in India first contributed by Shafi[16] in 1951. In his paper he made a strong plea to carry out a land utilization survey with land capability survey to determine the measures for using land to the best advantage in relation to its intrinsic qualities. Systematic purposive sampling approach to land used survey first used by Shafi[17] in 1952 while conducting land use survey in Eastern Uttar Pradesh. It was a pioneering work of its kind undertaken in India. After a detailed study of structure, and relief, drainage and climate and soils of the entire area, he divided the whole area into four homogenous strata and selected the representative villages from each stratum.

Chatterjee[18] in his series of articles from 1953 to 1962 pleaded for rapid survey and mapping of only

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[16]Shafi, M. (1951), 'A Plea for Land Utilization Survey', Geographer, Vol. IV 2.

[17]Shafi, M. (1980) 'Land Utilization in Eastern Uttar Pradesh', Department of Geography, Aligarh, pp.48-226.

[18]Chatterjee, S.P. (1953), 'Land Utilization Survey in India', Observer, Vol.I, pp.3-9; _____ (1956), 'Preliminary Remarks on Land use Survey in India', Proceedings of The International Geographical Seminar, ; _____ (1962), 'Land Use Survey in India', Proceedings of the Summer School in Geography, Simla.

marginal areas of different categories of landuse with the help of a generalized map.

Indian society of Agricultural Economics brought out Readings In Land Utilization in 1956 as one of its publications. It discusses varying approaches to the problems of land utilization in scope and methods and describes some important projects, which have been carried out on land utilization in the world. The extent of land misuse in India has also been discussed and problem that may arise in the formulation and excution of a National Land policy have been enumerated.[19] Rao[20] in 1956 argued for the merits of whole country survey in micro level study. He mainly emphasised for pilot studies in typical landuse regions by sampling. He also pointed on land use classification and mapping.

Sen and Chakravorty[21] in their article 'Selection and Appropriate Trends for soil and land use maps in 1958 stressed on utility of correct mapping and use of colour for land classification and land use maps. Sen and Guha[22]

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[19] Shafi, M., (1972), 'Land Use Studies', Survey of Research in Geography. ICSSR, p.20.

[20] Rao, V.L.S.P., (1956), 'Land use Survey in India' Its Scope and Some Problems' Proceedings of International Geographical Seminar, Aligarh.

[21] Sen, A.K. and Chakroborthi, S. (1958), 'Selection and Appropriate Trend for Soil and Land Use Maps' Geographical Review of India, Vol. 33, pp.42-48.

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made a detailed study on land use planning of a typical village in West Bengal in 1959. Rao and Bhat[23] write an article on Geographers role on land use planning. He categorically mentioned there that how geographer can play a vital role in land use planning.

Shafi[24] gave another jerk in the field of land use planning in 1961, while he advocated the adoption of purposive sampling technique to select areas for special study. In this connection in another study he emphasized for a careful objective and detailed land use survey as a must, for all long range planning of Uttar Pradesh agriculture. In a article on 'Land use and Agricultural Planning' Ganguli[25] in 1964 remarked that to meet the fast growing population how land use survey and planning is essential. Singh[26] in 1965 discussed the institutional problem of land use survey in Eastern Uttar Pradesh. Shafi[27] in 1966 presented a paper to the 20th International Geographical

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[23] Rao, V.L.S.P. and Bhat, L.S.(1959) 'The Role of Geographers in Land use Planning', Bombay Geographical Magazine, Vol. VI, pp.7-11.

[24] Shafi, M. (1961), 'Field Work in Land use Research under Indian conditions', Bombay Geographical Magazine, Volume-1(1); ________ (1962), 'Agricultural efficiency in Relation to Land use Survey in Uttar Pradesh', Geographical Outlook, Vol.3(1).

[25] Ganguli, B.N. (1964), 'Land use and Agricultural Planning', Geographical Review in India, Vol.26(2),pp.22-27.

[26] Singh, H.S. (1965), 'Land use Survey - A pressing problem in Eastern Uttar Pradesh', Geographical Thought, Vol. 2 (1 and 2).

[27] Shafi, M. (1966), Technique of Rural Land use Planning with Reference to India,'Geographer, 1966,Vol.13.

Congress in London with some concrete suggestions regarding the techniques for ideal landuse survey in India. He has pointed out that any technique which is adopted for rural landuse planning in India must go first recording the existing use of land and then by mapping of land capability or land potential at the next stage.

It is noteworthy to mention that Chauhans[28] (1966) work 'Studies in Utilization of Agricultural Land' highlighted some of the problems of landuse in relation to economic development of the country. Bhattacharya[29] in his study in 1971 tried to assess the work on landuse study done in India upto 1970. He has given some light on how it can be done properly.

Roy[30] indicated in his paper in 1972 how agricultural landuse interrelated with the socio-physical agricultural characteristic. Misuse of agricultural lands often suffers from poor soil management which has created various problems of soil erosion, floods, water logging, development of salinity and ravines. Tamhane[31] has therefore suggested

[28] Chauhan, D.S. (1966), 'Studies in utilization of Agricultural Land' Agra.

[29] Bhattacharya, B. (1971), 'Technique of Rural Land use Study', Geography outlook, Vol. 34(1), pp.17-25.

[30] Roy, A., (1972), 'Land use and Major Agricultural Characteristics of Damoder and Saraswati Doab', Geographical Review of India, Vol. 34(1), pp.28-35.

[31] Tamhane, R.U.(1971), 'Land use in Relation to Agroclimatic conditions for Optimum crop production', Proceedings of Symposium on Science and Indias Food Problem, ICAR, New Delhi, pp.156-159.

that the existing use of land needs important adjustments to get maximum output in different soil climatic zones. Ecological condition and the best adopted crops studied by Krishnan and Singh[32] in 1972. The authors have demarcated 63 soil-climatic zones and described the relationship between the distribution of important crops and soil-climatic condition in each zone. Spatial distribution of land utilization, land classification and landuse combination in Gurgaon block surveyed by Bharadwaj.[33] Singh[34] in 1975 reviewed landuse studies and sampling methods, he further studied how to select samples for different level.

Landuse (Case-Studies)

From the very beginning of landuse studies, Geographers in India developed a weakness for the case studies. Their attraction for these case studies ranges from regional to local level. Chatterjee[35] first selected a small area to study that is the district of 24 Parganas in Bengal. This work profusely, illustrated with diagrams and photographs revealed that the district was poorly drained though

[32]Krishnan, A. and Singh, M.(1972) 'Soil Climatic Zones in Relation to cropping patterns', Proceedings of Symposium on Cropping patterns in India, ICAR, New Delhi pp.172-183.

[33]Bhardwaj, B.K. (1973), 'Changes in Wet Area Sown in Gurgaon Development' (1956-64), Geographical view-point Vol. I(2), pp.1-14.

[34]Ibid.

[35]Chatterjee, S.P. (1945), 'Land Utilisation in the District of 24-Parganas in Bengal', B.C. Law. Vol. Part II

nature endowed it with big rivers capable of draining it most efficiently. He further discussed the influence of soils and climatic elements on landuse and cropping pattern.

Damodar Valley Corporation[36] conducted a landuse survey in its command area in 1950 like Tennesy Valley Authority in U.S.A. An integrated development under a rational landuse pattern was the main objective of that study.

A more detailed land utilization survey was conducted in Howrah District by Chatterjee[37] in 1952, while 1200 land-use maps at the scale of 1:3960 covering 813 villages were prepared. Landuse study in much more extensive areas has been attempted in Uttar Pradesh. Ganguli[38] has conducted a sample survey in a village Burki near Gyanpur in 1955 and pointed out the irrigation scarcity of the main problem of rational landuse of the village. Singh[39] surveyed five villages near Saranath in 1955 and found considerable changes in the crop pattern during the past 70 years (1883-84 to

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[36]Shafi, M. (1972) 'Land Use Study', Survey of Research in Geography, p.22.

[37]Chatterjee, S.(1952), 'Land Utilization Survey of Howrah District', Geographical Review in India, Vol. 14(2).

[38]Ganguli, B.N. (1953),'Land use and Agricultural Planning Uttar Pradesh, Geographical Review in India, Vol. 15(2).

[39]Singh, U (1955), 'A Sample Study in Land Utilization near Sarnath', National Geographical Journal of India, Vol. 5(4).

1951-52), he further advised consolidation of holdings may bring much more success. Anantapadmanabhan[40] made an attempt to show the relationship between landuse and rural population density in 7 representative taluks of Tamil Nadu. Sen[41] in 1957 carried out landuse survey of part of central Mayurakshi basin of Birbhum district on the basis of existing landuse pattern.

Ahmed[42] has presented an important case study dealing with one village of Choto-Nagpur Plateau. His main study was the impact of surrounding physical setting on agricultural landuse. Shafi[43] in 1960 surveyed 12 villages of Eastern Uttar Pradesh. The work gives an useful account of physical condition, a detailed landuse and crop-production and calorie consumption per head, per day. In the last part he discussed about the future development to increase production. Goswami[44] in 1960 has put forward that village level study can be ideal for the whole of

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41 Sen, A.K. (1957), 'Land Utilization and Agricultural Planning in Matpalsa union of Birbhum, West Bengal, Geographical Review of India, Vol. 19(4), pp.26-33.

42 Ahmed, E. (1959), 'A Sample Survey of Land use pattern and its Physical setting in Chotonagpur.' Bombay Geographical Magazine, Vol. 6, pp.26-33.

43 Ibid..

44 Goswami, S.B., (1960), 'Misirzonda, a prototype of Agricultural Land use in the Central Ranchi Plateau', Geographical Review of India, Vol. 22(2), pp.32-37.

Central Ranchi Plateau landuse study. Joshi[45] has made an intensive study of the landuse and settlements in the Ratnagiri Taluk. Duggal[46] in 1961 has emphasized the contribution of historical factors to the existing landuse patterns in Moradabad districts.

Learmouth[47] in 1962 made an intensive field study of 60 sample villages in Karnataka State. Chandrashekhar and Sundaram[48] first studied agricultural landuse in arid and semi-arid areas of Rajasthan and they suggested that the canal-irrigation can bring there a havock change utilization. Sharma[49] made a study of landuse changes in Salgawana village in the upper Damodar basin in 1962 and concluded that with proper soil conservation, consolidation of holdings and irrigation facilities can pull up the agricultural production of this region. Mukherjee[50] covered a Mewar village land utilization in 1963.

45Joshi, C.D., (1961), 'The Ratnagiri Taluka', Bombay Geographical Magazine, Vol. 7 and 9.

46Duggal, S.L. (1961), 'The Historical Factor Governing the Landuse Pattern in Moradabad District', Indian Geographical Journal, Vol. 36(4), pp.7-12.

47Ibid.

48Chandrashekar, S.C. and Sundram, K.V. (1962), 'A Note on Anticipated Land Use changes in the Rajasthan Canal area', Bombay Geographical Magazine, Vol. 14(3).

49Sharma, A. (1962), 'Land use changes in Salzawan village, Upper Damodar Basin", Proceedings of the Summer School in Geography, Simla.

50Mukherjee, A.B. (1963), 'Land use pattern in a Mewar Village', Geographical Review of India, Vol.25(1),pp.18-24.

Tewari[51] in 1965 came out that proper agricultural development only can take place if a rational landuse planning exist there. His work based on Jaunsar basin. A detailed landuse survey was conducted in the village of Bundelkhand district by Siddiqui[52] in 1966, he argued for immediate attention on fragment of holding, poor irrigation and subsistance agriculture. Raza[53] in 1968 emphasized the urgent need of optimum use of land for high production. After a detail study of land reform policy implementation of Uttar Pradesh he concluded that in Uttar Pradesh there is marked change in cropping pattern and landuse. Ahmed[54] has explained the need to explore the land in arid zone and its intensive use.

Another recent valuable addition to landuse studies in India was made by the Indian National Committee for Geography in the form of volume 'India Regional Studies (1968) presented to the delegates of the 21st International Geographical Congress. These volume deals with thirteen different regions of India and outline the regional

[51] Tewari, A.K., (1965), 'Land Utilization in Jaunsar Bawar', Deccan Geographer, Vol. 3(2), pp.36-43.

[52] Siddiqi, F.M. (1966), 'Study on Agricultural Land use and carrying capacity of crop land in Kabar soil', Agricultural Situation in India, Vol. 21(7), pp.48-

[53] Raza, M. (1968), Land Reform and Land use in Uttar Pradesh, Geographer, Vol. 15.

[54] Ahmed, A. (1968), A Geographical Approach to the Problem of Land use in the Indian Desert, Geographer, Vol. 15.

personality by focussing attention on the synthesis of the Physio-cultural environment and rural agrarian base. A detailed treatment of the distribution of landuse and crop association is given for Upper Bari Doab, Ganga-Yamuna Doab, Eastern Uttar Pradesh, the Tarai region of Uttar Pradesh, Kangra valley and the Mahanadi Delta.[55]

Landuse studies were conducted by Husain[56] who attempted to summarize the landuse in two crop seasons in Meerut districts in 1969. In the same year he has drawn attention on nutrition level and agricultural landuse in Saharanpur district. He pointed out that mainly Physio-Economic constraints are the dominant factors affecting the land utilization of that district. He also carried out a detailed survey of food habits and assessed the nutritional standard by preparing food balance sheets, he has concluded the only possible way left to pick up the standard of nutritional level by developing agriculture by improved landuse practices. Mitra[57] surveyed agricultural land utilization in Sonerpur part of Calcutta metropolish from different angles, the area is a transitional

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[55] Shafi, M. (1972), 'Land use Studies', Survey of Research in Geography, p.27.

[56] Husain, M. (1969), 'Agricultural Land use in Meerut District', Geographical Observer, Vol. 5, pp.110-114; ______ (1969), 'Land use and Nutrition in Saharanpur District', Geographical Review of India, 31(3), pp.27-37.

[57] Mitra, A. (1969), 'Agrarian Land use in Sonarpur' A Southern Fringe of Calcutta Metropolis, Essays on Agricultural Geography, Calcutta, pp.208-16.

zone between the metropolitan life of Calcutta and semi-rural life of its adjoining areas. He discussed though the agrarian economy has been changed by the metropolitan's overlapping economy but the agricultural landuse still governed by the physical environment. Landuse and nutrition in the central Ganga-Ghaghara Doab was studied by Siddiqi[58] in 1969. He has pointed out how by changing landuse pattern a food habit changes within the limited resource of the villages, and which can provide better nutrition and cheaper food. A concrete and dynamic landuse patterns in the Doab area of Damodar-Saraswati have been discussed by Roy[59] in 1972. His main emphasis was in soil and climatic impact on agricultural development. Chauhan studied a Vindhyan foothill village in 1973. He has found how agricultural landuse is affected by the socio-economic factors.

A land utilization in Bor-Command area by Pofali[60] in 1975, 'Patterns of agricultural landuse in Ghaghara-Rapti Doab' by Mohammad[61] and patterns of land utilization

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[58] Siddiqi, W.A. (1970), 'Land use and Nutrition in the Central Ganga-Ghagara Doab', Geographical Outlook, Vol.7, pp.97-106.

[59] Roy, A. (1971), Land use and Major Agricultural Characteristics of the Damodar-Saraswati Doab', Geographical Review of India, Vol. 34(1), pp.28-35.

[60] Pofali, R.M. (1975), 'A Study of Land utilization in a part of Bor-Command Area', The Deccan Geographer, Vol. XIII, pp.165-172.

[61] Mohammed, N., (1981), 'Patterns of Agricultural Land use in Ghaghara Rapti Doab', Perspective in Agriculture Geography, Vol. III, pp.245-253.

in three hill subdivision of Darjeeling District by Lahiri[62] are some of the important case studies.

Changing Pattern in Landuse

The temporal change in landuse is not very old concept in agricultural Geography in India. In fact from the III Five Year Plan, when agriculture started taking another ride, Geographers turned their attention to assess the qualitative and quantitative change which have been taking place in landuse patterns.

The first highlight was given by Chakraborthy[62] in 1972 when he wrote an article 'Statistical Presentation of Changes in Landuse Data'. He has explained the need of statistical method to assess the changing pattern and how it can be used as a pin-point indicator to get a clear picture. Ahmed[63] in 1966 studied, productivity and farming efficiency in Maunpura village based on two times data about area under different crops and production. Singh[64] has reviewed hundred years crop landuse data in Kachhwa to assess the changing patterns. In his study he

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[62] Chakraborthy, S.C. (1962), 'Statistical Presentation of changes in Landuse Data', Bombay Geographical Magazine. Vol. (10) I.

[63] Ahmed, Z. (1966), The Measurement of Productivity and Farming Efficiency in Village Manupura, Geographical Observer, Vol. 2, p.37.

[64] Singh, V.R. (1968), 'Changes in Landuse Patterns - A Case Study in Kachhwa,' National Geographical Journal of India, Vol. 13(1), p.36.

found that a significant transformation has taken place in that region and substantial area of cereals has been encroached by the cash crops. Mukherjee, Singh and Mukherjee[65] presented a study on changing patterns on agricultural landuse in Varanasi districts in 1967. They consulted data for fifty years (1911-1963) and concluded that there had been a tremendous change in net cropped area and area sown more then once in the region. Due to the expansion of irrigation facilities in recent times the dry crops are replaced by wet crops. Ahmed and Siddiqui[66] in their Luni basin study in 1967 have recommended that a right procedure and a right combination analysis can give reasonable result even in ecologically netagive area.

Roy[67] has taken two base years (1880-81 - 1960-61) to measure the changing patterns of crops and crop association in the East Ganga-Ghaghara Doab. He has found a change from double cropping to multiple cropping. Siddiqui[68]

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[65] Mukherjee, B., Singh, J.J., and Mukherjee K.L.(1967), 'Changes in Agricultural Land-scape in Varanashi District during the Past Fifty Years', National Geographical Journal of India, 1967, 13(4), pp.13-21.

[66] Ahmed, A. and Siddiqui, M.F.(1967), 'Crop Association Patterns in the Luni Basin', Geographer, Vol. 14, pp.67-72.

[67] Roy, B.K. (1967), 'Crop-Association And Changing Patterns of Crops in the Ganga-Ghagra Doab India, Abstracts of the 21st International Geographical Congress, New Delhi

[68] Siddiqi, N.A. (1968), 'A Comparative Study of Land use Patterns in the Central Ganga, Ghagara Doab, India. Abstracts of the 21st International Geographical Congress, New Delhi, 1968.

in 1968 attempted a comparative study in central Ghaghara Doab and concluded that very little change in landuse pattern has taken place from 1957 to 1967. He advised to change the cropping pattern to get optimum yield from the land. Mukherjee[69] has pointed out in his article in 1971 the agricultural wastelands are decreasing in 'Uttar Pradesh during 1951-67.

Deshmukh[70] has shown the changing landuse pattern of Lonkhet village. Pal and Shukla[71] have done a commendable study in the hilly tracts of Rajasthan (Chittaurgarh district) and they concluded after analysing twenty years data, a very slow and insignificant change in the landuse pattern. Bhattacharya[72] studied landuse characteristics of Bihar from 1958-59 to 1970-71 in terms of five fold classification both for the entire state and for the districts. The picture presented by the author is that only little changes have taken place during this period in the

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69Mukherjee, A.B. (1971), 'Geographical Patterns of Changes in Agricultural Waste Lands in Uttar Pradesh(1951-67), Geographical Review of India, Vol. 33(2),pp.120-131.

70Deshmukh, V.M. (1975), A Study in Changing Land use, The Deccan Geographer, Vol. XIII, Jan-Dec., pp.189-203.

71Pal, I and Shukla, L., (1981), 'Changing Agricultural Land use in the Hilly Tracts of Rajasthan', Perspective in Agricultural Geography, Vol. III, pp.271-307.

72Bhattacharya, R. (1981), Changing Land use and Cropping pattern in Agri Bihar', Perspective in Agricultural Geography, Vol. III, pp.437-468.

cropping pattern and crop combinations.

Prasad[73] studied the changing pattern of landuse in Bodh Gaya Block (Gaya) between 1914-15 and 1974-75. The author has selected seven villages of the block on purposive sampling methods and studied their landuse in detail Shastri[74] selected Wardha district in the cotton belt of Vidarbha to study the changes in landuse and a cropping patterns.

Modern Techniques in Landuse

Agriculture Geography have been getting increasingly aware of the need for the improvement of the modern techniques in land use study. Recently the studies are shifting towards the application of remote sensing and aerial photographs to analyse the land utilization.

Tewari[75] in 1977 examined the importance of aerial photo in landuse analysis. He has shown that for a difficult terrain how aerial photo can easily be utilized for landuse study. Mandal[76] described generally 'Air photographs in Land Use Analysis'. He discussed the methodology

[73] Prasad, M.(1981), The Changing Pattern of Landuse in Bodh Gaya Block (Gaya), Perspective in Agricultural Geography, Vol. III, p.506.

[74] Shastri, P. (1981), 'Changes in Landuse and Cropping Pattern in the Cotton Belt of Vidarbha', Perspective in Agricultural Geography, Vol.III, pp.507-520.

[75] Tiwari, A.K.(1977), 'Air Photo and Rural Landuse Analysis' Geographical Review of India, Vol.39, No.2, pp.14-20.

[76] Mandal, R.B.(1980), 'Air Photographs in Landuse Analysis', Recent Trends and Concepts in Geography, Vol.III pp.311-318.

or how to interpret the aerial photo. Rao and Vaidyanathan[77] in 1981 studied landuse capability of Krishna delta from Aerial photo interpretation.

Assam

Very little work has been done in Assam which provides an ample scope for agricultural landuse study. Sharma[78] in a study 'Exploration on the Land Utilisation in Kamrup' in 1970 is the first published work in this field. In another article he shows the changes that have occured in the agricultural landuse of 'Deharkuchi' village of Kamrup district since 1950. It is concluded that a change in its basic pattern is taking place due to greater concentration of crops having better market value. Some measures have been suggested to improve the existing conditions.

A valuable addition of landuse studies in Assam was made by the 'Agro Economic Research Centre' for North East India (Jorhat)[79] in 1979. They selected six villages

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[77] Rao, K.N. and Vaidyadhan (1981), 'Land use Capability Studies From Aerial Photo Interpretation - A Case Study from Krishna Delta, India, Geographical Review of India, Vol. 43, pp.226-238.

[78] Sharma, M.C. (1970), Exploration on the Land Utilization of Kamrup, Deccan Geographer, Vol. 8, pp.15-24.; (1970), 'Deharkuchi : A Study in Agricultural Land use,' Journal of North Eastern Geographical Society, Vol.2(1), pp.102-109.

[79] Agricultural Land use in Assam (A Case Study of Few Villages), Agro-Economic Research Centre for North East India, Assam Agricultural University, Jorhat, Assam.

from different parts of Assam and discussed in details. Das[80] in 1981 has attempted very sincerely 'Landuse pattern in Assam'. He analysed the volume of change in landuse in different districts during 1969-74 by the Weaver's index. He concluded his study by saying that the landuse change in Assam as a whole is marginal. But there is a spatial variation in it on the basis of which the state may be divided into dynamic, semi-dynamic and static regions.

Hypothesis to be tested

The study is primarily concerned with the changes that occured in landuse and cropping patterns in the Kamrup district of Brahmaputra valley during the pre and post Green Revolution periods. The main objective is to test the following points :

1) Farmers of the Kamrup district are moving from the subsistance farming to the market oriented economy;

2) Cultivated area increases with the increasing pressure of population;

3) The landuse and cropping patterns of the region have transformed under the impact of the immigrants;

4) The existing socio-economic and institutional attributes are helping in the adoption of new crops;

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[80] Das, M.M. (1981), 'Land-use Pattern in Assam', Geographical Review of India, Vol. 43, pp.239-247.

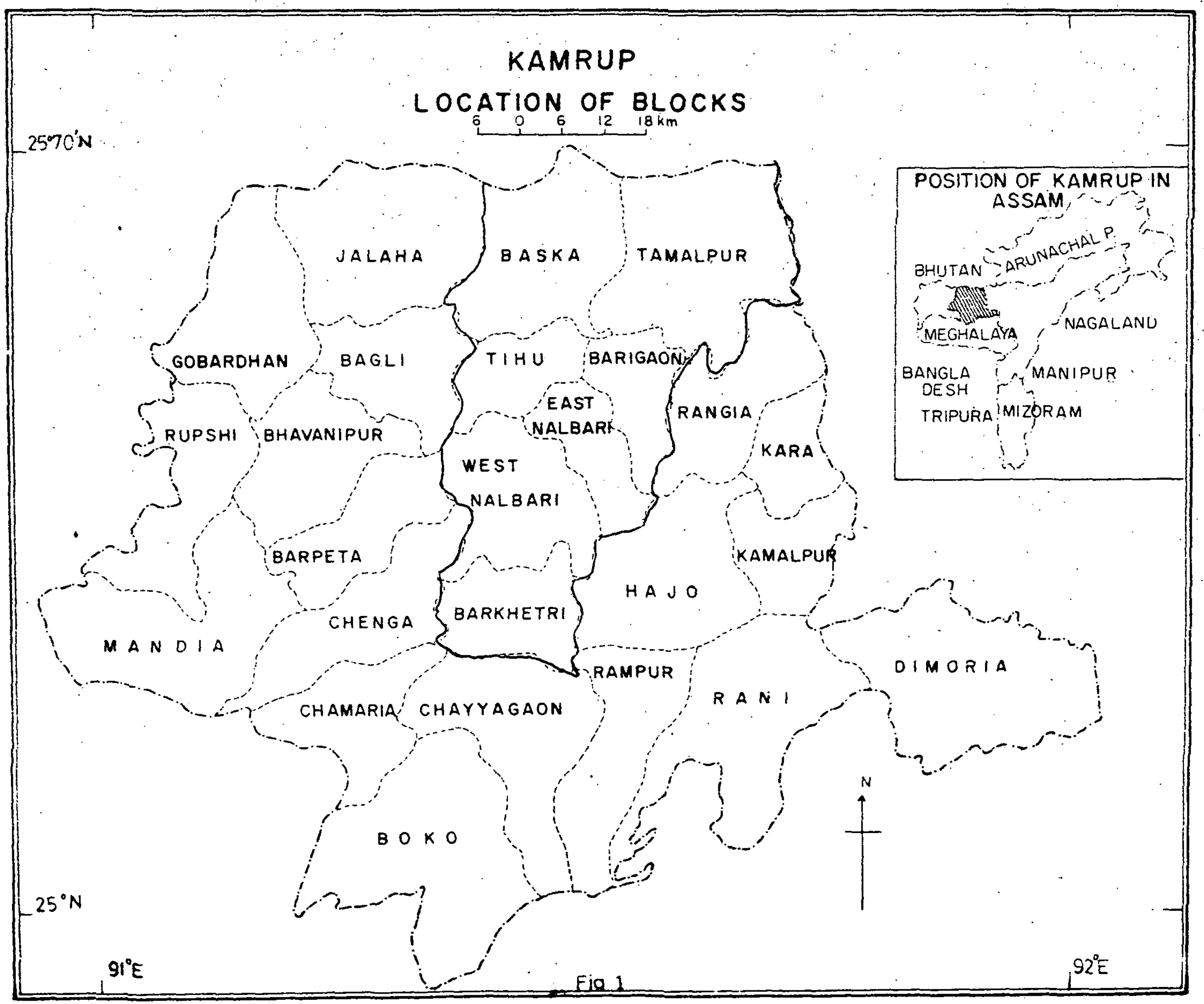
KAMRUP
LOCATION OF BLOCKS
6 0 6 12 18 km
25°70'N
25°N
91°E
92°E
N
JALAHA
BASKA
TAMALPUR
GOBARDHAN
BAGLI
TIHU
BARIGAON
RUPSHI
BHAVANIPUR
EAST NALBARI
RANGIA
WEST NALBARI
KARA
BARPETA
KAMALPUR
HAJO
BARKHETRI
CHENGA
MANDIA
RAMPUR
DIMORIA
RANI
CHAMARIA
CHAYYAGAON
BOKO
POSITION OF KAMRUP IN ASSAM
BHUTAN
ARUNACHAL P.
MEGHALAYA
NAGALAND
BANGLA DESH
MANIPUR
TRIPURA
MIZORAM

Fig 1

5) Urban influence have impact on the cropping patterns;

6) Some changes have taken place from the Pre Green Revolution period to Post Green Revolution period in the landuse pattern of the area under study.

Area of Study

The present study is confined to the district of Kamrup, which is agriculturally developed district in the Brahmaputra Valley, and represents the general prevailing conditions of the Brahmaputra Valley. The district lies between 24°75' and 25°82' North latitudes and 90°80' and 92°11' East longitudes. The mighty Brahmaputra river divides the district into two parts viz. North Kamrup and South Kamrup. The former is surrounded by Goalpara district in the West, Darrang district in the east and Bhutan in the north. The lower part of Kamrup is enclosed by Goalpara district in the West, Meghalaya state in the south and Nowgong district in the east.

The area of the district is 9,863 sq. km. and the population size is 28,541,83 (1971) with a density of 289 per square kms. Kamrup district has witnessed a sizeable increase in population of 38.38 per cent during 1961 to 1971. For administrative purpose, the district has been divided into three sub-divisions viz. Gauhati, Nalbari and Barpeta. There are 3344 villages and with 20 towns and one city in the district. Schedule tribes (2,980,90) and scheduled castes (16,4762) comprises 10.4 per cent and 5.8 respectively of the total population of the district. The population of Kamrup is overwhelming rural. About 80 per cent of which live in rural areas in comparison to 74.63 per cent in India as a whole.[81] Thus the burden of demographic pressure on the rural economy of Kamrup is much heavier and the pace of urbanization is very slow.

Kamrup district is essentially a levelled alluvial plain, deposited by the Brahmaputra and its tributaries. In places on either sides of Brahmaputra, the Assam range however, crop up above the alluvial plain. The average annual rainfall in the district is 1676.13 mm and at Gauhati, it is about 1700 mm. The rainfall has an increasing trend towards the hill sides and at Barduar it reaches to the limit of 2285 mm while at Barpeta in the West the average annual rain is appreciably high approaching 2300 mm. The average temperature for the district as a whole 28°C, the mean annual temperature varies[82] between as low as 16.78°C to as high as 36.0°C. In Kamrup district January is the coldest month while August records the highest temperature of the year.

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[81] A Statistical Outline (1974), Op.cit., p.11.

[82] Annual Report (1974), Gauhati Meteorology Department, Gauhati.

In the present work Community Development Blocks have been taken as the unit of study. Community Development Block was first introduced as an administrative unit in 1952. The area fixed for Community Development Block is to 100 villages, éncasing about ten thousand acres of cultivable land with a population of 60,000 - 100,000.[83] These criterias are fixed up by planning Commission.

In Kamrup district, there are twenty five blocks. Agricultural and socio-economic variables data was available for all the blocks except Karara and Baska blocks, which have been recently carved out.

The ideal method of quantitative study is by systematic field work. In fact, systematic field work is an important component in agricultural geography. For a small area the entire areal coverage is possible, but for a large area like a big district, the sample areas have to be positioned systematically for maintaining accuracy in mapping, discussion and analysis. Generally for a standard study dealing with socio-economic aspects about 10 per cent of the universe is taken as a sample. But owing to the financial and time constraints and the prevailing social conditions charged with foreigners issue, only six sample

[83]Panikkar, K.K. (1974), Community Development Administration, New Delhi, p.13.

villages were taken to depict the prevailing landuse practices in the district. While conducting the field work the author was confronted with many problems and obtaining of ever the villages base-map was a difficult task. In fact the socio-political unstability and foreigners issue were the serious impediments in the field work. All the time the villagers remained curious to know whether the incoming stranges is a Government Agent, politician, missionary worker, a social reformer or a simple research worker. During the period 1981-82 when the field work was conducted there was strong local Vs. outsider and Bengali Vs. Assamese feeling, which forced the author to restrict his work to only six villages.

In the selection of the villages, population structure, demographic composition and accessibility factors were taken into consideration.

Two of the selected villages namely Mergenda (Cheyagaon Block) and Dangarkuchi (Barpeta Block) are dominated by the Bengali population - both Hindus and Muslims. Next two villages i.e. Sawkuchi (Rani Block) and Kanaikuchi (Rangia Block) are situated in the vicinity of urban places, the study of which reflects the urban influences on agricultural landuse. The last two sample villages i.e. namely, Bangalpara from (Hazo Block) and Barkura

(Nalbari Block) are Assamese dominated village which depict the cropping structure of the local people having very little influence of the Bengali and the urban areas.

Place of Agriculture in the Economy of Kamrup

Kamrup is primarily an agriculture economy. It provides employment to 72 per cent of the total working population and 17 per cent of the total population of the district. Though agriculture is the main occupation of the people of the district, it has not been exploited to the optimum level. Commercial cropping or introduction of merchanised agriculture which can earn good money is not extensive.

Agriculture productivity in this district is relatively better that the other parts of Assam, but comparison to the national level it shows a low productivity.[88] The main causes of low productivity is the uneconomic size of holdings, traditional cropping patterns, low use of modern agro inputs, lack of proper irrigation facilities, absence of institutional finance, and over and above natural calamities such as droughts and floods.

The total area of the district is 872,626 hectares

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[84] India - A Statistical Outline (1974), *Op.cit.*, p.32.

out of which 111,974 hectares (12.83 percentage) is under forest, and 160,696 hectares (6.96 percentage) under non-agricultural uses. 79683 hectares (9.13 percentage) are uncultivable land, 38534 hectates (4.42 percentage) are grazing field. 48627 hectares (5.57 percentage) are use for miscellaneous tree growing and 20546 hectares (2.35 percentage) are cultivable wasteland. Total cropped area of the districts is 639749 hectares (73.31 percentage). The net cultivable land of the district is 457505 hectares of which 192244 are under double cropping.[85]

As mentioned at the outset the size of land holdings in the district is very small. For example 18.76 per cent of the total holdings are below 1.0 hectare. Another 25.22 per cent are between to 1.0 to 2.0 hectares. About 31 per cent of the holdings vary between 2.0 to 3.0 hectares. There are about 25 per cent of the farmer whose holdings size is above 4 hectares.[86]

Foodgrains are the major crops in the district. This includes paddy, maize and wheat. Apart from food-grains, sugercane, jute and tobacco, oil seeds and potatoes are grown in some parts of the district. The total area under Kharif and Rabi crops in the district was 668378 hectares in 1975-76. Paddy the principal crop in the district

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[85] Statistical Handbook, Assam 1976, Op.cit., Gauhati.

[86] All India Report on Agricultural Census 1970-71, Government of India, Ministry of Agriculture and Irrigation, Department of Agriculture, New Delhi.

occupied 490521 hectares were under Ahu, 246258 hectares under Sali and 8087 hectares were devoted to Boro. Wheat occupied 15015 hectares in 1975-76.[87]

During the Rabi season, pulses like Masur, Kesari and peas occupied 27107 hectates in the year of 1975-76. While oil-seeds were cultivated in 34925 hectares. Rape-seed, mustard, sesaum, Castor and linseed are the major oil-seeds of the area. The next important cash crop cultivated in the district is jute which was grown in 26420 hectares of land. Mesta and Cotton occupied 3010 and 1560 hectares respectively. Area under sugercane was only 15798 hectares in the district.

The income estimates at constant prices indicate that agriculture contributed Rs.14.6 crores in 1950-51 and this went to Rs.16.8 crores in 1965-86. In 1975-76 agricultural income rose to Rs.21.63 crores. It contributed 66 per cent of the total district income in 1950-51, but the contribution went down to 48 per cent in 1975-76. However, the position differs when the situation examined in relation to current prices. At the current prices, agriculture excluding tea cultivation contributes more than half of the total district income. Income from agriculture grew at a very slow rate from 1954-55 to 1964-65

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[87] Statistical Hand book, Assam, Op.cit., 1976.

and 1974-75 in comparison to total district income. This indicates that there had been some diversification of the economy due to growth of manufacturing and processing industry and the primary activity agriculture was virtually stagnating.[88]

In respect of population dependent on agriculture in the district, data provided by the Census do not give the whole picture. The National Sample Survey conducted during 1972-73 shows that 85 per cent of the rural population in Kamrup was dependent on agriculture which comprises 72.52 per cent of the total work force. The census further reveals that still 90 per cent of people of Mandia, Rupshi, Gobardhana and Jalah Community Development Blocks are dependent on agriculture. The proportion of agriculturists were comparatively low in Hazó, Nalbari, Rangia, Rani and Barketri.[89]

Data Base

The present study is based on the statistics of two time series i.e. 1964-65 and 1974-75 representing the picture of the pre and post Green +Revolution periods.

The study is based on both the primary and the

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[88] Plan outlet for District Kamrup (Assam) (1976), Government of Assam, Gauhati.

[89] Ibid., p.39.

secondary data. The first few chapters are primarily based on the secondary sources. Information about the temperature and rainfall was also obtained from the Gauhati Meteorological Department and three observatories, i.e. Barpeta, Nalbari and Rangia. Soil map was collected from the Agricultural University Jorhat and other soil parameters were gathered from Soil Testing Laboratory of the Government of Assam. Drainage map was obtained from the Survey of India office Gauhati. Statistical information about institutional frame-work was obtained from Agro-Economic Research Centre Jorhat. For Chapter-IV and V dealing with land use and cropping structure, the main sources of data is the published and unpublished records of the Directorate of Economics and Statistics and the Directorate of Agriculture Government of Assam. The block-wise map was collected from three sub-divisions of Kamrup District, because still there is no block-wise district map available in Assam. Apart from these sources data was obtained from the District Census Hand Book, the reports and documents of National Sample Survey, the Lead bank report[90] and State, District and Block Development Plans.

In addition to these, the author conducted field survey in the area under review to obtain first hand

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[90]Lead banks are national banks assigned by the Reserve Bank of India to formulate various district level developmental Plan.

information and data about landuse pattern, size of land holdings, and agricultural practices. A field to field survey in the sample villages of Kamrup district was conducted in the form of structured questionnaires. The schedules were designed at the village and house hold levels. The basic information were recorded and plotten on the village maps. The village maps were obtained from various Sub-Deputy Collector office.

The field and spot collection of data by a direct interview with the village Mauzader and Farmer of the Kamrup District have been executed in the following fashion.

A format containing questions about the attitude of farmers towards innovations, their socio-economic back-ground, standard of living and stage of technology was prepared. In the selected sample villages, the author completed the household and village schedules by visiting the sample households. The village headman and other elderly farmer provided the required information about the village.

Plan of Work and Methodology

The study is divided into seven Chapters. The study planned and designed within an environmental cum socio-economic frame work begins with an assessment of the physiographic back ground of the region. In Chapter II a discussion has been made on the geographical background and the analysis of various complex problems. The agricultural operations being implicit phenomena within the agro-climate set up of the Kamrup district, various climatic and soil indices have been prepared for a better understanding of the area in terms of environmental conditions. In this chapter discussion has been made to emphasize the different aspects, which have a direct bearing on the agricultural land use. The basic logic of this chapter is how far the environmental factors are responsible for high intensity of land use in one region and low intensity in another region.

In Chapter III an attempt has been made on institutional frame work of agriculture, only to know how far institutional development has improved the land use pattern and yield rate in the region. Therefore the types of land tenancy and how it evolved has been analysed. This chapter also includes a section on land reform policy in Assam. The Chapter ends with a discussion on the size of land holdings and its distributional pattern. A lorenz curve has been prepared with the help of cumulative Frequency percentage.

Chapter IV deals the general land use pattern, the land use in Kharif and rabi season and ultimately it finds the changes in land utilization from 1964-65 to 1974-75 in Kamrup District. The general landuse pattern has been discussed with the help of percentage of block-wise data. Seperately land utilization under Kharif and rabi season also dealt. In order to ascertain the spatial patterns of rice concentration, which is the main field crop of the district, the Location Quotient method has been applied. The regional dominance of rice has been determined firstly, by comprising the sown area in proportion and secondly, by relating the crop density in each of the component areal units of the district as a whole. This chapter also deals with the changes of general and agricultural land use during the Green Revolution Period. It will be evident from the analysis how far cultivable area increased or fallow land decreased or how far the area under different crops have been changed. Secondly how far the cropping pattern - of the district has been influenced by the Green Revolution and where are the changes. To measure this changes simple growth rate has been calculated, and the inter-relationship of the general land use variables have been tested through bivariate correlation coefficients. The analysis of residuals have been suggestive of the adjustment of different land utilization.

In Chapter V an analysis has been made to find out the agricultural efficiency of the district. In the first part of this chapter a detailed investigation is made to the degree of efficiency with which the net area sown is utilised and its spatial and temporal variation. For the demarcation of cropping intensity in this study Pathak's technique has been adopted. Secondly the existing patterns of crop combination have been examined to identify the relative strength of different cereals and non-cereals crops.. For the delineation of crop combination Weaver's Standard Deviation method has been applied. And in the end part with the help of Kendall's compositive indices, levels of agricultural development of different community Development Blocks have been ascertained. The bivariate relationship have been found out between the variables of agricultural development. The variables include, total cultivable and net cultivable area per agricultural workers, double cropped area, net irrigated area, wage rate, consumption of fertilizer, per capita agricultural product, cash crop area.

The last two Chapters entirely based on field survey and it deals with the study of land holdings and land utilization in the selected villages of the region under study. The Chapter VI embodies the existing pattern of land holdings and the extent of inequality and concentration among the several groups defined by the land size classification in six sample villages of Kamrup District. For selecting the sample villages from different cluster, principal factor components determining the individual categories have been statistically tested to obtain ranks through Kendall's Rank Indices method. The degree and the extent of the inequality in the existing pattern of land ownership have been analysed with the help of Loreng Curve and the Gini concentration ratio. Furthermore a two way ANOVA model has been applied to the sub-classified data of total number of household and the total land owned separately for testing the significance of statistically differences in the inter and of intra-regional distribution pattern.

In the last Chapter (VII) an attempt has been made to highlight the general and agricultural land utilization of the surveyed villages first than it analysis the distribution of land utilization under different land holdings, to ascertain the use and misuse of land in different size of farmers and the size of inter village inequality in a particular land use pattern. And ultimately this analysis seeks the differences of land utilization within the three clustered or socio-economic set up.

Inference and conclusion have been drawn in the concluding chapter, what are the factors responsible for the spatio temporal variation in land utilization in Kamrup

District, the causes of non-adoption of cash crops and how socio-economic factors determining the agricultural practice in this valley. Some suggestions also have been made about the future land utilization.

CHAPTER - II

GEOGRAPHICAL BASE

Agriculture is not merely the growing of crops, it is more than that i.e. it is also a form of applied ecology. Crop land use is directly dependent on the immediate natural environment which can be changed only at heavy cost. Initially, agricultural systems are imposed by the physical condition till the later are modified. Assam as a whole and Kamrup district particularly reveals regional contrasts in agriculture attributes, which must largely because differences in environment. The diversities in relief, climate, soil and water resources within Kamrup must therefore be investigated at the out-set because they combinedly constitute a major factor in describing and interpreting the pattern of agricultural formations.

Physical factors affecting agriculture may be divided into Geology, physiography, climate pedology, and hydrology, although they are clearly interrelated. Climate is modified by altitude, and slope aspects, soils by evapo transpiration etc.. Thus the role of these factors in the areal agricultural complex is undeniable.

A long list of geographers analysing the influence of terrain upon agriculture is on record, although some present ones are much less inclined to record terrain throws powerful illumination on land use and on the growth and distribution of crops in areas where relief encompasses complex and diverse lithology.[1] Physiography exercises a direct influence on land use particularly through elevation, ruggedness, and slope whilst in lower ground it affects flooding. It also influences farming by modifying the climate and affecting the case of cultivation and in the degree of accessibility.

Geology

Structurally, the district of Kamrup forming a part of the vast alluvial plains of the Brahmaputra valley, is characterized by a monotony of alluvial deposits. It lies between the ancient rigid platform of the Peninsuler India in the south and the newly folded ranges of the mighty Himalayas in the north.

The Kamrup district's geological formation belong to Archean period, except the recent soil and alluvium (Fig.2). The oldest formations are the geneisses which are extensively intruded by granites. Both the granites and

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[1] Singh, J. (1971), An Agricultural Geography of Haryana, Kurukshetra, Vishal Publication, p.35.

genisses are intruded by veins of pegmatite and quartz.[2]

The Archeans fringing the southern border of the Kamrup mainly consists of biotite and biotite-horns blend gneisses with bands of granulites and bosses of intrusive granites, pegmatites, quartz-veins and minor quartzite. Archean gneisses have been broadly divided into two types, oldest gneisses and younger gneisses. Fine to medium grained more or less Schistose type biotite gneisses is found occassionally as patches, bands and lenticuler bodies in younger gneisses particularly at places in Chunsali, Nabagarha hills near Barkumar village. Thin bands of horn blend and horn blend biotite and gneisses occur within granite near Ambari and Maliata hill south of Palasbari, concordant bans of pyroxane - Horneblend gneisses occuring north of Barduar Forest and south of Malikhar bill. Granitecid gneisses are found in Malitia hill, Dakhalla hill, in the ridges east of Digarm river near Sonapur. This graniteoid gneisses are rich in magnetite crystals in the south west of Barigeon in Maliata hill south of Palasbari. Porophyritu granite are found in order gneisses occurs extensively in the Kamakhya hills in Jalukbari ridge, in the hills the west of Barabhat and in the scattered hillocks along the north bank of Brahmaputra. Prophyritie granite

[2]Geology and Mineral Resources of the States of India, Part IV, Miscellaneous Publication No.30, Geological Survey of India, December, 1974.

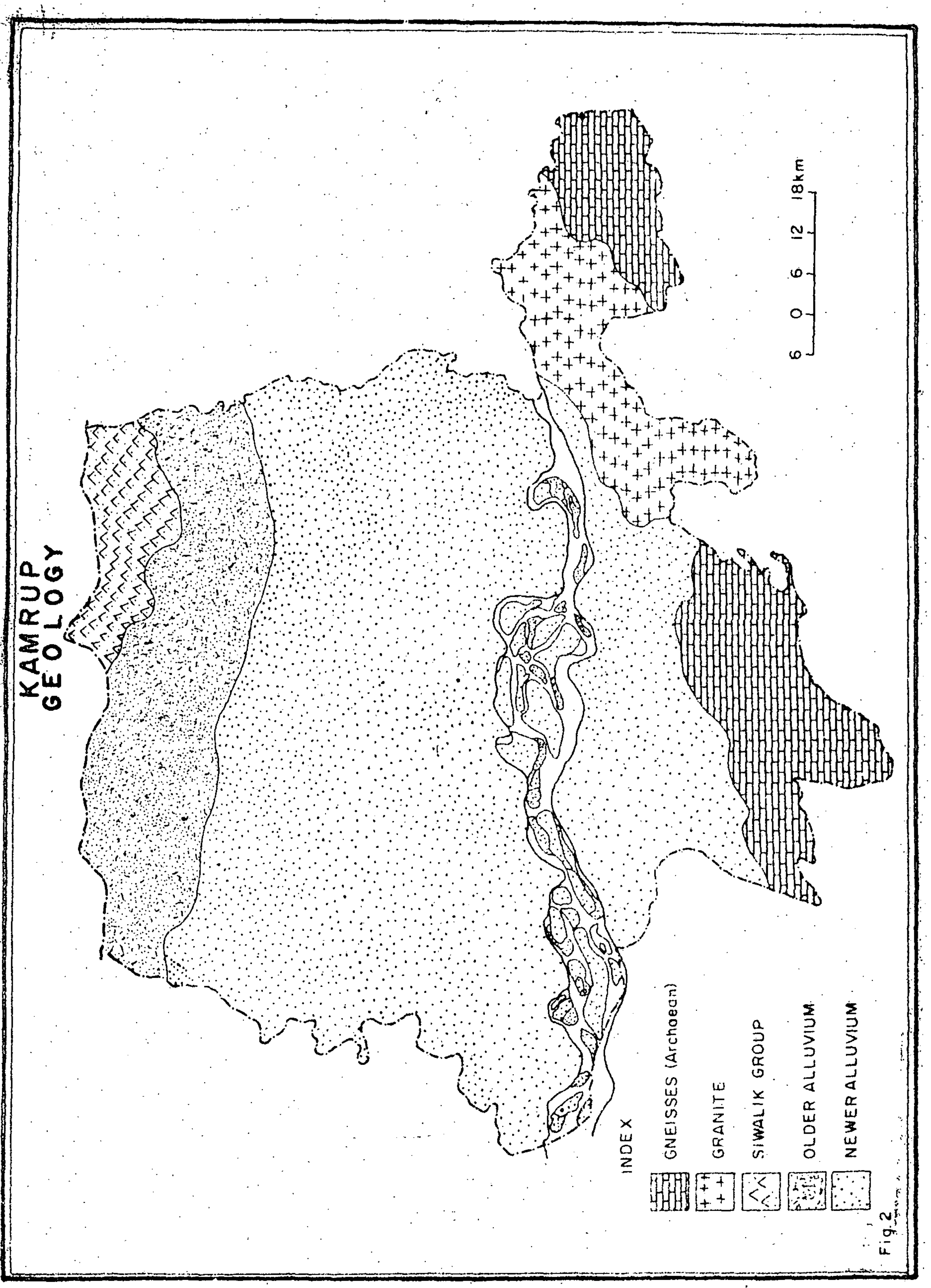
KAMRUP
GEOLOGY
6 0 6 12 18km
INDEX
GNEISSES (Archaean)
GRANITE
SIWALIK GROUP
OLDER ALLUVIUM
NEWER ALLUVIUM

Fig.2

occurs paralled to the foliation of the country rocks, cross cutting relation of these with the older-gneisses is seen in the road cutting to the south of Kamakhya hill, south-west of Jalukbari and some other places.

A thin strip of upper tertiary sand-stone (Siwalik group) associated with day alternation occurs all along the Bhutan foot hills, and found in the northern part of the district. The sand-stones are light gray buff and whitish gray, medium grained, compact generally soft and massive, micaceous and at places well ladded. These sand stones comprises a bottem horizon of clay grading gradually upwardly into Siltstones, Fine grained sand stones, medium grained micaceous pepper and salt type sand stones and finally pebble sand stones at the top.

Older alluvium or terrace deposited during the final phases of the Himalayan orogency or at the end of pliostocine period, consists of redish to Brownish sandy, alluvium with coarse parties of improve sand, unsorted pebbles. Newer alluvium consists of sands, silts and clays covering the major part of Kamrup district along the Brahmaputra valley. The formation shows much variations from place to place and is approximately 200 - 300 m in thick.

Relief

Kamrup is divided into two parts by the great river Brahmaputra, which bisects throughout its entire length. Speaking generally, the district forms a great plain with a few elevated tracts lying along the foot of the Khasi hills, which form respectively its northern and southern boundaries. In the north of the district the ground undulates considerably as it approaches the hills, so that the edge of the plain is not easily defined.

The Kamrup plain built mostly by the aggradational work of the Brahmaputra and its tributaries is almost flat with very little slope from its north-east corner to the west. The general level of the valley ranges from 115 m in the east to 30 km. west with a fall about 12 cm per km. Physically the valley is demarcated from its surrounding ranges by the 150 m contour. The plain is built by the deposition of alluvium 1500 m thick upon a sag formed during the period of the rise of the Himalayas. The valley is fairly wide, with an average width of 70 - 80 km. throughout Kamrup. Another interesting geomorphological feature of the valley is the pressure of a good number of isolated hillocks or monadrocks on both the banks of the river.

Though the valley is mainly of depositional origin, some of its areas adjoining the hills and plateaus particularly in the south, owe their origin to the head-ward erosion of its tributaries such as the Dhansiri and the Kapli which have elongated their courses on the east and west of Mikir and Rengma hills.

There is marked difference between the physiography of the north and south banks of the river.[3] In the north the innumerable tributaries running down from the Bhutan Himalayas debouch abruptly to the main valley and form a series of alluvial fans, which joins and obstruct the courses of the tributaries branchout in different channels till they form permanent courses further down streams in almost a southerly direction. But before finding their way into the Brahmaputra they almost run in a parallel course to the main stream as they encounter its levees. Consequently the tributaries have conspicuous meanduring courses leading to the formation of oxbow lakes and huge marshy tracts.

The southern part of the valley is less wide and uneven and the tributaries in the southeast are considerably larger. In the western part of the valley is very narrow with small tributaries which run in less meandering courses. But meandering in the eastern part of the southern section of the valley is conspicuous and there are good numbers

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[3]Assam, Physiographic Map (1972), Survey of India.

of bills and oxbow lakes.

Physically Kamrup falls into 3 sub-regions which provide a suitable framework upon which a systematic outline of the landform environment may be founded for use the analysis of land use pattern and crop structure.

(a) Bhutan Foothills to the North :

It's slim fringe between Bhutan Himalayas and Brahmaputra plain. Kamrup district is bounded on the north by the sharply rising and straight Bhutan Himalayas forming a narrow belt, which is semi Tarai nature covered with dense forest.[4] The hilly and piedmont area is cut by seasonal streams giving it an appearance of extreme un-evenness and creating difficulties in the implementation of agricultural development plans.

(b) Alluvial Plains of the Brahmaputra :

The greater part of Kamrup consists of a wide plain of alluvial soil, though the lower portion of which the Brahmaputra makes its way following a steady course from east to west. On the whole the plain imperceptabily slopes from north east to south and south-west. The average height ranges from 100-200 m above sea level. The river Brahmaputra divided the alluvial plains into two parts. In the northern parts alluvial plains are much more dissected that the southern bank by the tributaries of Brahmaputra. Though the plain is remarkably flat, they are marked alluvial uplands

[4]See Physiographic map.

in a number of localities. The old alluvium lying in northern and southern region of the alluvium plain and between these two old alluvial tracts around Brahmaputra recent alluvium are deposited. The tract comprising the old alluvial and the new alluvium plains, plays very vital role in districts economy.

(c) Scattered Hillocks in the South :

Geographical areas lying to the south bank of river Brahmaputra is much broken up by residual hills. These hills of the Kamrup district consists of a section of Assam range covered with dense forests and bamboo jungles. Most of the hills are of 215 to 246 meter high and their sides are stiff and rocky, several hills are having tea plantation at many steep slopes. These isolated hills are also important place for Hindu mythology.

Climate

No single element of environment is so uncertain and so difficult to fix as a climate variability, however is the key-note. It is the factor that imparts the quality of uncertainity of this aspect of natural environment.[5]

Climate represents the meteorological conditions within a nuclear area that expands and counteracts regularly. These zones of fluctuating climatic limites are

[5]Jha, B.N. (1979), Problems of Land Utilization, A Case Study of Kosi Region, New Delhi, p.40.

the greatest practical importance. They are immediately reflected on the pattern of land use, extension and characterization of the crops. The District Kamrup is one of such fluctuating climatic limits, because the region may well conceived as a transition zone between relatively dry and wet climates to the east and west of it.

In a region like Kamrup, where more than 80 per cent of the population is directly dependent upon soil for their livelihood, climatic control, specially the amount of rainfall distribution and vicissitudes of rainfall are the most important determinents of the economy.

The general climate of Kamrup District is predominantly monsoonic, having a fairly long period of monsoon rains, i.e. from June to October. This period is associated with cloudy weather, high humidity, and rise in temperature. The district climate has a rhythemic change in wind direction, and is influenced by the following factors.

i) The orography,

ii) The alternative pressure cells of North-east India and the Bay of Bengal,

iii) The predominance of maritime tropical airmass,

iv) The local mountain and valley winds,

v) The periodic western disturbences.

The high and lofty mountains in the north create barriers in the path of the cold airmass blowing from

Tibetan plateau to the valley. Moreover the Himalayan ranges provided suitable conditions for the occurance of orographic rainfall. These mountains also check warm moist south-west monsoon airmass. The east ward moving upper air trough called the western disturbances and the local phenomena such as mountain and valley winds have considerable impact on the climate and weather of the valley. The mountain and valley winds start moderating the temperature condition so that heat waves in the valley are experienced in summer. Fogs, thunder storms and dust raising winds also come under the local weather conditions. Winter mornings are very foggy in the valley and prolongs in the southern part. Fog persists from 90 to 100 days.[6] The existance of fogs is due to the availability of moisture evaporated from river beds and from marshy and swampy areas of the valley.

In the Kamrup District, climatically a year is divided into four seasons:

1. Cold weather season - December to February.
2. Hot weather season - March to middle June.
3. Season of general rains - Middle June to September.
4. Season of retreating monsoon - October and November.

There is a general corresponding between the cropping

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[6] Singh, R.L. (1971), India, A Regional Geography : National Geographical Society of India, Varanasi, p.331.

seasons and these climatic divisions of the year. Thus the season of general rains corresponds to the Sali crop while the winter paddy crop or Ahu corresponds with two seasons i.e. seasons of general rains and that of retreating monsoon. The hot weather season corresponds with the Kharif crops while the rabi crops corresponds together with the season of retreating monsoon and cold weather season.

Cold weather Season

From the beginning of November, temperature begins to fall rapidly in the region so that by December cold weather season fully sets in. January is the coldest month having an average temperature recorded 14°C. The main charecteristic features of this season are cool weather, frequent morning fog and dry winds.

During this part of the year the whole region is under the influence of the high pressure which is developed by in the North West plains of the Punjab and a feeble low pressure over the Bay of Bengal. The isobars extend approximately from west to east over the region but the winds are generally westerly due to the configuration of the Brahmaputra valley. Winds are feeble and blow towards the low.

The Kamrup district receives practically little rain during the season is even less than 10 cm. This meagre rainfall may be attributed to the western disturbances, which invade India in the north-west.

Hot Weather Season

This is a period of continuance and rapid rise of temperature and decrease of barometric pressure in India.[7] The hot weather season commences in March and continues upto the middle of June. The rapid increase in temperature since early March reaches to maximum in the month of May. May is the characteristic hot weather month. Temperature records at Gauhati, Nalbari and Barpeta are approximately the same i.e. 23°C. The total average rainfall during the season is recorded as 51.87 cm. As a whole this season is characterised by relatively low humidity and clear skies.

Season of General Rains

The season of general rains is commonly known as the period of Monsoon. The season normally commences in this region about the middle of June and continues upto the end of September. The low pressure trough created in the valley drawn in the monsoon currents. The seasonal characteristics include high humidity, weak surface winds,

[7] Singh, R.L. (1971), Op.cit., p.332.

cloudy sky and very sultry weather, due to high humidity. The mean temperature during the season increases to 27.77°C with a duinal range over 6°C. The hottest month of the year is August fall in this season and recording 30°C to 36°C of temperature. Rainfall in this season is appreciably high, ranging from 250 mm to 400 mm in each month of the season. The number of rainy days is 18 and 20 in July and August respectively and 14 days in September. Rain start in mid-June and attain their maximum in August, accounting for the highest discharge of the Brahmaputra during these months. As a result of such a large amount of rain within a short period, floods and water logging is a most common feature.

Humidity throughout the season remain very high due to the presence of sufficient moisture in the air contribution by the rain.

Season of Retreating Monsoon

This is the period when the monsoon rains are just over. In September, rains gradually slacken and as such the interval between the showers are also prolonged. This decrease in cloudiness helps increase in isolation. But quick radiation after sun-set causes cooler nights and large amount of dew formation due to abundant supply of surface moisture provided by the rains. The durinal range of temperature starts increasing and varies from 28°C to 5.6°C. Winds in this season blow from the north. The average rainfall in this season is about 150 mm with rainy days varying between 7 to 9 in October and 1 to 3 days in November.

There is a little drop in the relative humidity during the autumn months but even this lessend relative humidity combined with an almost motionless air turn these months into very oppressive period.

Summing up the whole climatic phenomena in the Kamrup District in general it could be concluded that their prevails a homogenous climate, and more monsoonic in character, than any other type.

Since the present study is based on agricultural land use and pattern of agricultural land use is largely product of climate, an analysis of the spatial distribution of rainfall seems to be imperative.

Rainfall Intensity

From the agricultural point of view in a region like Kamrup District where agriculture is mainly rain fed, it is the timely distribution of rainfall which is more important and not the seasonal average. In fact, heavy rainfall is one week followed by long intervals of dry weather may affect the crops adversely.

The precipitation and number of rainy days may be sufficient to meet the requirements of different crop production in general, but successful harvest and optimum land use is noticed only when the rainfall is timely and well distributed.

So it would be worthwhile if the intensity of rainfall is analysed for the five available rainfall recording stations, which explains the intension of rain per 24 hour period. The intensity of rainfall is calculated with the help of the following formula:

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

Table-II.1 shows the stationwise monthly intensity of rainfall.

It will be seen from table-II.1 that in Gauhati, August and November have the highest and lowest intensity of rainfall being 23.59 and 7.65 per rainy day respectively. But in Nalbari the highest intensity was observed in the month of April. Barpeta experiences high intensity of rain in June and low in January. Rangia shows the maximum intensity of rainfall in the month of July, which is 20.80 mm per rainy day and minimum 9.89 in the month of February. Boko lying in the lowest part of the valley has

TABLE - II.1

Intensity of Rainfall (1931-80)

Stations	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Gauhati	9.5	11.0	13.0	14.99	17.98	21.23	21.23	23.59	21.0	19.0	7.67	10.5	15.89
Nalbari	9.9	10.0	14.0	14.89	18.06	29.97	24.0	22.9	20.07	19.03	8.03	9.95	15.80
Barpeta	12.0	12.5	16.18	16.97	24.46	32.21	28.18	21.56	27.80	25.02	16.88	12.39	20.51
Rangia	10.0	9.89	12.0	14.44	18.57	17.39	20.80	21.0	19.76	19.0	13.0	9.7	15.46
Boko	11.5	11.5	10.0	12.05	18.95	18.95	21.0	22.0	18.0	18.0	12.5	8.5	15.25

Source: Calculated from Meteorological data.

the maximum intensity of rain in August and lowest in December. So the highest rainfall intensity throughout the valley from east to west observed in the months of June, July, August, for the station such as Barpeta, Gauhati, Nalbari, Rangia and Boko.

Rain Factors

Another Meteorological quantification has been done with the help of the formula rain factor, which is an index to express a relationship between precipitation and temperature to have an idea about the climatic aridity of the valley. On the other hand it also helps in delineating the climatic region. Since the number of stations are a few, a general discussion over this index could be given. The index has been calculated as,

$$\text{Rain factor} = \frac{\text{Annual precipitation}}{\text{Mean annual temperature in } ^{\circ}C}$$

The following Table-II.2 presents the station-wise rain-factor indices.

TABLE - II.2

Stations	Y E A R					Average
	1973	1974	1975	1976	1977	
Gauhati	65.52	82.61	62.19	67.33	106.06	76.74
Nalbari	58.88	90.02	61.71	82.0	91.15	76.00
Barpeta	90.5	80.22	59.67	90.46	135.48	91.27
Rangia	24.2	44.44	71.80	71.80	51.39	52.57
Dimoria	19.13	47.26	78.93	80.03	108.08	66.74

Source: Calculated from the Meteorological data.

As evident from the Table-II.2 the 5 years average rain-factor from 1973-77, varies between 52.56 to as high as 91.27 for Rangia and Barpeta respectively. The second and third highest indices are that of the Gauhati and Nalbari stations. Such low index which shows relatively arid in Rangia may be attributed to high temperature ranges and low rainfall. Moreover Dimoria is also having comparatively lower index i.e. 66.74 and is situated on in the south east of the Kamrup District, which is otherwise interpreted as the rain shadow area having rainfall comparatively lower. Hence crop risk in the area is considerable. In order to raise successful crop irrigation felt essential in this part of the district.

In the central part of the district have fairly high indices which show low aridity. So water surplus in these areas are much prominent than deficit. On the other hand these areas experiencing high amount of rainfall with low mean daily temperature range. A rational management of water resources in the part of the valley will help in raising the producitivity of paddy and other cereal and non-cereal crops.

Drainage

The Brahmaputra and its hundreds of tributaries play a vital role in the drainage system of the region.

The prospect and development of agriculture in the valley largely depends on the optimum utilization of water potentials of the Brahmaputra.

The mighty Brahmaputra owes the origin to Kailash range at an altitude of about 5150 metres. The upper course of the river lies in Tibet where it is called Tsangpo. While following through the Siang divisions of Arunachal Pradesh it is known as Dihang. Near Sadiya it joins with Dilang from North and Lohit from east and from this point the water of these rivers makes the Brahmaputra. The river flows between sandy banks and it has got numerous divergent channels which afterward rejoin the mainstream. It carries heavy silt and sometimes with little barrier. It creates almond shape banks, which may be washed away or lift out to form big char. Most of the places in the valley are endangered by the erosional activity of Brahmaputra during floods. Dibrugarh being situated on the sandy banks of the river is susceptible to erosion, every year during floods. But Tezpur, Gauhati, Goalpara, and Dhubri are less prone to erosion because they are situated on the outcrop of hard and resistant rocks.

The district Kamrup is intersected by numerous rivers and streams, all of which issue from or flow into the Brahmaputra. The principal tributaries of the

Brahmaputra on the north bank are as follows :-

1) The Manas, which takes its rise in the Bhutan hills and runs nearly north and south along the western boundary of the district. Manas, after receiving several small tributaries, falls into the Brahmaputra, opposite the town of Goalpara.

2) The Chaul Khoya flows east and west, and receives the drainage of most of the minor stream in the north of the district. It is fed by Pagla Manas, the Sari Manas, which falls into it about a mile about Barpeta, the Phaumara a very widening river in this region. The main channel of the Chaulkhoya, however, empites itself into the Manas, a little above the point where that river falls into Brahmaputra.

The only other rivers in the north of the district worth notice are Puthmari, Baralia both of which take their rise in Bhutan hills and after flowing a southerly course empty themselves into the main stream of the Brahmaputra.

In the southern bank of the Brahmaputra the principal stream are Boko, Kulshi, Bharasla, Digapur, Singra, the waters of all of which pour into the Brahmaputra. Besides them however there are numerous minor streams of which the following are the most important, Sajang, Tangamari, Takinadi, Tekelznadi, Agrannadi, Simbu Nadi etc.. Many of the smaller streams dry up during the hot weather season.

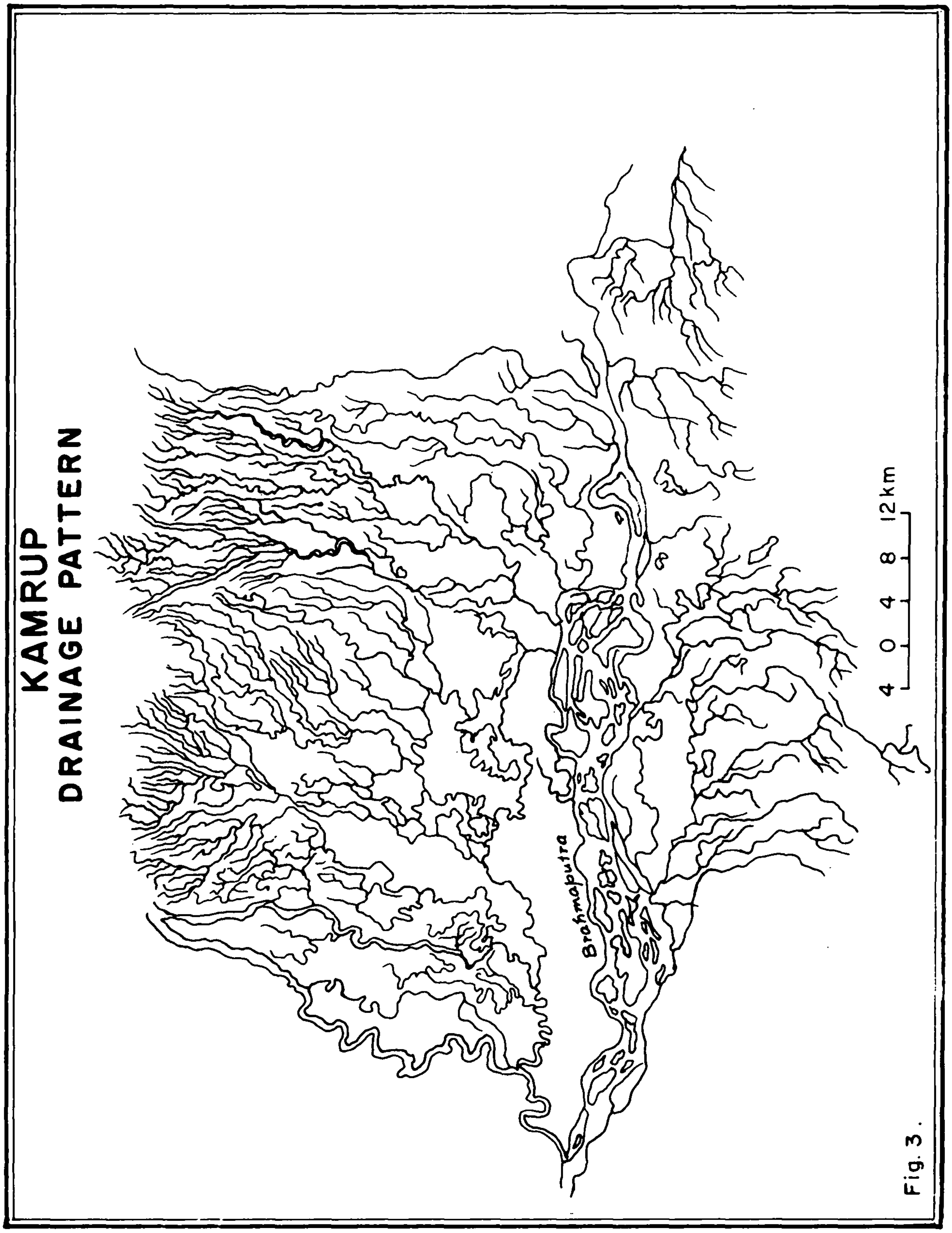

Fig. 3.

The rivers Brahmaputra and Kulsi change their course, frequently, throwing up immense sand banks, which remain for several years, but are in time cut away by the current and deposited at new places. These accretions are very extensive especially in the channel of the great river, and rapidity with which beds of sand newly washed down by the current during floods become converted into rich pastures, is astonishing. The beds of the rivers are rocky or sandy, and their banks are generally steep.

South bank tributeries are seasonal torrents and have less meandering course than the north bank (Fig.3). A few of these tributaries are however, navigable through out the year. In the valley during the rainy season floods are frequent which result into heavy damage of life and property.

This is because of the tremendous volume of water and heavy silt discharged by the river which shallows the bed of the river. Moreover heavy rain water is supplemented by the melting of snow in the Himalayas. The river gets chocked up, and active erosion starts on the bank thereby, filling the river beds which loose the water holding capacity. This sort of condition make the river swell, thus resulting innundation. Since the river valley lies in the seismic zone earthquakes are frequent which enable the river in shifting its course. Heavy discharge of water by the Brahmaputra thus affects its tributaries in their water profile. Hence floods have become a common feature. These floods cause damage to life, property and crops.

Soil

Soil parameters play a vital role in land utilization. A poor quality land always discourage farmers for reclamation of the land. In the case of Kamrup it was observed that net area sown increased much more in northern part of Brahmaputra than its southern eastern part mainly because soils in the southern parts are lateritic.

Soil is the ultimate asset of Kamrup District, the soils therefore must be used in such a way that they are kept in good health. No scientific soil survey has yet been taken up in this region though a Regional Soil Survey Division operating. Therefore the only sources were the casual observation made in District Gazetteer and settlements Reports. Data and literature on soil parameters, such as soil nutrient, soil texture and soil P_H values have been procured from the analysis records of the Soil Testing Laboratory, Government of Assam.

Soil Zones

It is evident from the history of the origin of the soils of the Brahmaputra Valley apart from the two slim northern and southern margin, that the whole region is covered with alluvium soil. While more than 30 per cent of the area under study has been very recently covered with huge deposits of sands and silt to a great depth by the Brahmaputra thus obscuring the original surface which lies at present at varying depths in different portions, depending upon the rate of deposition. Some portions still retains their original surface features and soils owing to their higher location in comparison to the adjoining areas or due to greater resistance or some other physical checks so that these areas were not subjected to the devastating floods and vigorous depositional activity of the Brahmaputra.

Soils of Kamrup can be classified into the following major categories among which the first three cover the entire valley and the last one is found only in the southern part of the district adjacent to Meghalaya plateau. The area distribution of soil is as follows :-

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

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

The old alluvium soils are found at relatively elevated tracts which are free from floods. These soils are more acidic in nature. The P_H values being less than of the greater parts of the valley are covered by the alluvium soils. These soils lack in available phosphate with low or medium potash content and texturally vary from sandy to clayey loam with high to low content of nitrogen. These soils are favourable for rice, sugercane, fruits but not conducive for the cultivation of pulses and mustard.

Laterite soils are found in limited areas in the valley. These are considerably leached poorly contained with plant nutritions thus agriculturally less useful. On the other hand forest and hill soils are available in the northern part of the district having higher ingradients of nitrogen, phosphorous and pottasium content.[9]

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[8] Soil Testing Report, No.2, Jorhat, p.21.
[9] Ibid., p.23.

Considering soil as one of the major agro-climatic factors for the growth and extension of agriculture, a thorough and detailed discussions on this parameter has been devoted for the district as a whole. Community Development Block has been taken as the unit area of study.

Genetic Background

The Kamrup district as we know it is part of a vast tract of alluvium built by sediments brought from the Himalayas by the Brahmaputra and its innumerable tributaries. Though a great diversity of soil types is unexpected in the region, but in the northern part on the Himalayan foothill and the extreme south adjacent to Meghalaya plateau two different types of soils are being observed.

Vast areas of the region are subjected to alluvial and deluvial actions which lead to the wear and tear of some areas while in others there have been huge amount of deposition of sand and silt. Large tracts experience swampy conditions due to heavy amount of rainfall and annual inundations. The dry period of desiccation on the other hand characterised by the blazing Sun and set up process of arid climate in the soil thus leading to the accumulations of noxious salts in the sub-soil in some limited areas.

A micro-level study (Community Development Block) in this region shows a significant vibration in the quality of the soil. For that a soil nutrient composite indices has been a prepared on the basis of the indivual soil nutrient index such as nitrogen, phosphorous and potassium by giving the different weightage as per their importance for the crop growth. The weightage used here for Nitrogen, phosphorous, Potassium are 1.5, 1, 1 respectively.

The soil fertility status of various Community Development Blocks, in terms of organic carbone, available phosphorous and potassium content reveals that the nutrient index for organic carbone varies from 1.7 to 2.95 in block Mandia and Bagli respectively. Out of 15 samples blocks under investigation only 6 blocks fall under higher nitrogen content group and the rest 9 come under medium category. Switching over to available potassium (K 20) content in the soils, it is noticed that only one block has higher proportion of potassium available in the soil. As per the laboratory analysis of the soil samples, the soils of 7 blocks show a medium level of potassium nutrient index and as many as 7 blocks are poorly contained with potassium, which is an essential inherent element of the soil for any kind of plant nutrition in its vegetation and growth period.

The overall nutrient index taking organic

KAMRUP
COMPOSITE NUTRIENT INDEX NPK

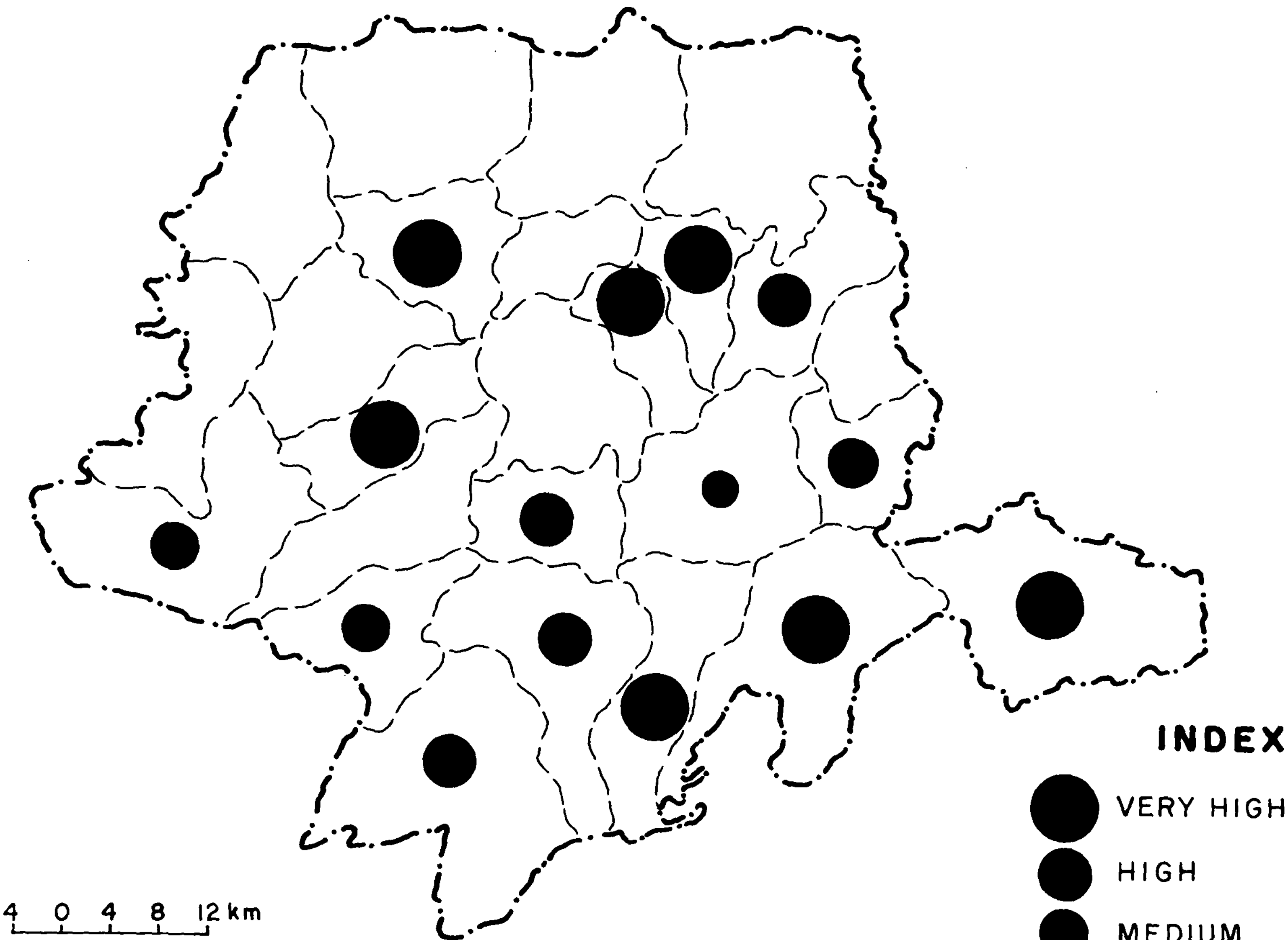

Fig. 4.

carbone (N), phosphorous (P_2O5) and potassium together, reveals that the spatial variation of the indices is not that significant. After having found out the composite indices varies between as low as 5.86 to as high as 7.64 in the blocks of Hazo and Borigog respectively. A vivid picture emerges out the following Frequency Table-II.3 concerning the fertility status of the 15 blocks.

TABLE-II.3

Class groups	Frequency	Cumulative Frequency	Categories
Less 6.0	1	1	Low
6.0 - 6.5	3	4	Medium
6.5 - 7.0	4	9	High
7.0 and above	7	15	Very High

Source: Calculated from the Soil Testing Laboratory data.

Having a look at the Frequency Table-II.3 prepared for the overall soil nutrient index it is observed that only one block comes under the very low category soil so far as the nitrogen, phosphorous and potassium ingradients are concerned. The block is Hazo of the Gauhati sub-division. This block has a strain topography leached by the fluvial action of the numerous tributaries of the Brahmaputra.

Coming over to the medium fertility group of the soil, it is observed that 3 block are falling under this category. The blocks are Chamarla, Kamalpur and Mandia. So far as the high nutrient index group is concerned 4 blocks are falling in this group, the block being, Borketi, Rangia, Chayegaon, Boko, of which Rangia has the lowest index i.e. 6.70 and Boko has the highest index 6.91.

Switching over to the last class group of nutrient index within which the soils of as many as 7 blocks having very high nutrient and fertility fall. The blocks are Rani, Barpeta, Demoria, Pub-Nalbari, Rampur, Bagli and Borigog, out of these Rani and Borigog are having indices 7.03 and 7.64 respectively as the lowest and highest.

Soil Texture

Soil texture is of prime importance of different crops. From the information collected regarding the quality of soil in terms of its texture it is noticed in each and every block in Kamrup, that the texture of a substantial percentage of samples collected by the soil survey unit, Government of Assam, is of medium category. However, the percentage of sample in this category invariably exceeds 90 per cent for all the blocks. And the percentage of light or heavy soils is very magnificient if not, sometimes nil also.

TABLE - II.4

Texture	Gradation
Sandy, Sandy loam	Light
Loam, Loamy sandy	Medium
Clay	Heavy

But there are few blocks which need special mention such as Dimoria, Chamaria, Hazo, Rampur, Rani, Chayagaon and Chenga where the soils are predominantly loamy and loamy sandy in nature for which the percentage exceeds 99 per cent. In case of Rampur, Dimoria and Rani as per the soil analysis data, hundred per cent of the sample falls in the medium category of the textural classification. On the other hand there is hardly any variation of soil texture of these particular blocks.

Loam and sandy loam are also found in the northern part of Brahmaputra river in Kamrup district. Tihu Badman, Bagli, Bhavanipur, Gobardhana, where percentage varries 52 as the lowest and 88 as the highest percentage.

Clayey or clay silt soils are found in Rangia and Tamalpur. The percentage vary between 35 to 45 respectively. Light textured soil only found in the western most tip of the Kamrup district in Mandia and Rupshi block adjacent to Goalpara District.

Hence from the above analysis of soil texture of different blocks, it is very distinct that the texture keeps on changing in a west to east direction of the Kamrup district. The soil being clay in the west and sandy loam to sandy in the east.

CHAPTER - III

INSTITUTIONAL FRAME WORK OF AGRICULTURE IN KAMRUP

Land Tenancy

A rotation and pragmatic land tenancy and size of holdings contributes to agricultural development by increasing the desirability of improvement in social and economic status, by increasing the technical feasibility of activities with the creation of an environment for enterpreneurial actions and by making it economically and financially possible to undertake sound operation and management decisions. More specifically it contributes to agrdcultural development by generating a sustained increase in farm productivity, saving and investment on farms. Furthermore, a reformed land tenancy contributes to development by increasing the feasibility of realising the advantages embodied in new farming techniques and methods of farm organisation and management by modifying the terms of tenure farm structure and resources availability.

Evolution of Land Tenures

The present land tenancy in Assam is a legacy of the colonial system of the British rulers. The traditional occupance and land tenancy of land was significantly transformed after the annexation of the province by the British in 1826.

Before the annexation of Assam by the British, the greater part of the Brahmaputra valley was under Ahom rule.[1] The Ahom rulers who had entered Assam as conquerors, wanted to establish their right not over a portion of the produce as revenue, but also on the soil and the subjects. Though in theory the rulers were owners of the soil in practice they remained satisfied with poll tax or plough tax. Their needs were few because the subjects not only supplied them all the commodities they required but also rendered personal service. The land as it was cultivated by the first settlers was considered joint property of the group or khel who occupied it. In special cases land was settled either free of revenue or at a very low rate of revenue. The Paiks[2] were alloted revenue free bari[3] and rupti[4] lands for their personal service to the rulers cultivable land was settled with the agriculturists at a very low rate of revenue. The Ahom Kings after adoption of Hinduism, began to patronise the nobles, priests and other officers of the

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[1]The Ahoms originally belonged to the Thaichan Shan State of Burma, entered Assam in the third decade of the thirteen century.

[2]Paik - Males available for service.

[3]Land for house and garden.

[4]Paddy land.

court by making free gifts of land. The lands granted to the temples and religious and charitable institutions were revenue free estates. In course of time the owners called themselves Lakhirajdars, the term denoting a class exempted from payment of revenue.

The land tenures evolved in the early British period might be said to be more by products of various kinds of settlements made from time to time for the purpose of revenue collection from land. The British administrators at first introduced poll tax in place of personal services to the ruler. Each district was divided into several blocks called Mouja. A local influential man was appointed as Maujadar in each mouza and was entrusted with the work of collecting the poll tax was abolished and regular land revenue was introduced. Assessment was made on the basis of the category of land viz. basti (homestead land) rupti (paddy land) and faringati (high land growing inferior crops).

It is important to note that in Assam, with the exception of the permanently settled areas of Sylhet[5] (Srihatta) and Goalpara districts, the successive conquests of districts or portions of districts had been held to have extinguished all private rights in land previously

[5] At present Bangladesh.

existing, unless expressively recognised by the British Government either by standing executive orders or legal enactment. Of course due consideration was made in settlement of lands which were enjoying special privileges under the Ahom rulers.

In the nineteenth century there was abundant supply of fertile land in the Brahmaputra valley and the cultivators preferred annual leases to periodic leases. In order to encourage cultivators to take periodic leases the government declared in 1870 that the right of the periodic leases holders would be heritable and transferable. In 1883 a system of 10 years settlement was introduced in the temporarily settled districts. The Assam land and revenue regulation, 1886 conferred a permanent, heritable a and transferable right to persons holding land under decennial leases. The holders of annual leases were not given any such right. Till this time, in the temporarily settled districts settlements is either periodic or annual. Thus raiyatwari[6] has been introduced in greater part of Assam.

Land Tenure System

In Assam before the abolition of the Zamindaris,

[6]Under raiyatwari system land is settled direct with the actual occupant without the intervention of any middleman, landlord or settlement holder. Revenue is fixed on individual pieces of land and the actual occupant becomes liable for its payment. Revenue is revisable under this system.

there were two major land tenure systems, the Zamindari and raiyatwari tenures and between these two a series of other tenures existed with varying nature of relationship between them and the government from the point of view of revenue demand. The important features which distinguish the major owe their origin primarily to the differences in the character of the settlement of land revenue made in the course of the eighteenth and nineteenth centuries. The fact that the revenue was fixed in perpetuity under the zamindari system and is revisable under raiyatwari system is a well known distinguishing features. The other important difference between the Zamindari and raiyatwari system lies in the unit which was adopted for the purpose of settlement under the former, the 'estate' was the unit and the holder of unit (commonly called proprietor), not the actual occupants became liable for its payment. The special tenures viz. Lakhiraj, nisf-khiraj. Fee Simple etc. occupy only a small portion of the total land area of the state and they do not fundamentally differ from the two major system of tenure.

The Assam land and Regulation Act 1886 defined the rights of the different classes of owners of land have been divided into classes viz.,

i) Proprietors, including the owners of revenue free estate;

ii) Land holders, including the settlement holders[7] of land held direct from government under leases for period exceeding ten years. continuouely before the Regulation came into force,

iii)Settlement holders other than land-holders including persons holdimg land direct from government under annual leases, or leases the term of which is less than ten years.

The following are the main type of estates or interests in land:

i) The Lakhiraj estates - Lakhiraj estates are lands which were granted revenue free for religious and charitable purposes by the previous rulers of the country before annexation by the British and were confirmed by the special Commissioner appointed under Bengal Regulation II of 1828 to enquire into the valddity of such grants. The estate of the Lakhirajdar is the highest estate in land that exists in Assam. The estate of Lakhirajdar is heritable and transferable, provided the Lakhirajdar is the legal owner.

ii)The estates held in fee Simple - The waste land Grant Rules were framed to encourage investors to take up land for the cultivation of tea, in the areas which were unsuitable for the cultivation of staple crops like rice. In order to encourage the cleaning of jungles and the use of these lands for the cultivation of tea, waste Land Grant Rules were first framed in

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[7]Settlement holder means any person, other than a proprietor, who has entered into an engagements with the Government to pay land revenue, and includes a land holder.

1838, under which grants were to be made of areas of not less than 100 acres and not more 1000 acres, of which one fourth was to be held in revenue free. These rules were modified from time to time till 1861 when they were superseded by rules for grant in Fee Simple which allowed holders of the lease-hold grants under the prior rules to redeem their revenue payments at 20 years. These fee simple estates enjoy the same rights and the privileges as the Lakhiraj estates.

iii) Permanently Settled Estates - Permanently settled means any estates in the districts of Cachar, Garo Hills and Goalpara included in the decennial settlement of the lower provinces of Bengal or permanently settled or treated as such at any time. The right of the owner of a permanently settled estates is inferior to that of the Lakhirajdar since he is a liable to Government for the payment of a fixed amount of revenue, on failure to pay which his estate may be put up for sale for relalisation of arrears of revenue. The owners property in a permanently settled estate is heritable and transferable. It is important to note that the owner of a permanently-settled estate has the right of mining and fishing.

iv) Acknowledge Estates - Acknowledge estates means estates in Bijni and Sidli Duars acknowledged by the state to be in possession of, and settled with the Rajas of Bijni and Sidli on a periodic basis.

v) Temporarity Settled Estates - The owners of all temporarily settled estates for terms of not less 10 years are, under Land and Revenue Regulation, styled land holders. The land holders have a permanent, heritable and transferable right in their lands, but their right is inferior to that of the owner of a permanently settled estates.

Classes of Tenants and their Rights

The status of the tenants and their rights were defined by the Goalpara Tenancy Act 1929, Sylhet Tenancy Act 1936, and Assam (Temporarily Settled Districts)Tenancy Act 1935. The relations of land lord and tenant are regulated by Goalpara Tenancy Act in Goalpara district, Sylhet Tenancy Act in Karimganj sub-division of Cachar district and Assam Tenancy Act in the temporarily settled districts of the State.

The tenancy Acts defined 'tenant' as a person who holds land under another person, and is, or but for a special contract would be, liable to pay rent for that land to that person.

The following classes of tenants are recognised in different parts of the state :

i) Tenure holder - Tenure holder means primarily a person who has acquired from a proprietor or from another tenure holder a right to hold land for the purpose of collecting rent or bringing it under cultivation by establishing tenants on it, and includes also the successor in interest of persons who have acquired such a right. A permanent tennure-holder is a tennure-holder who has a right to hold a heritable and transferable interest in land, otherwise than for a limited time.

ii) Jotedar - Jotedar means primarily a person who has acquired form a proprietor or a permanent tenure-holder or from another jotedar a right to hold land for the purpose of bringing it under cultivation, by establishing tenants on it, and includes also the successor in-interest of a person who has acquired such a right.

iii) Raiyat - Raiyat means a person who has acquired a right to hold land for the purpose of cultivating it by himself, or by the members of his family or by servants or labourers or with the aid of partners and includes also the successor in interest of a person who has acquired such a right. A raiyat may acquire his interest either from a proprietor or a permanent tenure holder or a jotedar.

The different classes of raiyat recognised in Assam are,

a) Privileged raiyat - The estates of privileged raiyat is attained when a tenant has been in continuous occupation of the land for not less than twenty years or either at a rate of rent not excluding the land revenue in addition to the service rendered by him or on payment of <u>bhog.</u>[8] The tenants in the Lakhiraj estates are usually privileged raiyats of transfer of sub letting of the land on which he has got possession.

b) Occupancy raiyat - The occupancy right can be acquired if a raiyat has been in continuous occupation of the land for twelve years. In the

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[8] Bhog means articles of food required by custom to be offered to a deity.

Karimganj sub-division of Cachar district and in Goalpara district and occupancy raiyat can transfer or subtle his rights without the consent of the landlord, but the written consent of the landlord is necessary in ryotwari areas both for transfer and subletting. An occupancy raiyat can use the land, except the trees standing before the commencement of the tenancy, as he likes. The occupancy raiyat is to pay a fair and equitable rent, which is slightly higher than the actual land revenue rate payable to the Government. He cannot be ejected on the ground of non-payment of rent, but the land he occupies may be sold, in excution of a decree for the arrears of rent.

c) Under raiyats - An under raiyat usually pays a higher rate of rent than the raiyat under whom he holds the land. The right of the under raiyat is heritable only for the un-expired period of lease. An ordinary under raiyat holding land under a privileged raiyat can transfer his holdings to his co-sharer or heir. He has no right of subletting, he can be ejected the non-occupancy raiyat.

+A tenancy may pay the rent in cash or in kind. The privileged or occupancy tenants are Generally cash tenants and their burden of rent is not much higher than usual land revenue rates payable to the government. But as has been seen, the tenancy in 'kind' is fairly common in many parts of the state. A share tenant normally pays half of the total output to landlord; the tenant himself bearing the operational expanses of cultivation. Besides, the share rent a fixed rent in kind which is fixed quantity of crop irrespectives of the output, is also prevalent in many parts of the region.

d)Non-occupancy raiyat - A non-occupancy raiyat is a tenant not having a right of occupancy in the land held by him. He has to pay the rent agreed by both the land lord and himself without a written agreement his rent can't be enhanced and after one enhancement it remains in force for at least five years. A non occupancy raiyat can be ejected from the land by a decree of court, if he has to failed to pay an arrear of rent or if he has used the land in a manner which renders it unfit for the purpose of tenancy.

It is important to note that adhiars (shan croppers) were not recognised in Assam as tenants under the tenancy legislation.

Kamrup Land Tenancy

The land tenures of Kamrup were the same as those prevalent throughout the Assam valley, but are entirely distinct from those found in Goalpara, Sylhet, Cachar and the hill districts. The three distinct classes of tenures in Assam proper are the rayatwari or ordinary cultivating tenure, the nisf-khiraj or half-assessed tenure; and the

Lakhiraj or revenue free tenure.

Rayatwari Tenures - The ordinary tenure is rayatwari in which the proprietory right in the soil belongs to the Government. According to local usage and custom, which has been confirmed by the courts, the tenant is hold to have a right occupancy in the land covered by his lease, so as he continues to pay the Government revenue punctually. If however, the land is required for public purposes, the Government has the right of resumption upon making the tenant compensation for any houses, crops, trees etc. on the land. The leases are generally for a period of one year and the right of transfer is tactly acknowledged. But holdings settled for a term of years are expressly declared by the Assam Settlement Rules to be heritable and transferable on condition of the transfer being registered. Certain large rayatwari holdings are called 'Chamuas'. The only distinction between an ordinary rayat or cultivator and a chamunder is, that the latter pay his revenue direct into the district treasury, without the intervention of the mauzadar or revenue collector to whom the former pays his revenue.

Nisf-Khiraj and Lakhiraj Tenures - In Kamrup as throughout Assam the native rulers made considerable grants of land to be held revenue free for religious and charitable purposes. The different classes of Lakhiraj or rent free estates in Kamrup are as follows :

i) Brahmaptara or lands given to Brahmans by the Hindu kings.

ii) Dharmottar, lands for the support of Hindu religious institutions.

iii) Debottar, lands for maintaining the worships of the Gods.

Among the nisf-Khiraj or lightly assessed tenures are as following:

i) Rirpal, lands granted for the support of Muhammadan religious institution.

ii) Nankar grants to Hindus for State services and other reasons. Nanker lands were granted to Sudras in the same manner as Brahmottar to Brahmans. These nisf Khiraj estates are heritable and transferable, the proprietory right belonging to the holder, and not the state, as in the case of ordinary rayatwari lands.

Land Reform Policy

After independence in the context of existing rural problems, the Planning Commission Formulated land reform programmes. The objectives of land reform were stated to be two fold "Firstly to remove such impediments upon agricultural production as arise from the character of agrarian structure, and secondly to create condition for evolving as speedily as may be possible an agrarian economy with high level of efficiency and productivity." The main constituents of the programmes of land reform undertaken under the five year plans for securing these objectives are,

i) abolition of intermediaries;

ii) tenancy reform designed to scale down rent and to give tenants permanent rights subject to the landlords right to resume land upto a prescribed limit for personal cultivation within limited time;

iii) fixation of ceiling on land holdings;

iv) reorganisation of agriculture including consolidation of holdings, prevention of fragmentation and development of co-operative farming and co-operative village management.

The factors which influenced the evolution of all India land reform policy have also led to formulation land reform policy in Assam. The basic idea of land reforms in Assam has been based on the socio-political opinion in the country. Public opinion in Assam was moulded to a great extent by the reports of Land Revenue Commission Bengal, and Famine Enquiry Commission. Immediately after independence, the Government of Assam decided to abolish Zamindari system and to protect the interest adhiar's (Share-cropper). Before the Planning Commission announced its land reform policy under the Five Year Plans, one bill was presented in the State Legislative Assembly in 1948 for the regulation of share-tenancy. The subsequent land reform acts have been based on the principles laid down by the Planning Commission. It is, however, to be noted that the land reform Acts in Assam have been amended from time to time with a view to bringing them in line with the all India reform policy.

The important land reform Acts enacted in Assam since independence are as follows :

i) The Assam Adhiars protection and Regulation Act, 1948 seeks to regulate land lord Adhiar (share-cropper) relation to give limited security of tenure to the adhiars to fix maximum rent payable by adhiars and to establish conciliation Board for the settlement of disputes between the adhiar and the land-lord.

ii) The Assam State Acquisition of Zamindaris Act 1951 seeks to establish direct relation between the State and the tenants by terminating the rights of intermediaries[9] to simplifying existing tenures of land by bringing the Zamindari areas in line with the raiyatwari areas, to evolve a uniform method of revenue administration all over the state, and to increase the revenue resources of the State Government.

iii) The Assam Fixation of Ceiling of Land Holdings Act seeks to impose a limit on the amount of land that may be held by a person.[10] It aims at satisfying the wide spread desire to possess land, reducing the glaring inequalities in the ownership and use of land, and encouraging the formation of co-operative farming societies by the landless cultivators in the surplus land.

iv) The Assam State Acquisition of Lands belonging to religious and charitable institutions to establish direct relation between the State and the tenants of these institutions, and to distribute the unoccupied lands among the land less cultivators.

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[9]The holders of certain recognised proprietory tenures of fudal nature, which have their origin in the early settlements of land under British rule.

[10]Person include a family, a company and a body corporate.

v) The Assam consolidation of Holdings Act 1960 seeks to consolidate the existed fragmented holding and to prevent further fragmentation of holdings.

vi) The Assam (Temporarily settled Area) Tenancy Act 1971 have changed the traditional land tenancy system in Assam. In this Act the old Assam (Temporarily Settled Districts) Tenancy Act of 1955 was repeated. Along with it, the Adhiar protection and regulation Act 1948 was also replaced and Adhiar was given the status of a tenent under the new Act. The Tenancy Act of 1935 was old fashioned and the status and the protection given to a tenant under its provisions were not considered adequate. The concept of ownership itself has under gone a change in the recent times. The old system under which an absentee land lord could victimise a distressed tenant in the name of a contract is no longer Sacro-Sanct. Nor is the status of the man behind the plough who raises the crops and feeded the nation is considered inferior to that of the landlord who does no economic function in his land. The new Act seeks to reduce the rent payable by a tenant drastically and makes eviction of tenant from land more difficult than before. Another remarkable feature of the new Act is that a tenant can become the owner of the land that he cultivates.

Land Holdings

The uneconomic size of most of the land holdings, inequality in the ownership and use of land and landlessness of a considerable portion of population are some of the serious hindrances in the development of agriculture of Assam.

The Assam fixation of ceiling on land holding Act, 1956 was enacted to fix the ceiling at 150 bighas

(20.25 hectares) for all kinds of land, irrespective of family size or soil or irrigation facilities. This should be enlarged by another 30 bighas (4.05 hectares) for permanent orchards. Subsequently the ceiling was reduced to 75 bighas (10.12 hectares) in 1970 and then to 50 bighas (6.7 hectares) in 1973, with the operation of ceiling lands. 4.87 lakh bighas (66 thousand hectares) of surplus land have been vested in the Government. By the end of 1974-75, 2.22 lakh bighas (30 thousand hectares) have been distributed among the landless cultivators. It is also reported that upto June 1976, 403289 bighas of surplus land was distributed to 107004 landless families, besides providing house sites to 7262 homeless families. After achieving all these, still Assam situation is far from satisfactory. The reports of the survey of the rural economic condition conducted by the Government of Assam during the period 1976-77 show that in the districts of Darrang, Sibsagar, Lakhimpur and Nowgong 11.26 per cent to 18.48 per cent of the households are landless, 31.81 per cent to 37.66 per cent households have holdings below 10 bighas and 12.21 per cent to 17 per cent households have holdings between 10 and 15 bighas. In Kamrup 17.6 per cent are without any land and 54.9 per cent have less than 10 bighas. In Cachar 12.6 per cent people are without land and 66.3 per cent people have less than 10 bighas. In Goalpara 20.4 per cent people have less than 10 bighas.

TABLE - III.1

Proportion of Holdings according to Tenure Status and proportion of Total Area in different size classes (1970-71)

Size Class in Hectares	Entirely owned		Wholly rented		Partly owned and Partly rented	
	Holding	Area	Holding	Area	Holding	Area
Below 0.5	79.43	78.96	18.75	18.69	1.82	2.35
0.5 to 1.0	76.85	76.75	17.44	17.30	5.71	5.95
1.0 to 2.0	74.41	74.24	14.60	14.34	10.99	11.42
2.0 to 3.0	72.01	71.95	10.71	10.60	17.28	17.45
300 to 4.0	70.85	70.79	7.92	7.89	21.23	21.32
4.0 to 5.0	68.86	68.81	6.83	6.80	24.31	24.39
5.0 to 10.0	66.43	66.15	5.72	5.68	27.85	28.17
10.0 to 20.0	61.62	61.89	7.45	7.59	30.93	30.52
20.0 to 30.0	61.69	61.55	19.05	19.40	19.06	19.05
30.0 to 40.0	61.68	62.94	22.00	21.91	16.02	15.08
40.0 to 50.0	54.55	54.70	32.95	32.28	12.50	12.96
50.0 and above	70.61	65.74	9.31	2.22	20.08	32.04
TOTAL	75.90	71.39	15.57	10.68	8.53	17.93

Source: Collected from the Agricultural Census (1970-71).

The Agricultural Census (1970-71) classified operational holdings into three groups according to tenure status : (i) wholly owned (ii) wholly rented and (iii) partly owned and partly rented. Data on the proportion of holdings and area operated by size groups of holdings have and area operated by size groups of holdings have been taken from the agricultural census of 1970-71 and given in Table-III.1.

An analysis of Table-III.1 shows that 75.90 per cent of total holdings in Assam operating 71.39 per cent of the area, by wholly owned groups. In case of wholly rented, 15.57 per cent of the holdings operating 17.93 per cent of the area were partly owned and partly rented. The proportion of the holdings wholly owned or entirely owned is higher in the lower size group mainly from (0.5 - 4.0 hectares). In these classes wholly rented holdings and partly owned and partly rented holdings are comparatively lower to that of higher size category. But in the higher size groups (20.0 - 50.0 hectates), there is large proportion (19.05 per cent to 32.95 per cent) of the holdings which was wholly rented. In the middle size groups (5.0 - 10.0 hectares) the author found a higher percentage (24.31 to 30.93 per cent) of partly owned and partly rented holdings. It may however be noted that in Assam lands leased in by the holders of operational holdings

TABLE-III.2

Cumulative distribution of percentage of estimated number of operational holdings and area operated by size class of operational holdings - Kamrup

Size class of operational Holdings(Hect)	1060-61				1970-71			
	Estimated number of operational Holdings		Estimated area operated		Estimated number of operational Holdings		Estimated area operated	
	P.C.	C.P.C	P.C.	C.P.C.	P.C.	C.P.C.	P.C.	C.P.C.
Upto - 0.20	5.35	5.35	0.24	0.24	7.73	7.73	0.86	.86
0.21 - 0.40	8.95	14.30	1.66	1.90	12.01	19.74	2.79	3.65
0.41 - 1.00	25.99	40.29	11.49	13.39	32.66	52.40	17.99	21.64
1.01 - 2.02	33.72	74.01	30.28	43.67	30.23	82.63	34.90	56.54
2.03 - 3.03	12.91	86.92	20.68	64.35	10.01	92.64	18.59	75.13
3.04 - 4.05	5.51	92.43	11.65	76.00	4.99	96.63	11.95	87.08
4.05 - 5.05	2.91	95.34	7.77	83.77	1.70	98.63	5.59	92.67
5.06 - 6.07	1.22	96.56	3.94	87.71	0.59	99.22	2.52	95.19
6.08 - 8.09	1.76	98.32	7.35	95.06	0.48	99.70	2.59	97.78
8.10 - 10.12	0.38	98.70	1.89	96.95	0.22	99.92	1.50	99.28
10.13 - 12.14	0.15	98.55	1.00	97.95	0.05	99.97	0.42	99.70
12.15 - 20.24	0.15	99.00	1.61	99.56	0.03	100.00	0.30	100.00
20.25 and above	-	99.00	.44	100.00	-	-	-	

Source: Collected from the Agricultural Census (1970-71).

are of two types: (a) land owned and rented by private owners, (b) land owned by Government but occupied without settlement.

It is interesting to note in the report of agricultural census of Assam that only 5.47 per cent of the operated land are rented out by private land holders.

Data on the distribution of operational holdings by size classes in Assam are available for 1960-61 and 1971-72 both from the National Sample Survey.

In Table-III.2, the distribution of operational holdings for the period of above two years is given. During the period 1960-61 to 1971-72 there occured significant changes in the proportion of operational holdings in the lower size groups. In 1960-61 about 40 per cent of the holdings were below one hectate which rose to over 52 per cent in 1971-72. The proportion of operational holdings in middle and higher size groups showing an opposite trend. Middle size groups (2 to 10 hectares) decreased from 24.69 per cent in 1960-61 to 17.29 per cent in 1970-71. The gap is even higher in the higher size group.

In order to ascertain a picture of the size of holdings over two times selected for study, Lorenz curve

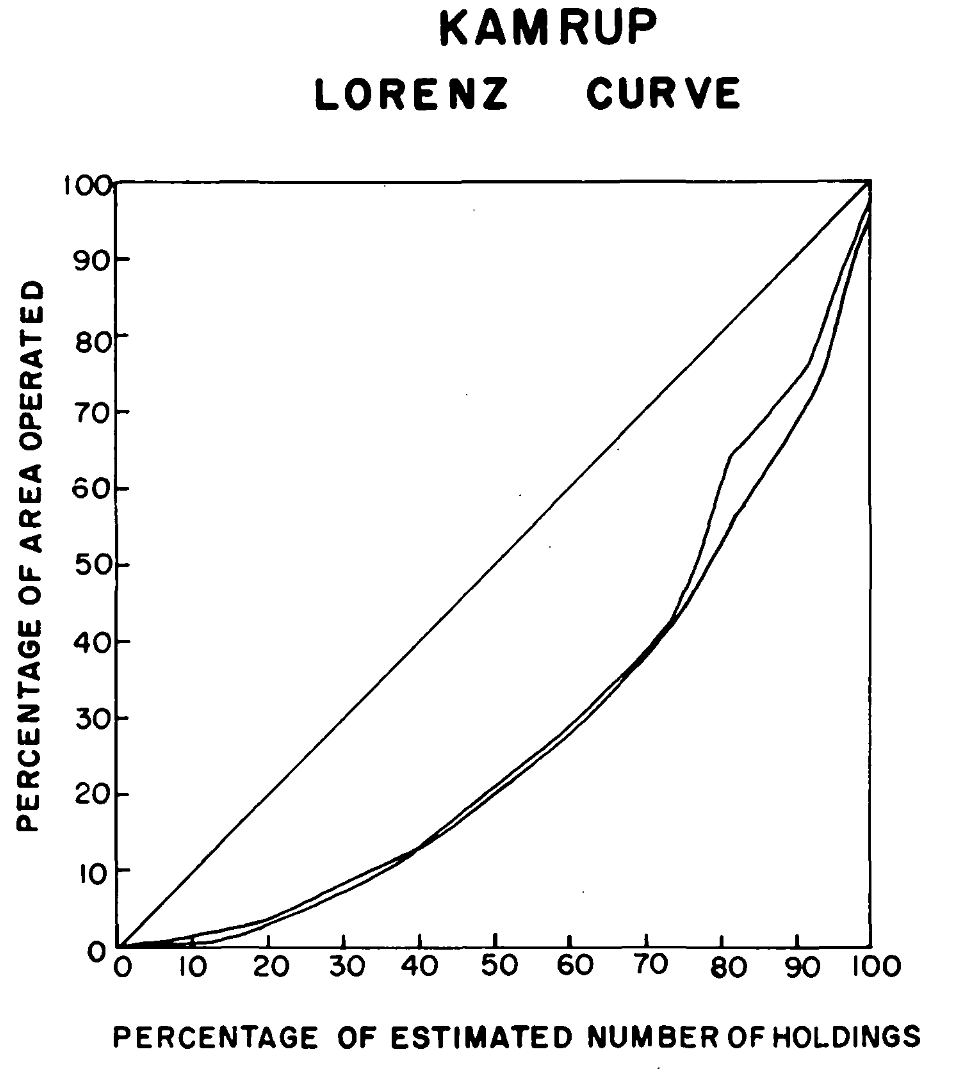
KAMRUP
LORENZ CURVE
PERCENTAGE OF AREA OPERATED
0
10
20
30
40
50
60
70
80
90
100
PERCENTAGE OF ESTIMATED NUMBER OF HOLDINGS

Fig. 5.

has been prepared (Fig. 5). The Lorenz curve distribution of the data on the concentration of operational holdings does not show any significant change during the period. It may be because the land reforms measures relating to tenancy have largely implemented only after 1973, when the new law on land ceiling was passed and given effect to preparation of tenants. So after this implementation, the proportion of the operational holding below 2 hectares might have further risen with the distribution of surplus land to the landless cultivators. In brief, Assam is a land of small and marginal farmers in which over 80 per cent of the operational holding are below 2 hectares.

Considering the size of land holding as one of the major determining factors for agrćultural landuse, a detailed discussion has been made for Kamrup district, where villages have been taken as the case study.

CHAPTER - IV

LAND UTILIZATION

The present chapter deals with the general categories of landuse, the landuse pattern in the Kharif and rabi seasons and the levels of transformation in the traditional cropping structure. The discussion of the regional pattern of landuse in Kamrup district is based on block level data of 1964-65 and 1974-75.

The landuse and cropping mosaic of any region are the outcome of geomorphic features, climatic variables, pedological differences, historical process and socio-economic institutions. In a given physical milieu, man as an active agent modifies the landscape, and uses it to fulfill his needs with the technology at his disposal. It is man who determines the use to which he wishes to put the land. Hence, it is natural that different types of living which are represented by social values and certain institutional control will create diversified patterns of landuse within the limits imposed by the agro-physical controls. The impact of physical factors is subtle and interwoven with socio-economic forces from which the former cannot be easily sieved for geographical investigation of contemporaneous landuse patterns and changes therein.

Forests

Most forested area represents an exclusive use of land, the growing of trees. Such an area is generally incomplete with other uses of land. Therefore, there is no difficult in the spatial interpretation of forested areas returns. Floristically, either for climatic reasons or due to heavy population pressure on flat easily workable alluvium plains, more suitable for cultivation than for forests and forests are generally grown in hilly and mountainous or foothills, humid or sub-humid areas.

Area under forest in Kamrup district in 1974-75 was only 12.80 per cent as compared to the national average of 22 per cent.

It may be inferred from Table-IV.1 that Gobardhana block with 35.12 per cent of the total area under forest has the highest forests area in the district which is almost one and a half times to the national average. Rani, Boko, Jalah and Rampur blocks also have higher percentage of forest area being 34.96, 33.32, 32.57 and 20.26 per cent respectively. On the other hand as many as five blocks namely, Barketi, Pub Nalbari, Pchim Nalbari, Rangia and Chamaria in which forest is not occupying even a single hectare of land. In the remaining areal units forest area varies from 2 to 10.89 per cent. Thus

TABLE-IV.1

General Landuse (1974-75)

Block	Forest	Land put to non-agri-cultural use	Permanent pasture and other grazing land	Land under tree, crops grows	Cultivable waste land	Old Fellow	Current Fellow	Barren Land	Net sown area	Area sown more than once
1	2	3	4	5	6	7	8	9	10	11
Barpeta	–	4.80	5.22	1.43	2.21	4.36	2.46	12.90	66.65	27.0
Rupti	–	4.81	5.24	1.57	2.23	4.48	2.47	12.51	66.65	27.7
Chenga	–	4.70	5.18	2.45	2.18	4.73	3.34	10.71	66.70	27.30
Jalah	32.57	3.24	3.53	0.99	1.49	2.95	1.62	10.72	42.80	18.68
Bagli	–	4.81	5.24	1.47	2.21	4.36	2.40	15.90	63.85	27.70
Bhavanipur	–	4.83	5.27	0.93	2.22	4.41	2.41	15.98	63.87	27.81
Gobardhana	35.12	3.12	3.40	0.95	1.43	2.84	1.56	10.31	41.22	17.90
Mandia	–	4.81	5.24	1.4	2.21	4.38	2.40	15.90	63.53	27.70
Jamalpur	10.89	5.43	7.8	5.28	1.35	1.50	1.40	2 .9	63.35	52.03
Borigog	–	8.68	3.35	5.27	2.61	1.71	.60	2.2	75.45	26.2
Tihu-Badana	–	5.11	7.43	3.46	2.43	3.73	1.49	.90	75.46	68.07
Borketi	nil	9.88	12.88	4.32	0.67	2.29	2.75	6.95	60.29	25.96
Pub-Nalbari	nil	8.92	3.42	2.99	2.33	2.80	2.74	6.05	69.79	20.5
Pchim-Nalbari	nil	18.95	7.91	3.66	1.13	.23	1.81	nil	66.27	26.21

Table contd..

Table-IV.1 contd..

1	2	3	4	5	6	7	8	9	10	11
Rangia	Nil	10.94	3.53	7.94	2.03	1.60	1.37	2.57	69.87	27.94
Hazo	2.14	8.25	8.86	5.76	3.55	4.07	2.81	8.09	56.41	23.2
Rani	34.96	4.27	3.68	5.29	4.92	2.23	-	2.82	41.73	3.7
Boko	33.32	14.13	.23	2.43	3.48	1.46	-	3.28	40.83	15.76
Chaygaon	0.28	4.11	4.00	24.9	.79	.11	.21	15.56	49.87	12.5
Rampur	20.36	9.06	3.50	7.68	4.01	1.10	3.15	8.31	42.42	3.34
Kamalpur	5.21	7.63	2.12	10.8	2.13	2.14	0.1	6.69	60.01	22.95
Chamaria	Nil	17.94	3.02	.94	7.77	4.77	1.20	4.06	60.85	9. 21
Dimoria	10.30	10.30	1.55	17.15	2.37	3.57	4.36	14.03	35.92	6.84
Kamrup	11.27	6.75	4.39	5.57	2.17	2.76	2.01	8.20	58.82	25.64

Calculated from the Directorate of Economics and Statistics(Gauhati)Data.

the distribution of forest in the district is most uneven. In southern parts of the district, the blocks adjacent to Meghalaya plateau and in the Bhutan Himalayas foot-hills are the major forested tracts of the district. Pressure of population and fertility of the soil did not allow to grow forest in the alluvial belt of this district.

Land not available for Cultivation :

Land not available for cultivation can be divided into two sub-categories because of the distinctly different uses.

a) Area under non-agricultural uses which generally comprises rural settlements metalled and un-metalled roads, railways, embankments, canals, tanks and burial, cremation, play, campâng, thrasing cattle, skinning and target shooting grounds.

On the whole land put to non-agricultural uses covers 11.82 per cent in Kamrup district against 10.90 per cent in Assam and 14.97 per cent national average. High concentration of land put to non-agricultural use lies in Pachim Nalbari (18.95 per cent), Boko (14.13 per cent), Rangia (10.94 per cent) and Dimoria (10.30 per cent). In Tamalpur, Tihu, Borigog, Barketi, Hazo, Rampur, Kamalpur blocks the percentage of land under non-agricultural use varies between 5 to 10 per cent. In other parts of the district, land under non-agricultural uses is less than 5 per cent which is well below the national average.

b) It may be noted from Table-IV.1 that 9.13 per cent of the geographical area of Kamrup district is barren and useless from the agricultural point of view. This figure is less than half of the national average (20.23 per cent) of waste-land. High proportion of barren and uncultivable land lies in the Bhavanipur, Bagli, Mandia and Chayagaon where percentage are more than 15 per cent while in the central part of the districts barren and uncultivable land is significantly low and in Pachim Nalbari it is almost absent.

Other uncultivable land excluding fallow land:

It includes permanent pasture and other grazing lands, miscellaneous tree crops and groves and cultivable waste. The permanent pastures and meadows are not. The common land in the village are grazing land within the forest areas are included under this head. The miscellaneous tree crops and groves are grown in the areas not included in the net area sown. All the culturable land put to some agricultural use, but not included under net area sown. The land under thatching grasses, bamboo, bushes and other groves, trees for fuel etc., which are not included under orchards are placed under this category. The cultivable waste includes land available for cultivation, whether or not taken up for cultivation or abundoned after a few years. For one reason or the other, such land may be covered with shrubs and jungles which are not put to any use. They may be assessed or unassessed and may be in isolated blocks or within cultivated holdings. It is a sort of residential class which includes all uncultivable lands not accounted for any other class.[1]

Permanent Pasture and other grazing land:

Land under permanent pastures and other grazing land is only 4.39 per cent as against 2.38 per cent in Assam and 4.2 per cent of the national average. The maximum percentage of permanent pastures and other grazing land concentration on Borketi, Tihu, Hazo, Nalbari, Tamalpur, Barpeta, Rangia, Chenga and Mandia. Here percentage is much higher than the district and national average. In the other parts of the region, this type of land occupied 1 to 4 per cent of the total land.

Land Under tree, crops, groves:

The land under these types of uses is found in all the blocks of the district. A high concentration lies in Chayagaon (24.9 per cent) and Dimoria (17.15 per cent) blocks. Medium concentration of tree, crops and groves

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[1]Singh, J. (1974), An Agricultural Atlas of India, Kurikshetra, p.110.

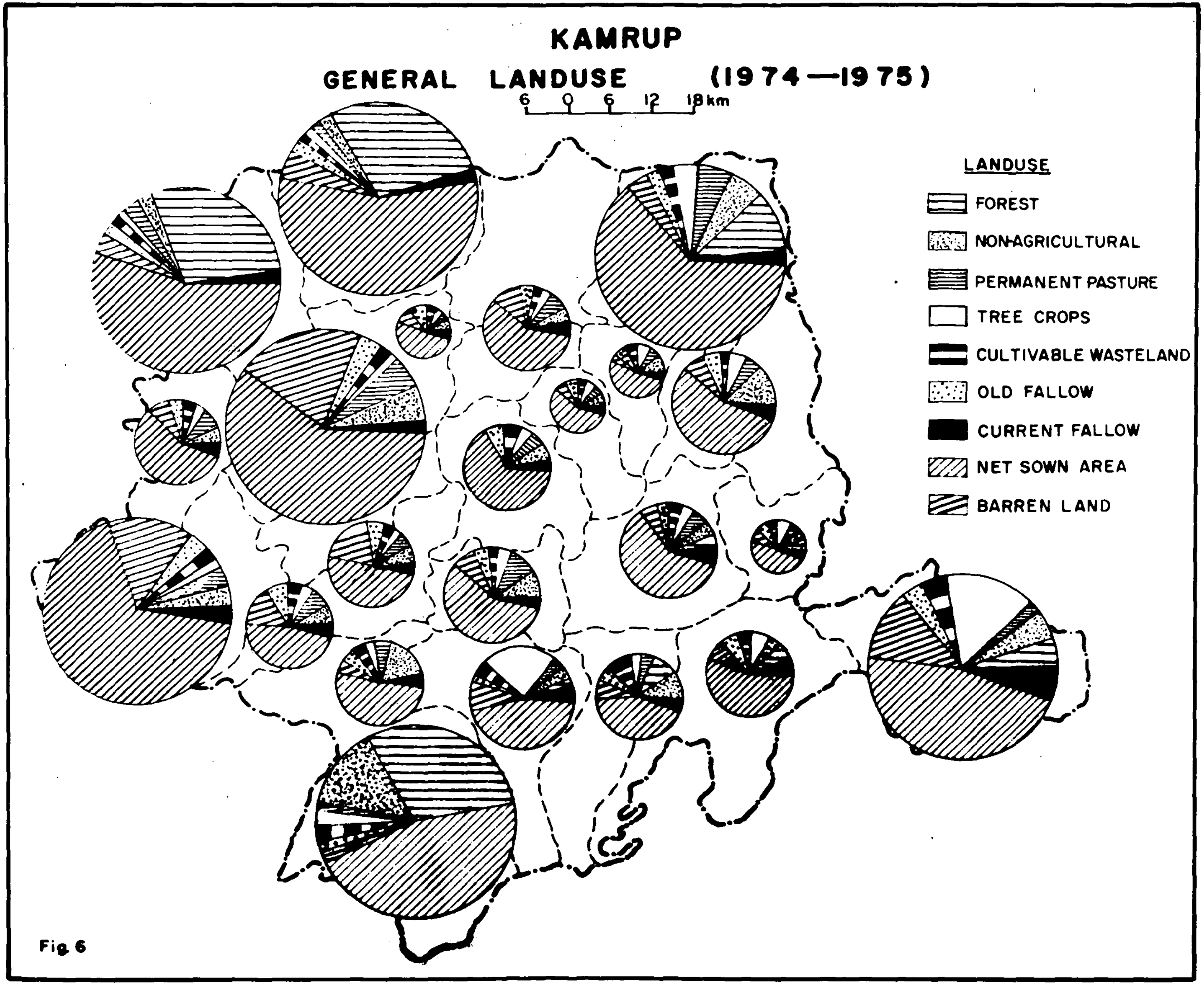
KAMRUP
GENERAL LANDUSE (1974—1975)
6 0 6 12 18 km
LANDUSE
FOREST
NON-AGRICULTURAL
PERMANENT PASTURE
TREE CROPS
CULTIVABLE WASTELAND
OLD FALLOW
CURRENT FALLOW
NET SOWN AREA
BARREN LAND

Fig. 6

is distributed in Kamalpur, Rampur and Rangia blocks. In the other part of the region there is low concentration of land which is under tree, crops, groves etc..

Cultivable Wasteland:

Kamrup has only 3.06 per cent of land as cultivable waste (Figure-6). The highest concentration of cultivable wasteland is found in Rani and Rampur block where percentage are 4.92 and 4.01 per cent respectively. Cultivable wasteland is moderately distributed in the Hazo, Boko and Borigog Community Development Blocks. In the remaining blocks the proportion culturable wasteland is less than 2.5 per cent which is significant to the national average.

Fallow land:

The fallow lands other than current fallows comprise all lands which were taken up for cultivation but are temporarily out of cultivation for a period of not less than five years. The reasons for keeping such land as fallow may be one of the following :

i) Inadequate supply of waters;

ii) Inability of farmers to cultivate due to lack of resources;

iii) Malarial climate;

iv) Silting of canals and rivers;

v) Soil erosion;

vi) Unremunerative of farming.

Against this the current fallow comprises of cropped areas which are kept fallow during the current year for example, if seedling area is not cropped again in the same year it is treated as current fallow.[2]

Kamrup has only 2.76 per cent of area under fallow land against 1.62 per cent in Assam and 2.84 per cent of national average. The spatial distribution shows from the Table-IV.1 that in Barpeta, Rupti, Chenga, Chamaria, Bagli and Bhevanipuri have more than 4 per cent of fallow land and it is moderately distributed in Jalah. Tihu, Pub Nalbari, Dimoria and Gobardhana blocks. In other parts of the district, there is very little fallow land. The highly fertile alluvial soils deposited by the Brahmaputra and its tributaries, the adequate monsoon and fairly good temperatures encourage the farmers to grow one crop or the other without giving rest to the arable land.

Current fallow:

Land under current fallow is far below than the national average in Kamrup is, however, confined in Dimoria block (4.36 per cent). Current fallow relatively

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[2]Hussain, M. (1979), Agricultural Geography, New Delhi, p.38.

high in Rampur, Kamalpur, Chenga, Hazo, Barketi and Pub Nalbari blocks. In other parts of the district land under current fallow is below 2.5 per cent.

Net Area Sown:

Net area sown represents the actual physical area under crops and orchards. It may be referred as net cropped area also. Land under net area sown in Kamrup district is 58.82 per cent as against 44.5 per cent to national average and 33.1 per cent to the state average. High percentage of net sown area mainly due to alluvial nature of surface and moderate to heavy rainfall. The percentage of net sown area to the total area varies considerably from area to area in Kamrup district. Borigog and Tihu blocks have the largest percentage of the total area developed to the crops. Here net sown area occupies 75.46 per cent and 75.45 per cent respectively. Arable land also has a high percentage in Rangia being 69.87 per cent, Pub Nalbari 69.79 per cent, Barpeta 66.65 per cent, Rupti 66.65 per cent and Pachim Nalbari 66.27 per cent.

Net area sown is comperatively low in Boko, Rani being 40.83 and 41.73 per cent respectively.

Area Sown more than once:

Area sown more than once or double cropped area in

Kamrup district is 25.64 per cent as against 6.5 per cent in Assam and 8.06 per cent in the country. The favourable temperatures and moisture conditions are largely responsible for double and multiple cropping in the district.

Tihu with 68.07 per cent and Tamalpur with 52.03 per cent have the largest double cropped area.

Land Utilisation in Kharif and Rabi Seasons:

An agricultural year in India is traditionally divided into the Kharif and the rabi seasons - corresponding to the summer and winter season respectively. A third crop season is known as Zaid rabi (additional rabi) which is transitional period between rabi harvest and Kharif sowings i.e. mid-March to Mid-June in which some of the farmers grow some short duration crops. The standard agricultural calender is, however, not exactly applicable in the case of Assam and particularly in the case of Kamrup district, which has high temperature throughout the year and more moist climate. The warm-humid conditions of the district permit the farmers to grow even rice in the winter season.

Landuse in Kharif:

The season of Kharif crops corresponds with the commencement of summer monsoon which actually prevails in Assam from June to October. The crops which require greater heat-budget and high moisture are grown in this season. This is the only season when extensive cultivation of crops adapted to warm environment may ben cultivated.[3] In this season more than 74 per cent of the cultivated area is sown and devoted mainly to the Kharif crops.

Kharif is the most important agriculturable season of the region in which nearly three fourth of the cultivated land is sown. The area occupied by each crop in each block is given in Table-IV.2 which shows many interesting features. The overall cropping pattern in this season reveals that out of the net sown area 79.0 per cent is devoted to cereals and only 21.0 per cent is given to non-cereal (Jute, Sugarcane, fodder, vegetables) crops. Rice, maize, small-millets and pulses are the principle cereals of this region.

Principle Crops :

No account of crop land use can be regarded as complete unless a proper study of the geography of the crops grown in the region is made. The diversity of edaphic and other physical conditions combined with an

[3]Tiwari, A.K. (1965). Land Utilization in Jawnsar Barwar basin. Deccan Geographer, Vol.3, p.37.

unknown length of occupation of the area have resulted into a glaxy of crops grown over the entire region. Their number is so great and the areas occupied by many of them is so insignificant that they all cannot be treated in the present work. In the following pages, therefore, only those crops have been discussed which exert a considerable influence on the economy of the region. On this criteria nine crops deserve elaborate discussion. These are rice, sugarcane, jute, rape and mustard, wheat, pulses, mati kalai and gram. These crops account for more than 88 per cent of the cropped area.

Rice (Oryza Sativa):

Rice is the most extensively cultivated staple crop of the district. It is grown under a variety of conditions ranging from comparatively dry, unirrigated hill slopes of shallow soils to the wet and water logged valleys of deep alluvial soils. The roots of paddy are semi-aquatic and are well adopted to survive under water. But the excessive availability of water has an injurious effect on the soil causing deterioration of its physical conditions, accumulation of soluble salts and the formation of toxic products. Water standing above the soil level suppresses tillering and thereby, reduces plant growth. Rice relishes heavy soils with an acidic reaction Lying besides the Brahmaputra, Kamrup presents the most suitable environmental condition for the cultivation of rice in which temperature, rainfall, altitudes, light, length of the day, wind and alluvial soils are all conducive for a good paddy. In the area, paddy is entirely dependent on seasonal rainfall. The variability of rainfall in Assam is low which helps in getting reliable agricultural returns.

There are two main varieties of rice grown in Kamrup district in Kharif season viz., the early maturing variety which is sown from the middle of June to mid-July and is harvested in the end of October. This crop is locally called as Ahu or Autumn. The second variety is an late maturing variety which is shown in August and harvested in December. Locally called Sali or winter rice. Boro is a broadcast and deep water paddy, sown generally in the flooded areas.

Early and late maturing varieties of rice in Assam are grown either as a puddle crop or dry cultivation. The cultivation in the puddle system is carried out in three different ways. In the first method, the seed is sown after being sprouted slightly, in the second the seed is sown broadcast, in the third the seedlings are separately raised in a nursery before being transplated in the puddled field. In the dry cultivation, the field is ploughed and sown after the harvest of the previous crop.

The late maturing variety usually transplanted in the rainy season, in the month of July and August. Seedlings are raised in highly manured nurseries. Before transplantation takes place, the field is ploughed and puddled 4 to 6 times depending on the nature of the soil and the labour and the cattle energy available. After ploughing, paddy seedlings are transplanted in bunches with standing water in the fields. Sali crop flourishes well during the rainy season and is harvested in the months of November and December.

Boro is grown with the broadcast method in the low lying areas in March and April after having ploughed and dried fields at least 4 to 5 times. Extensive weeding operation become essential for Boro paddy before the land gets flooded. In extreme case it can be grown in four to five feet deep water, at the time of flooded. After the recession of the flood water, the plants settle on the land and begin tillering. This is harvested in December and January.[4]

It can, however, be concluded in the light of the above discussion that Ahu and Sali rice crops are the most important and principal crops in the Brahmaputra valley.

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[4] Agricultural Development in Assam (1978), p.23.

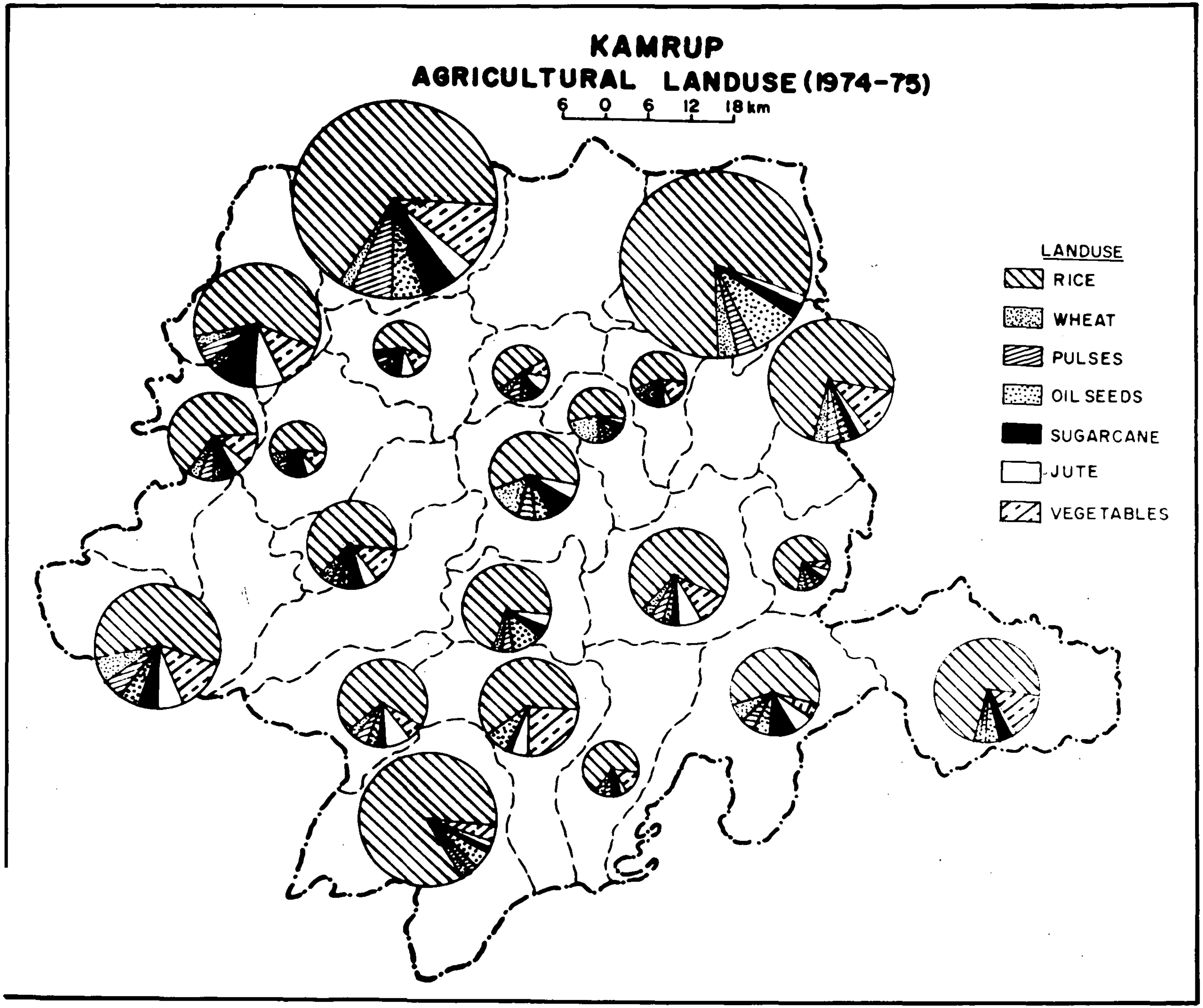
KAMRUP
AGRICULTURAL LANDUSE (1974-75)
6 0 6 12 18 km
LANDUSE
RICE
WHEAT
PULSES
OIL SEEDS
SUGARCANE
JUTE
VEGETABLES

TABLE-IV.2

Area under different Crops(1974-75)

Block	Ahu rice	Sali rice	Boro rice	Total rice	Wheat	Other Cereal	Mati Kalai	Pul-ses	Pot-ato	Rape-seed must-ard	Sug-ar cane	Jute	To-ba-cco	Vege-tables
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Barpeta	31.02	32.82	0.24	64.08	2.00	1.87	1.04	3.50	1.02	3.60	4.82	4.02	0.28	12.28
Rupti	31.02	35.70	0.23	66.88	2.18	1.05	1.94	3.42	1.09	3.52	4.55	4.20	0.28	10.28
Chenga	31.00	33.62	0.22	64.89	2.50	2.59	1.24	3.60	1.03	3.42	4.02	4.00	0.29	10.26
Jalah	31.73	35.40	0.23	66.89	2.38	1.14	1.34	3.71	1.01	3.00	4.87	4.12	0.28	10.27
Bajli	31.80	35.92	0.24	66.70	2.98	1.64	1.12	3.83	1.01	3.42	4.52	4.22	0.28	9.26
Bhavanipur	31.02	35.62	0.26	66.88	2.51	2.94	1.30	3.42	1.40	3.20	3.30	4.52	0.28	9 .28
Gobardhana	31.30	35.60	0.24	66.89	2.54	1.40	1.04	3.52	1.61	3.21	4.82	4.02	0.28	8.75
Nandia	31.02	34.61	0.29	65.88	2.28	2.03	1.21	3.52	1.00	3.62	3.82	4.72	0.28	11.27
Jamalpur	39.01	37.13	-	76.15	1.97	0.60	0.60	2.11	0.47	5.40	0.30	0.30	0.31	-
Morigog	35.08	54.46	0.96	90.50	0.82	0.03	0.03	0.31	0.44	1.80	1.58	1.58	0.24	3.74
Tihu	35.57	41.52	0.16	77.25	1.49	1.12	1.34	2.01	1.16	2.37	0.37	1.12	0.44	12.39
Borketi	23.16	46.68	0.32	70.18	4.11	-	-	4.11	1.34	10.48	5.10	5.10	0.47	-
Pub-Nalbari	30.02	31.85	3.69	65.57	10.33	-	-	4.92	-	6.20	1.83	1.83	0.83	-
Pachim Nalbari	34.71	50.11	1.33	86.16	1.57	0.51	0.51	0.22	2.21	2.50	0.30	0.32	0.77	1.69

Table contd..

Table-IV.2 contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Rangia	34.05	40.45	0.08	74.59	4.60	0.16	1.16	4.60	.66	3.72	.66	1.67	0.16	10.13
Hazo	28.26	40.51	1.44	70.21	3.64	0.65	1.39	5.04	2.09	3.38	0.72	5.80	0.13	6.87
Rani	7.75	67.02	3.16	77.94	0.14	0.39	0.81	0.14	1.95	1.37	0.52	0.61	0.14	14.62
Boko	29.16	58.81	0.77	85.75	1.14	0.22	-	1.14	0.60	5.61	0.38	0.98	0.04	4.16
Chaygaon	22.98	40.78	0.14	63.91	-	0.77	3.91	-	0.50	6.36	0.38	4.56	0.23	17.32
Rampur	7.30	66.27	1.56	74.13	2.92	2.95	0.51	2.92	1.03	2.01	1.57	1.92	0.18	9.66
Kamalpur	28.16	55.16	1.49	84.83	6.09	0.02	0.25	6.09	0.15	1.44	0.57	1.75	0.08	4 .69
Chamaria	31.64	29.55	1.30	62.50	2.32	4.93	0.74	5.32	8.41	5.62	0.12	6.66	0.22	3.31
Dimoria	17.10	43.28	12.16	72.55	0.77	2.06	0.03	0.77	.60	2.99	3.24	0.47	0.02	14.50
Karara	29.84	28.62	3.22	61.68	2.74	1.68	1.25	2.74	1.18	5.65	2.26	1.05	0.34	20.58
Kamrup	29.55	38.3	1.13	68.94	2.22	1.08	0.92	2.89	1.19	3.97	2.27	3.07	0.30	12.47

* Not included in rabi and Kharif season.

Calculated from the Directorate of Economics and Statistics(Gauhati) Data.

KAMRUP

RICE

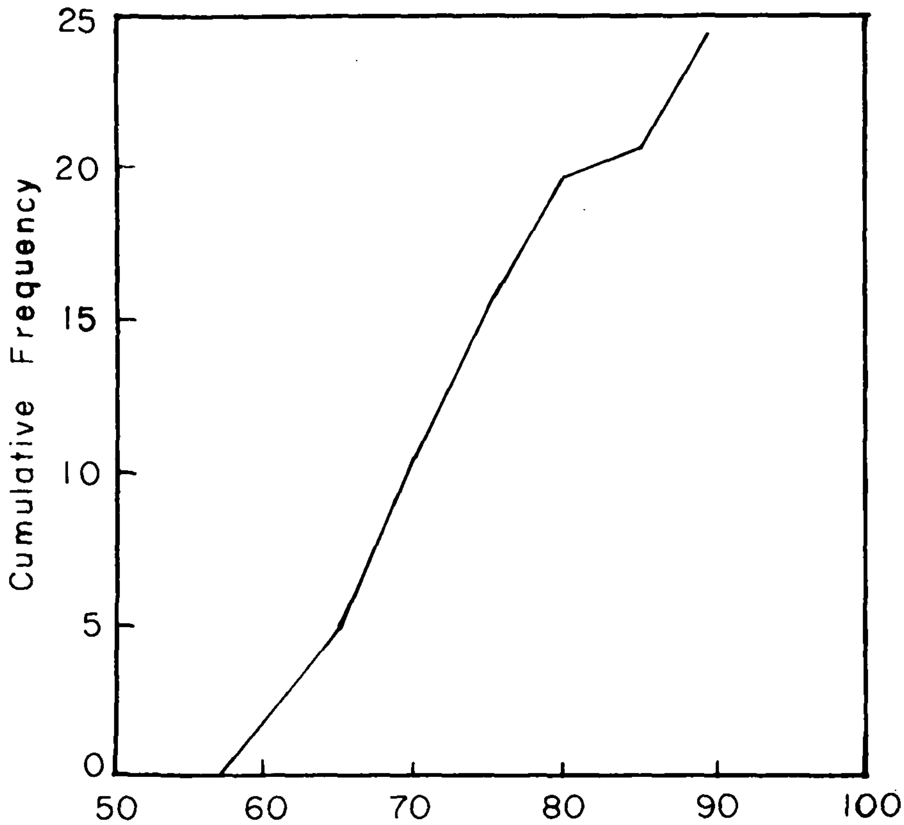

Fig. 8. Percentage class groups

Table-IV.2 shows that Kharif rice is the dominant crop in all the component areal units of the area under study and it has substantial percentage share in each block of Kamrup district. Its proportion exceeds more than sixty per cent in each unit. Hence rice ranks first in every areal units of the district. The minimum and maximum percentage of rice in the area varies between 61.68 to 90.50 in the Karara and Borigog blocks respectively.

In order to ascertain the Spatial pattern of rice concentration a cumulative frequency curve has been prepared (Fig. 8). The frequencies have been given in Table-IV.3 for the years of 1974-75.

TABLE - IV.3

Class in percentage	Fre-quency	Name of the Blocks	Cumulative Frequency
60 - 65	5	(Barpeta, Chenga, Chaya-gaon, Karora,Chamaria)	5
65 - 70	7	(Rupti, Jalah, Bagli, Bhavanipur,Gobardhana, Mandia, Pub Nalbari)	12
70 - 75	5	(Borketi, Rangia, Dimoria, Rampur, Hazo)	17
75 - 80	3	(Tamalpur, Tihu, Rani)	20
80 - 85	1	(Kamalpur)	21
85 over	3	(Boko, Pachim Nalbari, Borigog)	24

It can be seen from Table-IV.3 that 12 out of 24 blocks devoted 65 to 75 per cent of their total cropped area to rice which is more than 50 per cent of the total rice area in the district. These blocks are Rupti, Jalah, Bagli, Bhavanipur, Gobardhana, Mandia, Pub Nalbari, Barketi, Rangia, Dimoria, Hazo, Rampur. As many as 3 blocks namely Boko, Pachim Nalbari, Borigog have over 85 per cent of the cropped area under rice cultivation which is significantly high. In the Tamalpur, Tihu, Rani blocks 75-80 per cent of the cropped land is devoted to Kharif rice which is a fairly high percentage concentration of rice.

Agricultural landscape of a region is well conceived of when its area dominance of different crops is identified with the help of some standard statistical techniques. The simple delineation of an area into a wheat or cotton region conceals the degree of their concentration. The study of concentration of crops therefore, has great relevance in understanding the agricultural land use planning at macro and micro levels. The main objective of such an attempt is to study and analyse the cropping patterns of an area on a regional basis with a view to bring out their area concentration.[5] Since the introduction of new high yielding varieties of crops can be relatively easier in the region where its traditional

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[5] Husain, M. (1970), Patterns of crop concentration in Uttar Pradesh, Geographical Review of India, Vol.2 p.85.

culture is dominated, the study of spatial concentration of a particular crop is of immense help and most vital to the planners, agricultural scientists and administrators for policy formulation in the implementation of new innovation of agricultural programmes.

With a view of showing the density pattern of rice cultivation in Kamrup district a seasonwise break up of the area under rice has been presented. The regional dominance of rice has been determined firstly, by comprising the sown area in proportion and secondly, by relating the crop density in each of the component areal units of the district as a whole. Hence, for the purpose, the Location Quotient method has been applied. The Location Quotient or the index of concentration of crop has been worked out in the way as given below.

I = Index of Concentration of Crop

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

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

It will be seen from the Table-IV.4 that the indices of concentration very between as low as 0.89 in Karara to as high as 1.42 in Hazo. The reason for such a low

TABLE - IV.4

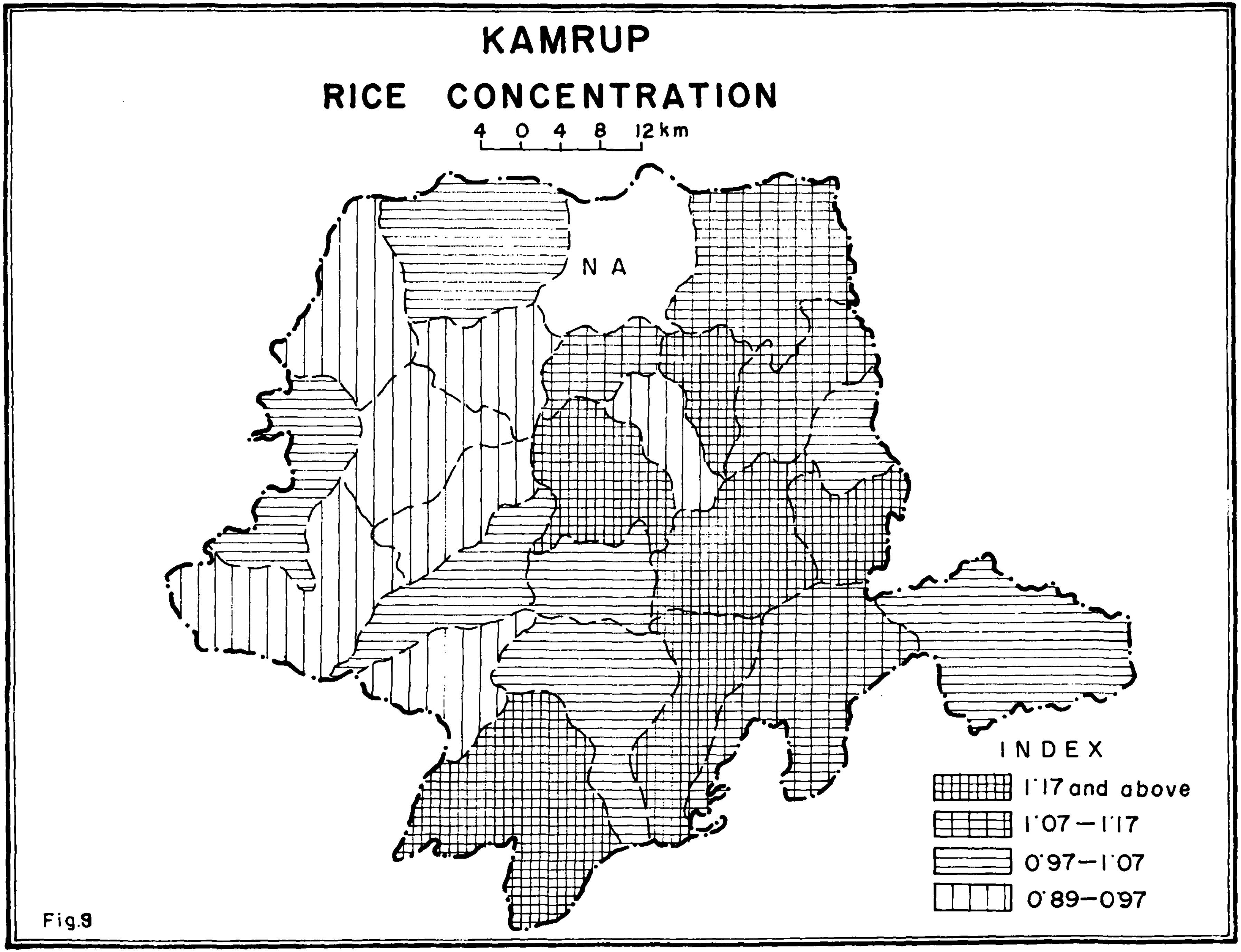
Concentration of Area under Rice

Class group of the indices of concentration	Degree of concentration	Frequency	Cumulative Frequency
0.89 - 0.97	low	8	8
0.97 - 1.07	Medium	6	14
1.07 - 1.17	High	4	18
1.17 and above	Very high	6	24

It will be seen from the Table-IV.4 that the indices of concentration vary between as low as 0.89 in Karara to as high as 1.42 in Hazo. The reason for such a low concentration of area under rice in Karara may be attributed to less areas put under rice and low irrigation potential. Hazo having high areal concentration of rice seems to be an exception because the area despite of a low irrigation potential has the highest density of rice cultivation as compared to the rest of the blocks in the Kamrup district.

Very high concentration of rice is noticed in the blocks of Borgog, Kamalpur, Hazo, Boko, Pachim Nalbari and Rampur. Similarly, high areal concentration of rice is observed in the blocks of Rani, Tamalpur, Tihu, Rangia with a variation in index values between 1.07 to 1.17.

As many as seven blocks show low concentration


KAMRUP
RICE CONCENTRATION
4 0 4 8 12 km
N A
INDEX
1·17 and above
1·07 – 1·17
0·97 – 1·07
0·89 – 0·97
Fig.9

having index values between 0.90 to 0.97. The blocks include Gobardhana, Mandia, Bhavanipur, Barpeta, Bagli, Chamaria and Pub Nalbari (Fig. 9).

From the discussion initiated about the concentration of rice areas in the entire district of Kamrup, it is inferred that the areal units comprising a substantial part of the Kamrup district come within medium, high and very high categories indicating better agricultural potential.

Jute (Corchorus):

Next to rice, jute is the main Kharif crop in Kamrup district. Its successful cultivation needs highly fertile alluvial soils, heavy rains, high relative humidity, warm temperatures and cheap mannual labour. It occupies second position in area and production in terms of money. In Kamrup, generally two varieties of jute viz., Capsularies and Olitories are grown. Capsularies is grown in both high and low lands but it thrives well in lowland areas where water can stand for a longer time in the field. Olitorius jute is cultivated only in high lands. Jute before harvesting needs sufficient water, that is why after sali, rice jute is sown in February-March in lowland and is harvested in June-July.

The spatial distribution of jute is shown in Table-IV.2 which reveals that its concentration is highest in Chamaria and Hazo where it occupied 6.66 and 5.80 per cent of total cropped area respectively. Jute also occupies a sizeable area in all the block of Barpeta sub-division. It is interesting to note that jute concentration is most pronounced in the immigrants dominate areas.

Sugarcane (Saccharum officenarum):

In Kharif, sugarcane is another important cash crop of the Kamrup district. It occupies about 16183 hectares or about 2.27 per cent of the total cropped area. Before the sowing of cane, lane is repeatedly ploughed and the soil is properly manured. Sowing begins in March when the temperature is sufficient for the germination of crop, but low rainfall in the early period of sugarcane growth makes irrigation essential. Barpeta, Rupti, Chenga, Jalah, Bagli, Borketi have more than 4 per cent of land under sugarcane. Borketi (5.10 per cent), Jalah (4.87 per cent), Barpeta and Gobardhana (4.82 per cent) are the leading sugarcane producing blocks of Kamrup district.

Matikalai, Blackgram are the other crops grown in the Kharif season, but their total area in each of the blocks is insignificant.

Landuse in Rabi Season:

The season of rabi crops corresponds to winter and autumn months (October to March).Only those crops are are grown in rabi season which can germinate in cool weather and moderate rainfall. The rabi crops are sown during October to December, but the seeds do not sprout for many days. The spring times brings in a new flush after the winter slumber from which the planets rise to resume their suspended growth. Because of these factors, the rabi crops generally harvest in four to five months time.

Rabi crops occupied 62774 hectares or about 11.40 per cent of the total cropped area. Out of the total sown area in the rabi season, about 54.73 per cent was devoted to grain crops and the remaining 45.27 per cent was given to oil seeds and vegetables.

Wheat (Trilicum Sativunm):

Wheat cultivation in Assam is a recent innovation. Its cultivation in Kamrup has however spread at a slower pace. Wheat is grown is clayey loam or sandy soil in the riverine tracts of the district. During the field work the author was told that wheat is cultivated in the fields which do not have irrigation facilities, but irrigation gives quite high yield. Wheat is generally sown broadcast in a well prepared field in the mouth of November or December and is harvested in March. Wheat covered an area of 15822 hectares in 1974-75 as about 19.47 of the total cropped area in rabi season. The highest land under wheat we have seen in Pub Nalbari block (10.33 per cent), it is followed by Kamalpur (6.09 per cent), Rangia (4.60 per cent) and Tihu (4.11 per cent). And it occupied more than 2 per cent in Barpeta, Rupti, Chenga, Jalah, Bagti, Bhawanipur, Gobardhana, Mandia, Hazo, Rampur and Chamaria and Karora blocks. Area under wheat can be increased significantly if irrigation provisions, fertilizer and other capital oriented inputs could be provided to the small and medium size peasants.

Mustard and Rapeseed (Brassica Campestrics):

Mustard and rape occupying 28313 hectares or about 3.97 per cent of the total cropped area constitute as one of the prime sources of oil and fat in the region. Rape and mustard are cultivated in Assam throughout the riverine belts. It grows well in flood prove lowlying areas with alluvium soils which are less acidic.[6] The crop is sown in October and ripen in February. At least one watering is necessary for its successful cultivation.

It will be seen from Table-IV.2 that rape-seed

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[6]Agricultural Development in Assam, p.137.

and mustard are the important rabi crops in Assam and almost all the blocks have significant percentage of land under their cultivation. The major blocks of its cultivation are Borketi (10.48 per cent), Chayegaon (6.36 per cent), Pub Nalbari (6.20 per cent), Chamaria (5.69 per cent), Karova (5.15 per cent), Boko (5.61 per cent), Tamalpur (5.40 per cent).

Boro-Rice :

Rice is also sown in rabi season. It occupies 9.13 per cent of the total rabi sown area. The rabi season rice is called Boro. It is grown in marshy land during winter season. In winter, the crop is repeatedly irrigated as in this season there is hardly any rain. For this crop seeds are grown in nurseries in the months of November and December, followed by well puddled fields in December and January.

Table-IV.2 shows that rice as a rabi cereals is an important crop in Dimoria blocks (12.16 per cent), Pub Nalbari (3.69 per cent) and Karara (3.69 per cent). It occupies more than 1 per cent land in Pachim Nalbari, Hazo, Rampur, Kamalpur and Chamaria but in North western part of the district winter rice covers a very insignificant area.

Potato:

Potato is an important crop in rabi season in Kamrup district. It is cultivated in all the districts of the area at a small scale. Ahu paddy and jute lands which are not suitable for sali paddy cultivation are generally devoted to potatoes. Potato is planted in the month of October and is harvested from February to March. Chamaria, Pachim Nalbari, Hazo are the leading potato growing blocks of Kamrup district.

Decadal Change in Landuse Patterns

The existing landuse pattern of an area is an outcome of a pretty long and sustained period of settled people. In an agrarian society land is the sole support of growing population, while the agricultural land is almost fixed in areal extent.[7] Population is relentlessly increasing and the growing numbers can be supported only if there is a proportionate increase in agricultural production by means of a more intensive utilization of land. This necessitates a constant process of adjustment and re-adjustment in the pattern of utilization for providing the barest standard of living to the population.

Pattern of landuse in Kamrup district is the result

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[7] Shastri, P. (1980). Changes in land use and cropping pattern in the cotton belt of Vidarbha, Perspective in Agricultural Geography. Vol. III, p.506.

of historical process of land exploitation within the framework of agro-climatic complex, which has been modified by the expansion of irrigation, population pressure and socio-economic requirements. The general landuse of the district has appreciably been transformed, each category of land has shown either increase or decrease. This interchange and mutual adjustment of landuse has partly helped to sustain large population of Assam, though at a low standard of nutrition. In order to study the changes in landuse in Kamrup district landuse in 1964-65 (pre green revolution) is compared with the landuse in 1974-75 (Post Green revolution).

Forest:

Area under forest in Kamrup is far below to the prescribed level yet it is striking each year owing to encroachment and destruction. In 1964-65, 117333 hectares of land was under forest, which recorded a decrease of 4.48 per cent (111974 hectares) in 1974-75.

The devastating deforestation during the period of 1964-65 to 1974-75 was a result of expansion contemplated a ruthless resumption of forested area for agricultural use in Assam. Large scale tree cutting for fuel and other uses also have a great impact on deforestation. The main dependence of the rural population on agriculture

TABLE-IV.5

Simple growth rate for General Land Uses from 1964-65 to 1974-75

Block	Net area sown	Area sown more than once	Current fallow	Old fallow	Cultivable waste	Land put to non-agricultural use	Barren uncultivable	Permanent pasture	Forests	Others
1	2	3	4	5	6	7	8	9	10	11
Barpeta	7.18	25.06	-14.39	-8.84	-13.5	9.62	-7.43	-11.30	-	39.35
Rupti	6.49	27.85	- 5.19	-0.90	-10.44	0.72	-3.56	- 6.92	0	26.98
Chenga	4.51	14.84	-12.19	-10.47	-16.66	6.99	-10.92	-18.54	0	26.62
Jalah	1.93	4.37	- 5.30	-1.17	- 3.92	3.65	-8.26	- 5.48	-0.17	32.57
Bagli	11.9	19.76	-16.37	-9.02	- 3.97	12.03	-8.26	-23.24	-	20.52
Bhavanipur	7.76	22.59	- 8.15	-7.30	- 18.53	5.34	-3.30	-22.24	-	9.82
Gobardhana	15.92	17.97	-14.58	-24.53	- 8.77	8.22	-8.56	- 8.37	-7.96	22.83
Mandia	10.63	8.11	-18.01	-24.66	-25.14	9.98	-3.60	-10.60	-	14.14
Jamalpur	6.42	7.13	-25.54	-24.56	-28.69	3.47	-17.30	-10.43	-4.75	3.87
Borigog	8.97	11.10	-45.50	-32.50	-29.95	18.59	-18.36	-18.18	0	16.16
Tihu	5.30	28.30	-15.21	-5.19	-35.24	19.42	-27.27	- 3.49	0	21.05
Borkheti	5.66	12.87	-13.51	-19.23	-43.71	3.02	-11.45	-12.08	0	- 1.09
Pub-Nalbari	6.16	5.23	- 8.51	-7.64	-18.07	8.79	-15.26	-19.75	0	37.26
Pachim Nalbari	7.45	5.61	- 6.61	-37.03	-33.24	3.04	-15.60	- 4.27	0	16.18

Table contd...

Table-IV.8 contd.

1	2	3	4	5	6	7	8	9	10	11
Rangia	3.89	9.13	-37.79	-28.95	-15.53	6.84	-31.25	-17.00	0	-10.52
Hajo	1.55	14.83	- 8.97	- 5.78	- 1.53	7.20	- 4.51	- 4.51	-13.50	8.91
Rani	10.07	26.66	-	-19.75	- 9.48	2.54	-13.45	-13.45	- 1.85	19.10
Boko	3.32	20.13	-	-15.55	- 9.63	8.72	-37.5	-37.5	- 2.57	-21.41
Chayagaon	5.23	3.38	-70.57	-30.35	-36.06	5.17	-27.60	-27.60	-39.82	- 3.15
Rampur	9.91	8.27	-17.42	-39.18	-21.52	4.08	-16.44	-16.44	- 3.39	7.15
Kamalpur	0	7.13	- 7.94	-13.69	-10.00	13.89	-17.54	-17.54	- 7.43	16.05
Chamaria	5.37	12.5	-21.50	- 5.69	- 4.49	7.30	- 4.18	- 4.18	- 4.18	69.69
Dimoria	1.20	19.48	- 4.68	- 7.74	- 5.41	2.36	- 3.11	- 3.11	- 3.12	11.32
Kamrup	5.82	13.01	-16.26	-12.47	-13.96	6.46	- 6.30	-11.60	- 4.48	4.61

Calculated from the Directorate of Economics and Statistics (Gauhati) Data.

is an important reason for the difficulties in acquiring more land for afforestation.

Deforestation has taken place in Kamrup district mainly in Chayagaon block (39.82 per cent). In this block the pressure of population has tremendously increased owing to large scale immigration of the Bangladeshis which forced the farmers to bring more area under plough for sustenance and settlements. A significant percentage of deforestation is found in Hazo, Gobardhana and Kamrup blocks.

Land under non-agricultural uses:

Table-IV.5 shows the percentage change occured in non-agricultural use in ten years time. A significant expansion or reduction of land under non-agricultural use depends on the development of industries, service sector, increase in population and implementation of land reclamation programmes in relation to limits imposed by the physical environment. The spatial changes in area under non-agricultural uses reveals an uneven distributional pattern though a general trend is that of a constant increase in all the blocks. The district has witnessed a total increase of 6.46 per cent of land in non-agricultural uses during the study period, with the maximum increase of 19.42 per cent in Tihu block, followed by

Borigog (18.59 per cent), Kamalpur (13.89 per cent) and Bagli (12.03 per cent). Land under non-agriculture use increased more than 8 per cent in Barpeta, Gobardhana, Mandi, Pub-Nalbari and Boko blocks. This is mainly due to the establishment of small factories, expansion of settlements, construction of mainly unmetalled and metalled roads and irrigation project which have taken cultivable wastes but mostly from the barren land and thus has increased the area under this category.

Barren and Uncultivable Land:

Development of irrigation and land reclamation programmes implemented by the State agencies have helped in reducing the barren and uncultivable land by 6.31 per cent in Kamrup district. The new agricultural technology under the green revolution in one hand and pressure of population in the other, reduced the percentage of the category of land in each of the blocks. Barren land declined significantly in Rangia (3.15 per cent), Tihu (27.27 per cent), Chayagaon (23.15 per cent) and Rani (20.07 per cent) blocks.

Permanent Pasture and other Grazing Land:

In Kamrup district, land under permanent pasture and other grazing land has declined in almost all the blocks. The significant decrease over 20 per cent occured in Boko, Chayagaon, Bhavanipur, Bagli blocks. In Borigog, Pub Nalbari, Rangia, Rampur and Kamalpur block the extend of decrease varied between 15 to 20 per cent. While in the remaining areal units below 15 per cent decreases was recorded. This heavy decrease of pastures can be attributed to the heavy increase in population pressure. The reduction in pasture has however affected adversely the protein intake of the people. Milk and butter infact is available comperatively in less quality per head of population these days. The change in land use practice have influenced not only the landscape but have affected the nutritional intake and habits of the population dependent on primary sector.

Cultivable Wasteland:

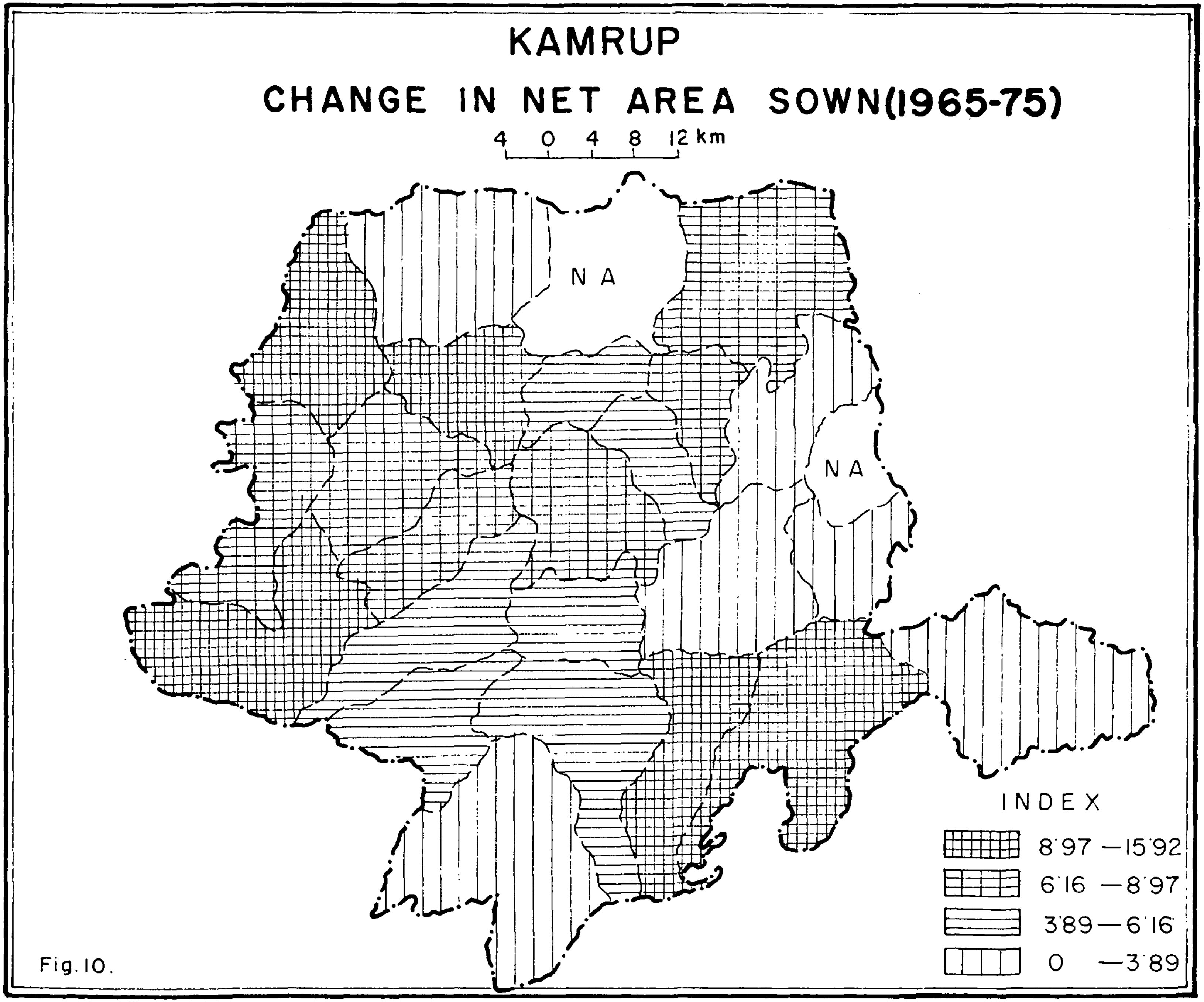
Cultivable wasteland has decreased in Kamrup considerably during the period of study. The major decrease in cultivable wasteland occurred in Borketi (43.71 per cent), Chayagaon (36.06 per cent), Tihu (35.24 per cent) and in Pachim Nalbari (33.24 per cent). In Mandia, Jamalpur, Borgog and Rampur blocks more than 20 per cent decrease has been recorded. In fact under the increasing pressure of population most of the cultivable land has been brought under cultivation and at present there is very little scope for horizontal expansion of agriculture in the area.

The magnitude of decrease in cultivable waste land is an ideal index for reckoning the extent of agricultural development. The impact of socio-economic and techno-organisational variables is reflected in the distinctive decrease in the extent of cultivable wasteland. The significant and constant decrease in this category of land became possible only due to some dynamic steps, such as the expansion of irrigation, more use of good seeds and fertilizer, the advanced reclamation technology and the rapid growth of population. In Assam, the cause of this change lies in Green Revolution and package programme and last but not the least immigration population which has revolutionized the land use practices in the State.

Fallow Land:

It may be seen from the Table-IV.5 that fallow land has significantly decreased in Rampur (39.18 per cent) Pachim Nalbari (37.03 per cent) and in Dorigog (32 per cent). A substantial decrease has been observed in Gobardhana, Mandia, Barketi, Rangia and Rani blocks. The volume of change varies from 19 to 25 per cent.

Fallowing of land has been a common practice all over the valley to increase the fertility of soils. But now owing to the short duration paddy seeds, adoption of


KAMRUP
CHANGE IN NET AREA SOWN(1965-75)
4 0 4 8 12 km
N A
N A
INDEX
8·97 —15·92
6·16 —8·97
3·89—6·16
0 —3·89
Fig. 10.

new crops and extension in irrigation, the farmers are growing crops all the year around. The pressure of population has put the farmer in a situation where he is compelled by the socio-economic constraints to grow one or the other crop without giving rest to the soil. The continuous occupancy of land by crops may provide more cereals to the farmers, but this practice is injuries to soil health and eco-system. Land reclamation programme development of irrigation and demand of more arable land stimulated agriculture colonization to encroach cultivation on more fallow land in almost all areal units of the Kamrup district. The area under fallow land decreased considerably in new irrigated areas of the district.

Net area Sown:

A substantial increase in the arable land has occured in the landuse of Kamrup district. The net area under plough has extended from 432325 hectares in 1964-65 to 457505 hectares in 1974-75, which recorded an increase of 5.82 per cent as a whole.

Figure-10 and Table-IV.5 reveals that net sown area has increased in all the component areal units of the area under study. This certain changes in net sown area shows that in Kamrup district during the observed period, appreciable transformation in agricultural land have taken place, which was by and large brought by the Green Revolution in the mid-sixties. Reclamation of cultivable waste and fallow land and extension of irrigation, new high yielding variety of rice and wheat, use of fertilizer and mounting pressure of population, increase in the end part of sixties and the first part of seventies are reasons behind this expansion of arable land.

TABLE-IV.6

Expansion of Arable Land

Class	Blocks	Degree
0 - 3.89	Kamalpur, Dimoria, Hazo, Boko, Rangia, Jalah	Very less
3.89 - 6.16	Barketi, Pub Nalbari, Tihu, Chenga, Chamaria, Chayagaon	Less
6.16 - 8.97	Rupti, Barpeta, Bhavanipur, Borigog, Pachim Nalbari, Tamalpur	Medium
8.97 -15.92	Rampur, Rani, Mandia, Gobardhana, Baghi	High

The conspicuous increase in net area sown is found in Gobardhana (15.92 per cent), Bagli (11.9 per cent), Mandia (10.63 per cent) and in Rani (10.07 per cent) blocks. This increase of net sown area have been taken place, when in these blocks fallow barren and pastures land had gone done significantly.

A sizeable amount of net area sown has increased in Rupti, Barpeta, Bhavanipur, Borigog, Pachim Nalbari and Tamalpur blocks varying from 6.16 per cent to 8.97 per cent. Increase in net sown area between 3.89 per cent to 6.16 per cent was recorded in Barketi, Pub Nalbari, Tihu, Chenga, Chamaria and Chayagaon blocks. An insignificant in the net sown area has been observed in Kamalpur Dimoria, Hazo, Boko, Rangia and Jalah (0 - 3.89 per cent) blocks.

Area Sown more than once -

A perusal of this data in Table reveals a picture which can't be described as magnificent progress, infact it is only 25 per cent of the total land cultivated more than once in 1974-75 and showing a change of 13.01 per cent on the Pre-Green Revolution period. The expected growth of area sown more than once is seriously hampered by inadequate irrigation facilities in most of the blocks.

The area sown more than once increased substantially in Barpeta, Rupti, Tihu and Rani community development block, where it varies from 20.63 per cent to 28.30 per cent. It increased reasonably in Bagli, Dimoria and Gobardhana blocks.

A meaningful and significant study of change in landuse can be drawn with the help of an analysis of inter correlations between the general landuse variables.

TABLE - IV.7

Matrix of Inter Correlations

1	2	3	4	5	6	7	8	9	10
1.00	0.19	-0.09	-0.36	-0.14	0.07	0.05	-0.06	0.13	0.09
	1.00	-0.42	-0.50	0.26	0.09	0.13	0.09	0.31	0.15
		1.00	0.58	0.46	-0.22	0.49	0.26	0.64	0.27
			1.00	0.56	0.05	0.48	0.25	0.35	0.52
				1.00	-0.12	0.22	0.04	0.20	0.26
					1.00	-0.20	-0.21	0.01	-0.07
						1.00	0.05	0.18	0.37
							1.00	0.24	0.39
								1.00	0.27

Variables

Calculated by the author.

1. Net area sown
2. Area sown more than once
3. Current fallows
4. Old Fallows
5. Cultivable waste
6. Land put to non-agricultural use.
7. Barren
8. Permanent Pasture
9. Forests
10. Miscellaneous.

Table-IV.7 reveals that most of the bivariate relationship between the general landuse variables are weak and insignificant. However, some positive as well as negative significant correlation have been found.

The paired variables being negatively correlated are area sown more than once and current fallows (r=-0.42 significant at 5 per cent levels) area sown more than once and old fallow (r = -0.50 significant at 5 percent) net area sown and old fallows (r = -0.36 insignificant at all levels) net area sown and cultivable waste (r = -0.14 insignificant at 5 per cent level).

The negative correlation between the area sown more than once with current fallow and old fallow are quite significant and strong. It can be infered that possibly to spare land for double cropping fallow land has declined in Kamrup district during the period of investigation.

The negative correlation between the net sown area with fallow land and cultivable waste, irrespective of being insignificant is suggestive of area needs a large scale reclamation of unculturable waste and fallow land. The negative relationship between the above variables further suggests that the increasing trend in the area sown more than once is attributed to a similar trend in the net area under cultivation. However the negative correlation between current fallow and land put to non-

non-agricultural use ($r = -0.22$ insignificant at 5 per cent levels). Land put to non-agricultural use and permanent pastures ($r = -0.21$) reveals the fact the former increases with the decreases in the latter.

It is distinct from the Table-IV.7 that Net Sown area and double cropped area is not efficiently brought from barren and permanent pastures, which are showing very insignificant relationship.

The paired variables being positively related include current fallows and old fallows ($r = 0.58$), old fallow and culturable waste ($r = 0.56$), current fallow and forests ($r = 0.64$), old fallows and miscellaneous ($r = 0.52$), old fallows and barren ($r = 0.48$). Relationship between these variable is insignificantly high at per cent levels of confidence.

The first pair current fallows and old fallows showing a high significant positive correlation because both these variables are declining together to provide land for double cropping.old fallow and cultivable waste area also positively related largely because of the same reason.

It can be seen from Table-IV.7 that old fallow possess a high positive relationship with miscellaneous and barren land. It implies that in Kamrup district as the area under old fallow decreases, there is corresponding decrease in the area under barren land and miscellaneous use.

In the last ten years, substantial change in the general landuse pattern of Kamrup district have taken place. Forest area has shrinked in most of the blocks. Fallowing practice has been discarded to intensify cropping in arable land. Imbalances have thus been resulted in the traditional land use owing to the technological changes and increasing pressure of population. The horizontal expansion of cultivable land is not possible as newland can not be brought under cultivation without heavy investment in the reclamation of marshy waterlogged are barren lands. The scarcity of land is accentuating the tension between the landowners and landless labourers. A more judicious and profitable use is therefore to be evolved to increase production on the one hand and to keep the eco-systems in the perfect operational health on the other. This can be achieved by adjusting and interchanging various categories of landuse till and ideal set up is evolved to each geographical situation of the region.

Decadal Change in Cropping Pattern:

Cropping pattern means the proportion of area under various crops at a point of time. It is a dynamic concept as the cropping mosaic goes under transformation. In fact, no cropping pattern is ideal for all times to come. The cropping patterns differs from macro to micro regions both in space and time, depending on the physical, socio-economic and technological factors.

In Kamrup district, the cropping pattern is mainly on the traditional system of subsistance paddy farming in which every farmer attempts to produce everything for his family consumption. Such a cropping pattern is based on utilization of the inherent fertility of soil without much use of modern agricultural inputs and technology. Some transformation of traditional cropping structure can be seen in the district, yet food crops dominate the Kharif and rabi seasons. The crops grown by the farmer of Assam are of great variety due to appreciable range in the factors of natural environment and human element having different preference in food habits and the degree of market orientation.

Cropping pattern in this district has undergone limited changes during these ten years. Table-IV.8 The ratio of food crops and non-food crops to gross cropped area are almost stagnant. Rice, owing to the agro-climatic and cultural set-up is the dominant crop and continue to be so in the near future. But the position of second ranking crops is changing in the different blocks as the

TABLE-IV.8

Simple Growth Rate for Agricultural Crops from 1964-65 to 1974-75

64-65 74-75

Block	Rice	Wheat	Rape and Must-ard	Jute	Sugar cane	Vege-tables
Barpeta	8.08	53.88	13.10	18.03	12.63	18.63
Rupti	5.54	58.64	22.32	9.40	19.82	20.70
Chenga	3.96	50.89	21.66	7.37	7.27	69.13
Jaleh	4.40	43.03	9.61	10.77	10.64	29.21
Bagli	4.02	91.82	18.55	19.05	21.92	39.97
Bhavanipur	6.82	66.90	24.76	7.99	7.85	43.36
Gobardhana	3.02	36.40	3.32	8.90	7.04	26.52
Mandia	4.67	50.00	5.16	7.46	11.54	15.82
Jamalpur	3304	38.73	0.67	1.05	14.97	27.57
Borigog	9.16	165.30	13.89	0	28.85	0
Tihu	4.04	73.16	21.88	4.52	49.25	14.94
Borkheti	9.91	140.27	5.56	1.56	13.04	-
Pub-Nalbari	10.29	84.06	17.96	15.01	55.61	-
Pchim Nalbari	7.28	185.32	22.94	18.51	48.78	14.60
Baska	3.88	164.59	189.47	9.42	27.48	8.71
Rangia	2.51	104.94	6.92	0	36.45	11.29
Hajo	27.78	55.42	9.45	6.79	89.90	45.38
Rani	6.57	0	7.29	69.23	100.00	5.00
Boko	3.20	148.09	4.50	25.13	63.55	25.00
Chayagaon	8.04	-	8.37	19.32	23.80	9.32
Rampur	2.02	67.91	20.39	15.42	104.30	20.74
Kamalpur	6.93	48.76	13.21	0	8.51	0
Chamaria	9.85	82.09	7.12	28.87	127.27	28.83
Dimoria	3.80	84.30	21.92	37.86	15.62	150.00
Karora	10.68	84.16	4.95	7.59	22.48	28.43
Kamrup	8.47	88.0	17.42	13.33	15.62	25.48

Calculated from the Directorate of Economics and Statistics (Gauhati) Data.

farmers seem to try new combination of crops to optimise their income and thereby, the standard of nutrition and economic prosperity.

It will be seen from Table-IV.8 that rice is the most important crop in Kamrup district. It occupies over 69.0 per cent of the gross cropped area in the district. In Kamrup area under rice has increasec by 8.47 per cent during 1964-65 to 1974-75. This increases in the area under rice is almost in the same proportion as the increase in gross cropped area which shows that multiple cropping of rice has been intensified in new areas.

A blockwise analysis reveals that in Hazo and Rampur increase in area of rice is significantly high which is more than 20 per cent. High yielding varieties widely introduced in Hazo where it occupied 14.21 per cent of net sown area. Rice has sown an increase of 5 to 10 per cent in Barpeta, Rupti, Bhavanipura, Borigog, Barketi, Pub-Nalbari, Pachim Nalbari, Rani, Chayagaon, Kamalpur and Chamaria blocks. In the remaining blocks, area under rice has increased by less than 5 per cent.

Introduction of dwarf varieties is changing the composition of food grains output. Now HYV of rice are grown in the place of coarse grains millets and pulses. This is particularly due to the technological change which has favoured rice and partly to the price policy which has in effect, ensured support for price of rice. The proportion of rice in total food grains output has increased by 12 per cent. Other crops like caster seeds, tobacco, Matikalai, Small-millets showed a declining trend. The important one to suffer being small millets and pulses. This shift in the output structure has come about alongwith a shift in the share of gross cropped area.

Rape and Mustard:

Oilseeds (rape and mustard) is the second important crop in Kamrup which grows in the rabi season. It may be noted from Table-IV.8 that the area under rape and mustard has increased by 17.42 per cent after Green Revolution. The linear growth rate of area under mustard and rapeseed being 4.54 per cent.

A block level analysis shows that in Baska block rape and mustard extended its area 187 per cent to the previous period. A tremendous development in lift irrigation made this magnificient growth in this block. This increase varies between 20 to 25 per cent in Rupta, Chenga, Bhavanipur, Tihu Pachim Nalbari, Rampur and Dimoria blocks. In the other parts of the district, extension of area under oil seeds is less than 20 per cent. Increase in rape and mustard area can be attributed highly remunerative price (crises in 1960-70) of the commodity which fetches handsome amounts to the farmer in the months of February and March when the farmers do not have any other source of income. The new seeds of black mustard in fact are performing well under the moist soil condition of the valley.

Jute:

Jute is the third major crop in Kamrup district after rice and oilseeds. The simple growth rate of jute area increased between 1963-64 to 1973-74 is 13.13 per cent, whereas the annual linear growth is 1.10 per cent. It will be seen from Table-IV.8 that the outstanding increase in area of jute occurred in Rani (69.23 per cent), Dimoria (37.08 per cent), Chamaria (28.27 per cent) and in Boko (27.13 per cent). In other parts of the district its areal increase is less than 20 per cent. Among them some significant blocks are Barpeta (18.03 per cent), Pachim Nalbari (18.51 per cent), Chayagaon (14.32 per cent). This steady increase in jute area is found in the areas where people from Bangladesh is high. The immigrants in fact, have a long traditions of jute cultivation and they have diffused this cash crop in the division of lower Brahmaputra, which are close to Bangladesh.

Wheat:

Traditionally, Kamrup is a rice growing district, but the introduction of High Yielding Varieties of wheat has brought a structural change in the landuse pattern of the district in the rabi season. Its area has expanded and production has increased in all the areal units during the period of 1963-64 to 1973-74. Simple growth rate of area under wheat during ten years time was 145.98 per cent with a linear rate of 45.30 per cent which is fairly above the national average.

Table-IV.8 shows that wheat area has increased by more than 100 per cent in Borigog (165.30 per cent), Borketi (140.72 per cent), Pachim Nalbari (185.32 per cent), Baska (140.72 per cent), Boko (148.09 per cent) and in Rangia (104.94 per cent) blocks.

In Bagli, Chamaria, Dimoria, Tihu, Pub Nalbari and Karora blocks wheat increased its area by 70 to 100 per cent, where as in other blocks area of wheat extended by 36 to 70 per cent except Rani block where no change has been found in the wheat area during this time.

The important varieties of wheat adopted by the Kamrup's farmers are Larma-roza and Sonara-64. These varieties proved to be great success and it appears that Kamrup can produce large quantities of wheat if the required package inputs are provided to the medium and small size farmers.

Looking at the performance and expenses of wheat in all the blocks of the district irrespective of their agro-climatic condition, it can be said that during the last ten years, wheat is the only crop which has shown a strikingly upward trend in area, yield and production. The district thus has a great potentials for wheat which can be grown with artificial controlled irrigation in the winter season when skies are generally clear, a condition required for the High Yielding Varieties of wheat. It is encouraging to see that some of the highest per acre yields of wheat 1974-75 were obtained from Assam. The Green Revolution imprints can be seen at least in the case of wheat in the Kamrup District.

CHAPTER - V

AGRICULTURAL EFFICIENCY

The extension of cultivation is not a matter of significance at present except for achieving local gains. Intensity of cropping, extent of maturity and increasing the yield from the existing cultivated area are problems of paramount importance in the agricultural economy of India.[1] These need a serious thought by the planners. Under utilization of land is not problem in India, since most of the topographically accessible area for cultivation is already under the plough, but the problem of under use of the net area sown under productivity and the risk of crop failures are taxing the rural population. It would be useful gain to overcome these problems in the forseeable future. Hence, it is desirable to investigate the degree of efficiency with which the net area sown is utilized. In the case of Assam and specifically in Kamrup district this problem is being felt much more urgently, where pressure of population created a serious socio-political crisis in this whole region. So in this chapter an attempt has been made to find out the spatial and temporal variation of cropping intensity of the Kamrup

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[1] Singh, J. (1974), An Agricultural Atlas of India, A Geographical Analysis, Kurukhestra, p.139.

district from 1964-65 to 1974-75, secondly the existing patterns of crop combination have been examined to identify the relative strength of different cereal and non-cereal crops after Green Revolution and lastly the levels of agricultural development in Kamrup have been ascertained.

Landuse efficiency is defined as 'the extend to which the net sown area is cropped or resown'. The total cropped area as a percentage of net area sown gives a measure of landuse efficiency which really means the intensity of cropping.[2] An enormous pressure of population on agricultural resources created an alarming situation in Assam today when the frontiers of arable land have almost been pushed to the limit. It would seem imperative that the Assamese farmers should raise more than one harvest from the same field to meet the needs of the population increasing at a faster rate than ever before. The other way to increase production is to improve hectare-yield efficiencies, but after an optimum limit which follows than Law of Diminishing returns where output does not increase according to the increased investment. Therefore intensive utilization of the net area sown is one of the effective means of meeting the food requirements. Keeping this in view an attempt to examine the regional variation, to display the changes in the extent of landuse efficiency and to demarcate areas

[2]Singh, J. (1974), Op.cit., p.139.

of poor performance in the utilisation of the net area sown in Kamrup is well worth effort.

For the demarcation of cropping intensity a number of statistical techniques have been evolved and used, one of such techniques, adopted by the Directorate of Agriculture, Government of India is,

$$\text{Cropping intensity} = \frac{\Sigma a_{ij}}{\Sigma a_{io}} \quad \frac{N_j}{N_o} \times 100$$

where a_{ij} = area under the i[th] crop in the j[th] year.

a_{io} = area under the i[th] crop in the lease year.

N_j = net area sown in the j[th] year.

N_o = net area sown in the base year[3]

After consulting this technique, it has been felt that it gives a better result in a much more crop diversified area than the Kamrup district where rice having a monopoly all over the region. In order to overcoming the said techniques the author has adopted Pathak's technique for the delineation of crop intensity regions.[4] One technique can be stated as below:

$$\frac{\text{Gross cropped area}}{\text{Net sown area}} \times 100$$

During 1974-75 the area sown more than once for the

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[3]Hussain, M. (1979), Agricultural Geography, New delhi p.118.

[4]Pathak, H.G.(1977), A Study in Methodology and crop Association region and their role in agricultural regionalization. The National Geographical Journal of India,p.79.

TABLE-V.1

<u>Intensity of cropping</u>

Block	1964-65	1974-75	Change 1964-65 - 1974-75
Barpeta	137.6	143.60	6.24
Rupti	136.31	143.59	7.28
Chenga	139.67	143.60	3.93
Jalah	142.57	143.60	1.03
Bagli	140.72	143.60	2.88
Bhavanipur	138.83	144.29	5.96
Gobardhana	142.84	143.60	.76
Mandia	144.71	145.84	1.13
Tamalpur	135.62	136.05	0.43
Borigog	134.10	134.75	.05
Tihu	144.50	147.44	2.44
Barketi	148.37	151.76	3.39
Pub Nalbari	131.36	132.68	1.51
Pchim Nalbari	137.17	137.52	0.35
Rangia	138.62	140.50	1.85
Hazo	136.38	141.13	4.75
Rani	107.72	108.89	1.17
Boko	133.21	138.62	5.41
Chayagaon	129.80	131.28	1.48
Rampur	108.62	109.49	.87
Kamalpur	135.72	138.26	2.54
Chamaria	114.75	115.75	1.00
Dimoria	116.13	119.45	3.32
Karara	122.25	122.85	.65
Kamrup	139.40	141.88	2.44

Kamrup as a whole was 210047 hectares of which about 81.74 per cent was in the sub-divisions of Nalbari and Barpeta.

The extent of which cropping has been done on the net area sown is recorded in Table-V.1 . The most direct expansion of the variation in the areal distribution of cropping intensity have, of course, reference to the effect of rainfall, relief, irrigation facilities, pressure of population, human traditions and initiatives and the methods practised. A successful season of monsoon in time leave the field ready for rabi crops and it is also the controlling factor for the intensity of cropping in irrigated areas. Further, the normal monsoon is one of the primary determinants affecting the use of net area sown because of maximum dependent on dry farming.[5] In Kamrup about 76 per cent of the net sown area is still dependent on rain for crop husbandry, therefore the impact of uncertain monsoon arrivals and retreats on the intensity of cropping is very much there. However, monsoon rain is just enough in Assam to support only one agricultural season. Rugged terrain, forest and unfertile soil are not allowing to extend net sown area in some of the parts of Kamrup district. The land with good irrigation facilities is always a positive factor for cropping intensity, this factor matters much, when studying a micro-region like Kamrup district, because the areal differences of climate and relief are relatively less and variation within these factors shows a original picture. Population pressure and traditions controlling the cropping intensity in this region in a large scale. High intensity is found in parts where density of population

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[5] Singh, J. (1974), Op.cit., p.147.

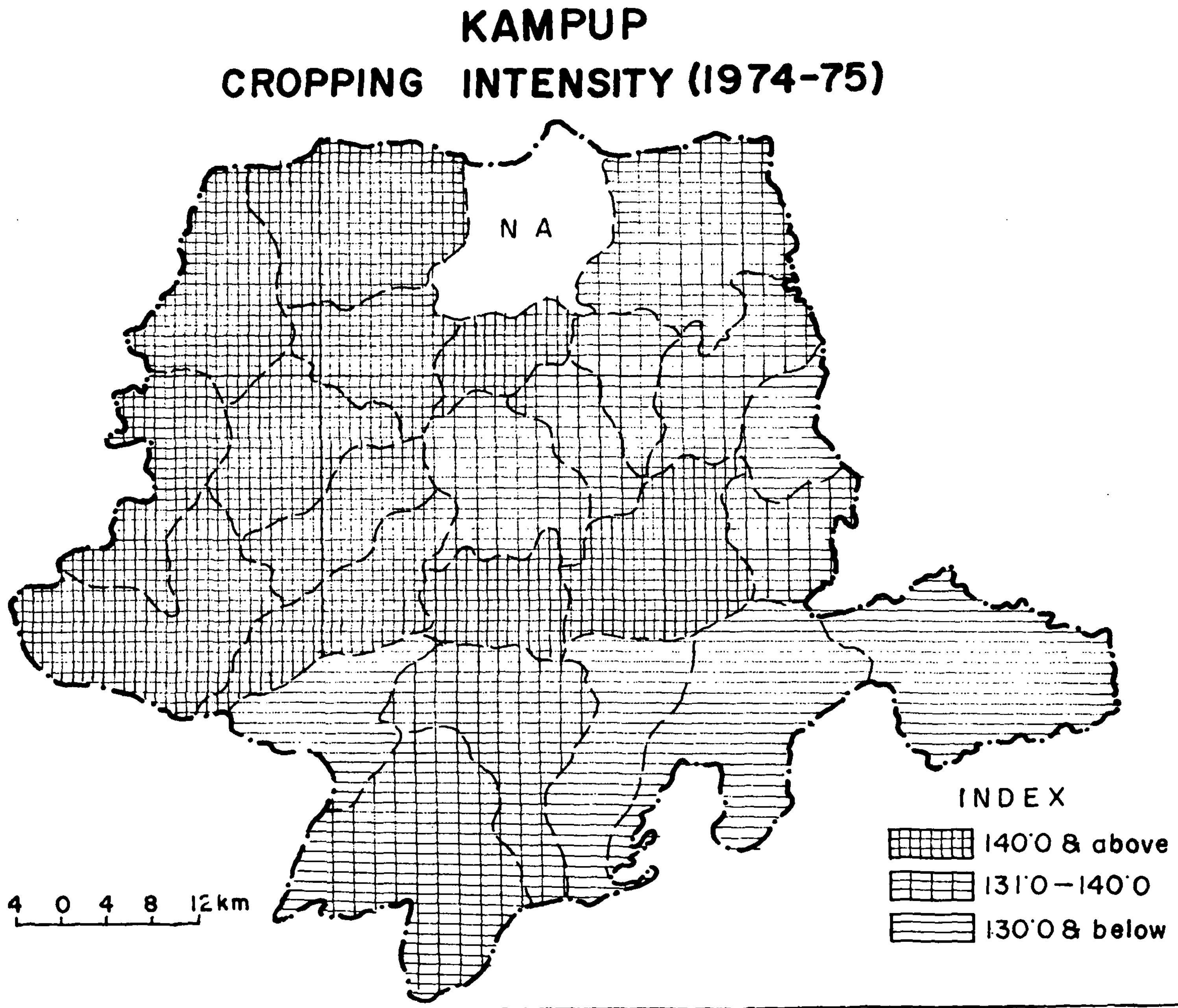
KAMPUP
CROPPING INTENSITY (1974-75)
N A
INDEX
140·0 & above
131·0—140·0
130·0 & below
4 0 4 8 12km

Fig. 11.

is high and it is showing a low trend where rural population density is low. Moreover high intensity is also found in the Bengali dominated areas. In the tribal areas also the intensity is low as they practice Jhuming in which only one crop in a year is grown.

In all the blocks of Kamrup district, the total cropped area exceeds the net area sown because there is always a part of latter which is sown during both the crop seasons. In Kamrup the intensity of cropping varies from slightly above 109 to over 151 per cent exhibiting a regional disparity.

The identified three categories have been plotted in Figure-11 and for the purpose of discussion these categories have been grouped into three empérical regions.

TABLE-IV.2

Intensity of Cropping(1974-75)

Class	Degree	Blocks
Below 130.0	Low	Rampur, Chamaria, Dimoria Rani, Karara.
131.0 - 140.0	Medium	Chayagaon, Boko, Pub and Pchim Nalbari, Rangia, Tamalpur, Borigog,Kamalpur.
above 140.0	High	Barpeta, Rupti, Chenga, Jalah, Bagli, Bhavanipur, Gobardhana, Mandia, Hajo, Barketi, Tihu.

Calculated from the Directorate of Economics and Statistics (Gauhati) data.

Areas of low intensity are in those blocks which have either large areas under forests or hills or where there is soil moisture deficit and irrigation facilities are not available. Chamaria, Rampur, Rani and Dimoria blocks fall under this category. The southern parts of all the blocks is much dissected by residual hills, covered with dense forest and bamboo jungles, which reduce the extension of the arable land. Moreover, these blocks are inhabited by Boro and Kachari tribes who practice shifting cultivation. In the northern parts of these blocks, the intensity of agriculture is high as the soil is alluvial deposited by the Brahmaputra and its tributaries and the population is that of immigrants who are known for their hard work and agricultural skill. Some of the 'Chars'[6] are also located in this part, which are highly fertile and on which normally more than one crop is grown in a year. Karara is the only block located in the northern part of Brahmaputra which has a low intensity. This low intensity of agriculture is may be because irrigation facilities are inadequate and the population is predominantly Assamese who consider the cultivation of other crops like vegetables and mustard as an inferior activity. In the blocks dominated by Assamese rice, jute, millets, pulses are the major kharif crops, while in some blocks a small acreage of land is devoted to rabi pulses and mustard.

[6]Char - River island.

Areas of medium intensity index are confined to Chayagaon, Boko, Pub and Pchims Nalbari, Rangia, Tamalpur, Borigog and Kamalpur blocks. These are the areas in which either the irrigation is inadequate or the terrain and pedological conditions restricts the farmers to grow only one crop (Kharif) in a year. The intensity of cropping is not always determined by irrigation, relief, soil and human traditions, but also the pressure of agricultural population. Because a denser agriculturally populated area must tend to produce much more crop than the less populated area. The blocks having low density and less dominance of the Bengalis (Pub and Pachim Nalbari, Rangia, Borigog) have generally little area under double and multiple croppings.

The high intensity of agricultural landuse is found in Barpeta, Rupti, Chenga, Jalah, Bagli, Bhavanipur, Gobardhana, Mandia, Hazo, Barketi, Tihu blocks. The major parts of higher intensity area lies in north-western part of the district. Irrigation facilities and physical support is almost same as in the medium intensity area - but one factor, which is making all the differences is re-settled people. A sizeable population of these blocks came from Bangladesh who are generally laborious and enterprising. These people within a moderate physical and socio-economic support extended sown area as much as it possible. A good amount of land in these blocks devoted to rabi pulses, vegetables and oil seeds. Wheat as a new crop has also been diffused in these blocks significantly. Borketi (151.76), Mandia (145.84) and in Tihu (147.74) are some of the important blocks where cropping intensity is high because of their presence.

4.
Volume of Change in Intensity of Cropping:

The recent changes (1964-65 - 1974-75) in the extent of the double cropped area in Kamrup district mainly because of the high growth of rural population (7.39 per cent) and partly because the expansion of irrigation (2.30 per cent), growing of cash crops, incentive and initiative of peasant proprietors are some other factors which govern the cropping intensity. The growth of rural population increased mainly by the immigrants from Bangladesh. They are both Hindus and Muslims and settled besides Brahmaputra river, which is one of the most fertile tract of India. Their tremendous urge and suitable physical support made a phenomenal increase of double cropped area in this district. The agricultural statistics show that area sown more than once in this district is showing a growth rate of 16.7 per cent from 1954-55 to 1964-65 and 11.6 per cent from 1964-65 to 1974-75. The actual area increased from 157572 hectares in 1954-55 to 187928 hectares in 1964-65 and 210047 hectares in 1974-75.

On the other hand rural population has increased by 53.11 per cent from 1954-55 to 1964-65 and by 39.36 per cent from 1964-65 to 1974-75. This phenomena indicates a positive correlation between population pressure and land-use intensity. Irrigation has been playing a vital role in the extension of double cropped area in other parts of the country, but in Assam, in general and in Kamrup district in particular the expansion of irrigation is so less that it cannot be taken as a major determinant.

During the Adhoc Annual Plans (1966-67 to 1968-69) for the first time a few quick maturing High Yielding varieties were introduced in the district by both local and immigrants farmers and only 13.1 per cent of area under High Yielding rice in the district by 1974-75.

TABLE-V.3
Volume Change (1964-65 - 1974-75)

Class	Frequency	Degree	Blocks
> 2.0	13	Low	Karara, Chamaria, Rampur, Chayagaon, Rani, Rangia, Pub Nalbari, Pachim Nalbari, Borigog, Tamalpur, Mandia.
2.1 - 4.0	6	Medium	Bagli, Tihu, Barketi, Kamalpur, Chenga, Dimoria.
< 4.1	5	High	Boko, Hazo, Bhavanipur, Barpeta, Rupti.

The above Table-V.3 reveals that inspiteof population growth there is not a corresponding increase in the double cropped area in all the areal units under review. Inadequate irrigation facilities, shortage of fertilizer, good seeds, small holdings and capital area some of the impediments which are restricting the intensification of crops.

It may also be noted from the Table-V.3 that the volume of change in intensity of cropping vary between as low as 0.5 per cent in Borigog to as high as 4.75 per cent in Hazo community development blocks. Significant change (over 4.1 per cent) in intensity of cropping comprise those areas where marginal increase of population by the immigrants have been found. It may also be noted that the Bengalis who entered in the district during sixties have settled in the fertile tracts of the northern banks of Brahmaputra while those who came after 1971 are settling in the southern side of the river.

Moderate increase in multiple cropping is found in the areas where irrigation facilities have been extended recently, for example - Bagli (6.26 per cent), Kamalpur (8.26 per cent), Tihu (4.01 per cent) are under double cropping. Diffusion of High Yielding Varieties is another factor which keeps these blocks ahead of the other blocks in cropp ing intensity.

Low increase in cropping intensity is noticed in Rampur, Chayagaon, Rani, Mandia, Gobardhana, Tamalpur and Jalah blocks. In these blocks terrain, pedological conditions and forest covers come in the way of multiple cropping.

From the preceding discussion it is evident that the role of pressure of population is important in determining the intensity of cropping than any other factors in Kamrup district.

Crop Combination (1974-75)

Delineation of crop combination is imperative for a scientific agricultural land use planning crop combination given an idea about the agricultural typology, agricultural practices and agricultural income on the one hand and on the other it gives an insight in the cropping practices and rotation of crops are quite pertinent for the maintenance of soils fertility and their health.[7]

The growing demand for food to feed the tremendously increasing population and the physical restriction in the expansion of arable land demand a careful and judicious utilization of land by selecting appropriate crop combinations to increase production and to save soils from being leached and depleted. It is, therefore essential to

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[7]Hussain, M. (1982), Crop Combination in India, New Delhi, p.61.

identify and to adopt the crop combinations for each agricultural set-up which can give optimum agricultural returns and can provide employment to the farmers and dependent unskilled labour force throughout the year. Such practice can go a long way in overcoming many of the socio-economic problems of our rural masses. Moreover, cropping patterns and their combination area geographical reality which demand identification and definition. In fact a systematic study of crop combination and their dynamics in space and times helps in ascertaining the major crops which constitute cropping structure on which the agricultural income, level of nutrition and standard of living of the rural population depend. By paying more attention towards the major constitutent crops of a region the farmers can increase the production of food and raw materials on which the economy of our country hinges. While doing so the less important crops can be excluded from the combination and the land thus spared could be given to crops which perform well at a reasonably low level of inputs.[8] Keeping this fact in view in the present chapter an attempt has been made to delineate the crop combination in the post Green Revolution period.

For the delineation of crop combination regions,

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[8]Hussain, M. (1982), <u>Op.cit.</u>, pp.37-38.

geographers have applied a number of simple and sophisticated statistical techniques. Such techniques vary from arbitrary choice method to the deviation approach. However most reliable and rational approach for the delineation of crop combination was given by weaker.[9] In his study, weaker demarcated crop association developed in terms of variables based on certain differences which are relative and not absolute. This method being used on statistical approach is more scientific and authentic. Weaver's technique for crop combination regions has been modified by the experts of agricultural and urban geography. Doi simplified the standard deviation technique and Rafiullah used the positive standard deviation method for the functional classification of towns. Some geographers using productivity of different crops to delineate the crop combination regions. In the present work the most commonly applied techniques for the delineation of crop combination regions i.e. the standard deviation method has been applied. In his study, weaver has taken into account the percentage of crops area to the total cropped area and has calculated deviation of real percentage for all the possible combination in the component areal units against a theoretical standard. The theoretical value is 100 per cent, if the gross cropped area for mono culture,

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[9] Weaver, J.C. (1954), Crop Combination Regions in the Middle West, <u>The Geographical Review</u>, pp.175-209.

50 per cent of or two crop combination and 25 per cent for four crop combination and so on.

For the determination of the minimum deviation for each of the component areal unit, the standard deviation method given below was applied.

$$\delta = \sqrt{\frac{\Sigma d^2}{n}}$$

However, as weaver has pointed out since relative rank of the amount of deviation among the several combination was desired and not the actual magnitude of deviation, the square root was not extracted in accordance with the Standard Deviation Formula. The specially used varient procedure thus could be expressed as follows :

$$\delta = \frac{d^2}{n}$$

Weaver's method was admirably been accepted and applied for the demarcation of crop combination and agricultural regionalization as its application results into suitable and accurate grouping of crops. The technique, however, gives most unwieldly combination for the areal units of high crop specialization.[10]

The application of Standard Deviation method shows a great diversity in the crop associations varying from one areal unit to another. Out of the twenty four blocks of

[10]Hussain, M. (1982), Op.cit., p.25.

the district, twelve are dominated by mono-culture of rice and the other eight have a two crop combination. There is however four blocks which have three crop combination. The small number of crop combination can be attributed to the almost uniform distribution of rainfall in the valley of Brahmaputra and the traditional paddy subsistance economy of the farmers in which they have expertised with great skill and dexterity.

TABLE-V.4

No. of Crops	Frequency	Name of the Blocks
1	12	Tamalpur, Borigog, Tihu, Barketi, Rangia, Hazo, Rani, Boko, Rampur, Kamalpur, Dimoria.
2	8	Barpeta, Rupti, Chenga, Jaluh, Bagli, Chayagaon, Chamabia, Karara.
3	4	Bhavanipur, Gobardhana, Mandia, Pub Nalbari.

Mono Culture

Mono culture of rice is the dominant feature of the agricultural landscape of Kamrup district out of the twentyfour community development blocks of the district, twelve are under mono-culture. Rice occupied over 70 per cent of the cropped area in these blocks. This rather heavy concentration of rice cultivation at the cost of other crops is not due to any specialization or commercialization of agriculture in this area. It is a result of

KAMPUP
CROP COMBINATION
(1974–75)

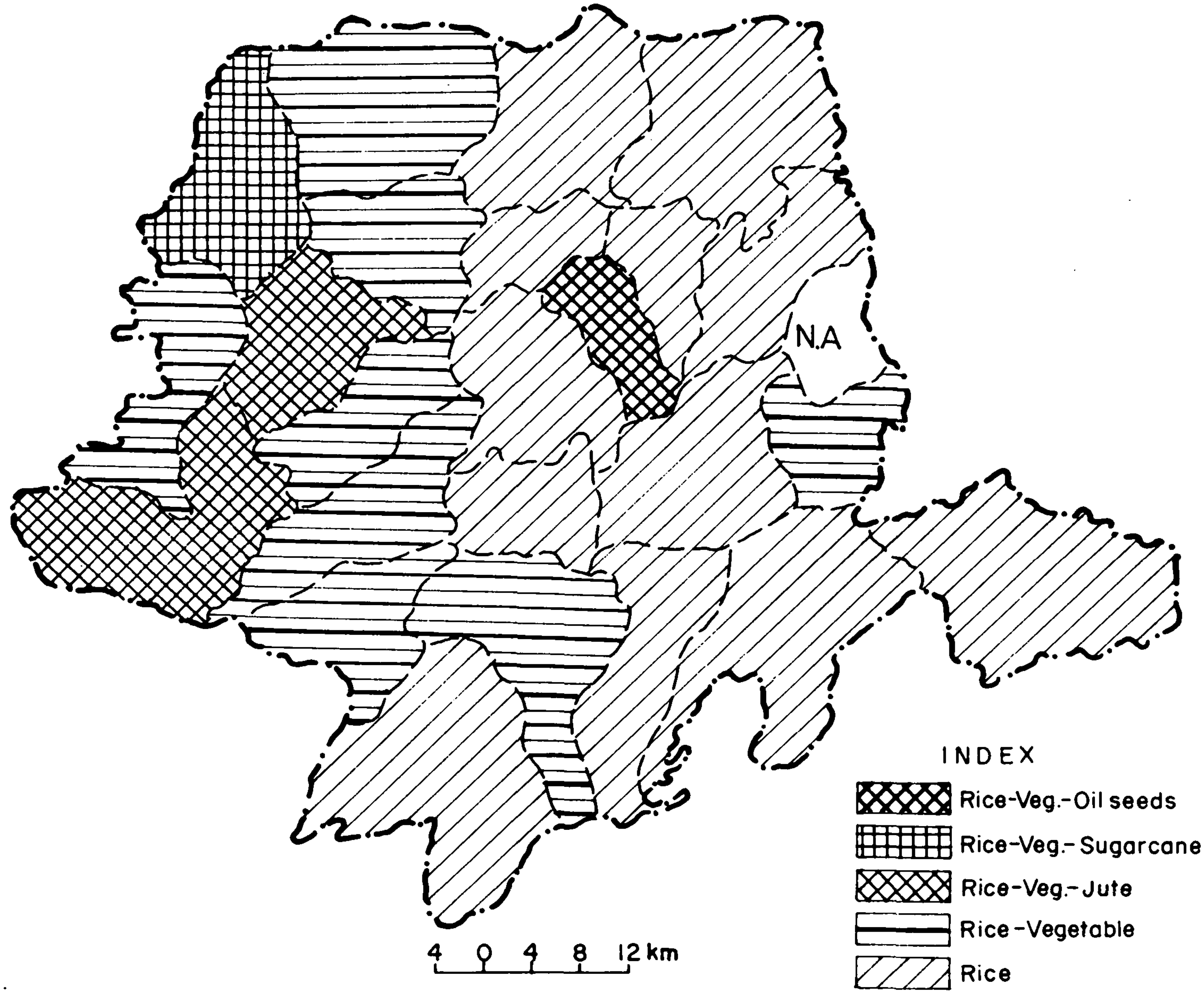

Fig. 12.

a number of limitation suffered by this area. Flat low-land, high temperature (average temperature required 20 to 30°C), heavy rainfall during the monsoon period, and highly fertile soil of the valley, which is stiff clay and clay-loamy with a heavy texture which makes it exceptionally suitable for paddy cultivation, are largely responsible for the heavy bias of the farmers towards rice cultivation. On the other hand irrigation is significantly low in the district for supporting rabi crops and moreover rabi crops require a light soil which is rarely found in these blocks. Apart from these favourable condition, which is more important in this region is a traditions, which support paddy as a mono crop. Both for Assamese and Bengali farmers still rice is the only stable crop. Moreover, it has been observed that mono crop region sprawled over mainly on central part of the district, Fig. 12, where Assamese farmers consider except rice, cultivation of other crops as an inferior activity. The spready and intensification of rice in large number of units can also be attributed to the introduction, adoption and diffusion of the High Yielding varieties and high density of population.

Two Crop-Combination

As many as eight blocks in Kamrup district got the designation of two crop combination which have been sown in Fig. 12. The constituent crops of the combination of two crops were, Rice and vegetables. More than one third area of the Kamrup district is dominated by two crop system. Thus two crops account for nearly 75 per cent to Gross sown area in all the blocks. The two crops combination is found mainly in the Barpeta sub-division's blocks and in Chayagaon, Chamaria and Karara blocks in Gauhati sub-division. It's interesting enough to note that except Karara all the blocks having sizeable amount of immigrants population. A remarkable feature of the crop combination of these blocks is that next to rice, vegetables are the second major crop in all the blocks. Sandy or silty and less acidic soils of Barpeta and 'Char' areas of Brahmaputra used to see a great variety of vegetables both in rabi and Kharif seasons. It has been noticed from a direct investigation during the field survey by the author that the farmers of Barpeta, Rupti, Chenga and Bagli blocks growing vegetables in both the season and there is a good amount of land given permanently only to vegetables. And in Chamaria, Chayagaon blocks farmers in the Kharif season devote their land to rice and in the rabi season vegetables is the favourite crop.

Three Crop Combination

Three crop combination has been observed in four areal units. Three crop combination, sprawled over in

Bhavanipur, Gobardhana, Mandia and Pub Nalbari blocks.

In the blocks of Bhavanipur and Mandia, rice vegetables, jute formed three crop combination, which occupied over 80 per cent of the total cropped area in the year of 1974-75. Agro-climatic condition in Kamrup district is mostly suitable for this crop combination. However another two different three crop combination has been found in Gobardhana (Rice-vegetables-Sugarcane) and in Pub Nalbari (Rice-vegetables-Rape and mustard). It has been felt that due to two oil mills in Nalbari, farmer are growing rape and mustard in relatively large scale (6.20 per cent gross cropped area) than the other blocks.

Crop combination in Kamrup district shows that still subsistance traditional agriculture is dominating the agricultural mosaic. The overwhelming position of rice as a mono crop, reveals the backwardness of the agriculture, though mono-cropping can be a symbol of extreme speciali-zation and modernization in the modern concept of agri-cultural geography.

Two crops and three crops combinations also do not suggest a market oriented agriculture in the region, because a very little area is devoted to these crops and they are grown mainly for their family requirements. However, a process of semi-commercialized market oriented agriculture has been started amongst the Bengali farmers. In fact recently the agricultural income of many of the farmers has gone up in some of the blocks in Kamrup district as well as in whole Brahmaputra valley. And this has increased income disparity in the rural areas.

TABLE-V.5
Blockwise Crop Combination

No. of crops	Crop combination	Blocks
2	Rice-vegetables	Barpeta, Rupti, Chenga, Jalah, Bagli, Chayagaon, Chamaria, Karara.
3	Rice-vegetables-Jute	Bhavanipur, Mandia
	Rice-Vegetables-Sugarcane	Gobardhana
	Rice-Vegetables-Rape & mustard	Pub-Nalbari

Levels of Agricultural Development

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

industry and so on, in terms of some selected economic indicators.

Agriculture being the backbone of the national economy, the study of regional disparity in the levels of agricultural development draws urgent attention of research to evolve a rational and pragmatic policy at the micro-levels. The present study, is, however, an attempt to highlight the levels of development in agriculture attained so far, in the Kamrup district of Assam, considering the community development block as the unit of study. Agricultural development in Assam has been conditioned by several factors viz., lack of necessary institutions, the largely unstable agricultural economy subjected to recurring floods, erosion and other natural calamity, inadequate communication facilities, lack of power etc., which are not so pronounced in other parts of the country. Kamrup district being located almost in the heart of the valley appears to have had numerous socio-economic and physical disadvantages for achieving the goal of an advanced and mechanised agriculture, unlike the other districts within the valley of Brahmaputra. It is, therefore vital to assess and evaluate the levels of agricultural development achieved by each component areal unit in terms of some selected socio-economic variables within a spatial frame-work.

Problems of regionalisation have always been related with physical and socio-economic characteristics of any region. Since such characteristics are only partially reflected by several variables and these have been measured through all related variables, a composite picture from some selected variables may be extracted by working out a composite index from them.

In order to measure the agricultural efficiency in England and Wales, Kendle[11] tried to sort out the areas of high and low agricultural productivity. Hence for the purpose, he took the countrywide data or per acre production of different crops. Before preparing the composite index of agricultural efficiency the scale effect was eliminated by converting the production per acre of each crop into ranks. So far as the weightage problem was concerned, each crop was given equal weightage.

Ashok Mitra[12] also classified the Indian districts into four quartiles of development by using Kendall's method of preparing composite index. He took as many as 35 indicators of regional development. A Kundu[13] has also given

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[11]Kendall, M.G.(1939), "The Geographical Distribution of Crop Productivity in England", JRSS, Vol.102, No.21, pp.23-25.

[12]Mitra, A.(1961), Levels of Regional Development, Census of India, Vol. 1, Part I-A(ii).

[13]Pathak, C.R. and Kundu, A.(1973), 'A Critique of the Techniques for Measuring the Levels of Development', An Abstract presented to Symposium on Regional Disparities in India, First Indian Geographical Congress, New Delhi.

many guidelines for construction of composite index for regionalization.

Since the levels of development are not directly measurable one must select suitable indicators. A development indicator should represent some aspects of development such as efficiency, equality, participation etc., because development involves changes in structure, capacity and output. But the choice of indicators is not an easy task, the proper choice of indicators constitutes the crux of methodology, which in turn depends on theoretical assumption. Raza[14] has amply demonstrated the selection of such indicators which are really not related to expression of economic development in developing countries but their selection is made on account of the influence of the conventional Anglo-Saxon theories of regional development.

The choice of indicators of regional development should distinguish between the basic forces and derivative result and base itself on the intrinsic relationship between spatial and sectoral process in a holistic frame - with such an approach, the groups of economic and social indicators, or individual indicators within each group, reflect different aspects of phenomenon which inspite of

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[14] Raza, M. and Chattopadhyay (1973), Regional Development, Analytical Framework and Indicators working paper prescribed in the symposium organised by CSRD.

its complexity and its apparently fragmented character is essential one.

For the measurement of the levels of Agricultural development in Kamrup district the following indicators have been choosen for the study;

i) Cultivable area per agricultural workers
ii) net sown area per agricultural worker;
iii)double cropped area to net sown area;
iv) net irrigated area to net sown area;
v) wagerate of agricultural worker;
vi) consumption of fertilizer per hectare of net sown area;
vii)High Yielding varieties to net sown area;
viii)per capita net agricultural product(in Rupees);
ix) Ratio of Pumps to net sown area;
x) Per capita credit in Rupees;
xi) Tractors and other implements per block;
xii)percentage area under cash crops to Net Sown Area.

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

Net sown area per agricultural worker is also a good indicator of agricultural development, because all the cultivable area is not sown every year. The share of net sown area to total cultivable area indicates the fertility of the soil. So net sown area per agricultural worker is a refinement of the first indicator i.e. cultivable area per agricultural worker.

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

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

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

Area under High Yielding Varieties to net sown area and area under cash crops to net sown area is a good indicator to assess agricultural change of a particular region. However the gross value of agricultural output per agricultural workers seems to be the best indicator of agricultural development. It account for total production as well as their market value.

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

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

TABLE-V.6

Categories of composite index	No.of blocks	Name of blocks	Levels of development
> 109.0	6	Dimoria, Rampur, Chayagaon, Mandia, Chenga, Bhavanipur	Low
109.0 - 135.5	6	Barpeta, Rupti, Jalah, Gobardhana, Tihu, Chamaria	Low medium
135.5 - 163.0	6	Tamalpur, Rani, Pub and Pchim Nalbari, Rangia, Hazo	Medium
< 163.0	5	Kamalpur, Boko, Borketi, Dorigog, Bagli	High

A glance at Fig.13 reveals strinking variation in the

KAMRUP

LEVELS OF AGRICULTURAL DEVELOPMENT

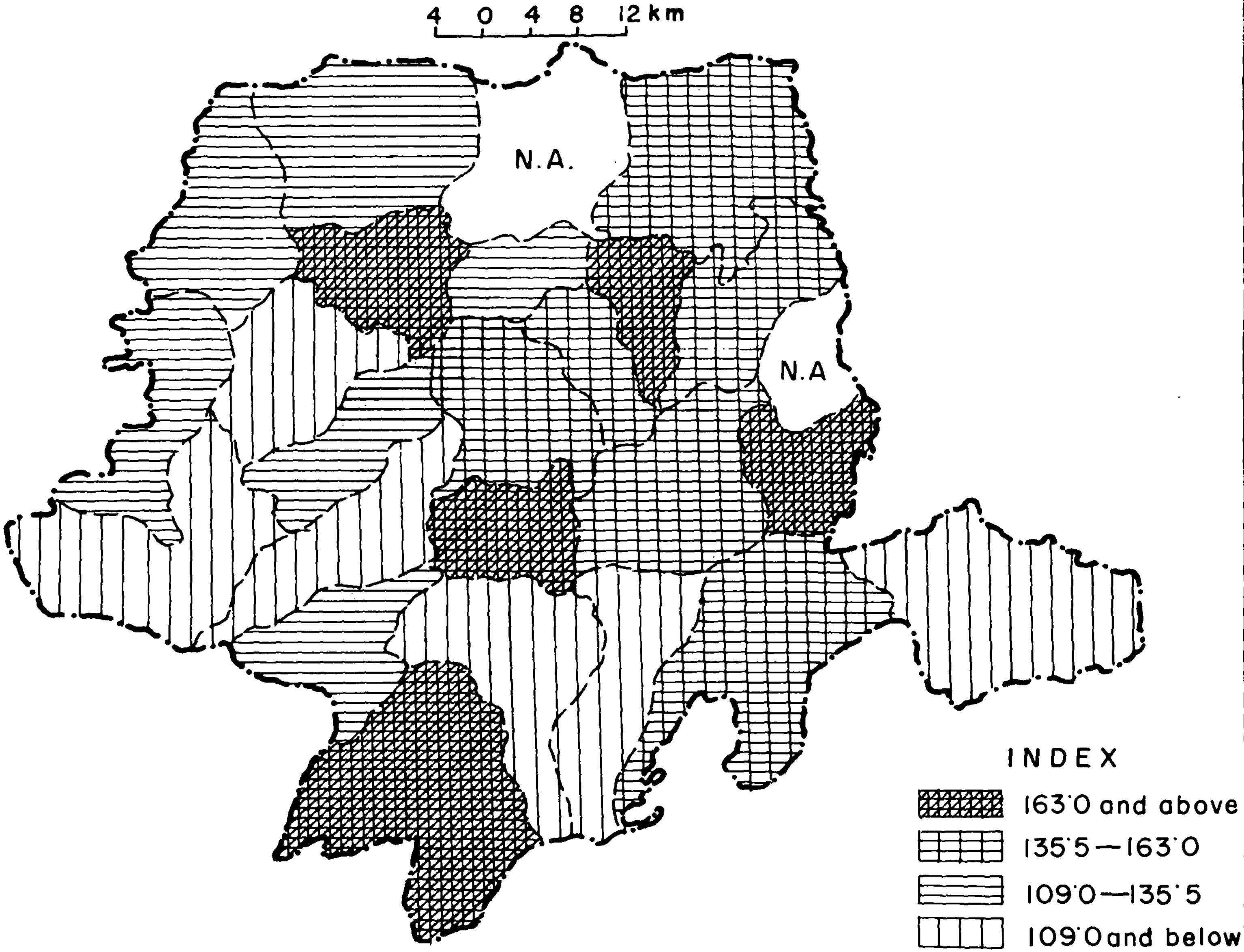

Fig. 15.

levels of agricultural development amongst the component areal units. The indices come within a range of variation between as low as 57.5 to as high as 211.5 for the block of Dimoria and Borigog in accordance to Kendall's method of having areal differentiation in agricultural efficiency has attained the highest level of agricultural development, while Dimoria having the lowest index appears to be agriculturally the least developed block. From an early study made about an identified problem, it is however been found that Nalbari sub-division is highly developed in agriculture because the area is endowed with adequate infrastructure for mechanised agriculture [15]. In the present case two most developed block i.e. Borigog belong to Nalbari sub-division. Such an appreciable development in agriculture in the block may be attributed to a favourable agro-climatic set-up, adequate infrastructural facilities both economic and institutional and relative concentration of credit and other financial institutions.

Dimoria being located at a considerably dis-advantageous position for which the area appears to be in relative isolation from the surrounding parts. Being placed in the south-eastern hill periphery of the Kamrup district, the area lacks adequate cultivable area, net area sown and area under HYV crops. It may also be mentioned here

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[15] Chattaraj, S. (1980), Emerging patterns of Agricultural Landuse in Assam, An Unpublished M.Phil thesis.

that despite the HYV which has already been launched in the area (6.68 per cent) the consumption of costly inputs like fertilizers is insignificant.

Of the 23 areal units under study only 5 units fall in the highly developed category in agriculture. These units are Borigog, Barketi, Bagli, Kamalpur and Boko Blocks. A high degree of agricultural efficiency in these blocks can judiciously be attributed to adequate area under cultivation, an appreciable share of cultivable area as well as net sown area available per agricultural worker, high amount of land deveőted to cash crops, a good progress in double cropping and multiple cropping, relatively good irrigation facilities, higher wage rates, higher consumption of fertilizers, use of tractors and speedy diffusion of High Yielding Programmes in the blocks in terms of progressive and mechanised agriculture. With these positive factors per capita net agricultural product (in Rupees) in these blocks are quite high - Borigog (518.86), Kamalpur (522.50), Boko (334.2), Barketi (305.70), Bagli (244). However except Kamalpur and Bagli, other three blocks enjoying less per capita credit facilities by the financial institution than some other blocks in the district. Conversely, Gauhati and Nalbari as a growing commercial centre is in the close proximity of these blocks. Though Boko does not avail enough institutional facilities and it does not have a favourable physical location, nevertheless, the progress achieved in these blocks in terms of High Yielding Varieties Programmes (22.10 per cent of the net cropped area) has accelerated the growth of double and multiple cropping through an efficient crop cycle. This block is not endowed with adequate irrigation potentials, nevertheless, the farmers may be depending largely one the rainfall which is effective particularly during rainy season. Because of higher share in the net and double cropped area per capita agricultural product and last but not the least the immigrants farmers raised this block is in the upper stratum in terms of agricultural development.

A substantial share of the study units (6 out of 23) have been categorised which have reached the medium levels of development in agriculture. The reasons are mostly attributed to the negative trend of the indicators for these blocks which include Tamalpur, Rani, Pub and Pachim Nalbari, Rangia and Hazo. Except Rani block, per capita net cropped area in these blocks is relatively less, and extension of double sown area is not in good scale, it is exceptionally low in Rani (8.89 per cent) block. The irrigation system also does not appear to be favourable particularly in these areas. The distribution and consumption of fertilizer is poor in these parts as evident from the information collected. Low per capita net agricultural product due to mainly higher growth of rural population in these blocks.

However, the levels of farm mechanisation seems to be better in these blocks in terms of pumps, tractors and other implements uses. There are numerous other reasons for such relatively low agricultural development in these blocks, which need more research and investigation.

Switching over to the low medium level of development in agriculture it is noticed that six blocks, namely Barpeta, Rupti, Jalah, Gobardhana, Tihu and Chamaria fall under this category. These areas are located considerably away from the areas serving a magnet in terms of developed agriculture such as Nalbari, Gauhati etc.. The blocks lie on the north bank of Brahmaputra (escept Chamaria). The agrarian situation concerning the per capita gross cropped area and net cropped area very low in these blocks except Jalah, this is because a sizeable amount of immigrant population increased the population density of these blocks. Moreover, share of multiple cropping, share of irrigated area, popularisation of HYV seeds and consumption of fertilizers and a high wage rate, appears to be unfavourable for a steady agricultural growth. Per capita net agricultural product and per capita credit facilities are also quite insignificant in these blocks. In case of Jalah block where per capita gross cropped area and net cropped area is relatively better, but the irrigation facility, consumption of fertilisers, extension of irrigation and per capita net agricultural product are not favourable for agricultural development.

There are 6 areal units, namely Dimoria, Rampur, Chayagaon, Mandi, Chenga and Bhavanipur, which are agriculturally the least developed blocks. As a matter of fact Dimoria, Rampur, Chayagaon are occupied largely by forests and hills, consequently the level of development is low. Cultivation in these blocks is practiced only in small tract. The infrastructural facilities are almost absent. Per capita credit received by these blocks also too low, Dimoria (Rs.6.70), Mandi (Rs.18.45), Chayagaon (Rs.24.2), Rampur (Rs.34.93). Area devoted to the cash crops is almost nil in these blocks. However, Bhavanipur, situated in a relatively better position is showing a low development because of the heavy pressure of population.

Looking from the point of view of real development in agriculture the district is still in its infancy stage despite the fact that location of the districts in terms of physical and socio-economic standing is most favourable. Barring environmental problems to some extent, the bottlenecks of technological and institutional constraints have retarded the growth of agricultural development in Kamrup district. The disparity in the spatial dimension of agricultural development in the district could, however, be minimized if the agricultural development strategy and extension services are efficiently implemented at the micro-level. As evident from the analysis of inter correlation of the district it appears to be in a situation of fast agricultural transformation with the advent of new technology.

The subsequent part of the discussion has been substantiated by an analysis of inter-correlation amongst the agro indicators.

Table-V.7 entitled "Matrix of Inter Correlation" reveals that most of the bivariate relationships are positive except a few which show negative relationships.

The paired variables being negatively correlated are cultivable area per agricultural worker and net irrigated to net sown area (r = -.05), cultivable area per agricultural worker and consumption of fertilizer per hectare net sown area (r = -.18). Net sown area per agricultural workers and double cropped area to net sown area (r=-0.23), double cropped area and per capita credit in Rupees(r=-.27) net irrigated area to net sown area and percentage area under cash crops (r = -0.22), wage rate of agricultural worker and percentage area under cash crops (r = -0.21). The negative correlation between all the above mentioned variables are insignificant and very weak at 5 per cent levels of confidence. This is because these indicators are independent, having less relation between each other.

The paired variables being positively related include cultivable area per agricultural worker and per

TABLE - V.7

Matrix of Inter-correlation

X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
1.00	.93	.19	-.05	.17	-.18	.07	.34	.22	.48	.43	.20
	1.00	-.23	-.008	.08	-.18	-.14	.32	.23	.52	.39	.22
		1.00	-.07	-.04	.15	.35	.44	.24	-.27	.03	.47
			1.00	-.04	-.02	.14	.46	.12	.07	.24	-.22
				1.00	.25	.67	.50	.42	.45	.65	-.21
					1.00	.36	.31	.19	.14	.21	.13
						1.00	.40	.52	.08	.53	-.06
							1.00	.45	.47	.56	-.18
								1.00	.43	.68	.10
									1.00	.44	-.15
										1.00	-.07
											1.00

Variables

X_1 Cultivable area per agricultural worker
X_2 Net sown per agriculture worker
X_3 Double sown area to net sown area
X_4 Net irrigated area to net sown area
X_5 Wage rate of Agricultural worker
X_6 Consumption of Fertilizer per Hectare net sown area
X_7 High Yielding varieties to net sown area
X_8 Per capita net agricultural product
X_9 Ratio of Pumps to net sown area
X_{10} Percapita credit in rupees
X_{11} Tractors and other implements
X_{12} Percentage area under cash crops

Calculated by the author.

capita credit available (r = .48 significant at 1and 5 per cent levels), net sown area per agricultural workers and per capita credit facilities (r = 0.52 significant at all the levels), proportion of double cropped area and per capita net agricultural product (r = 0.44 significant at 5 per cent level), wage rate of agricultural worker and HYV to net sown area (r = 0.67 significant at all the levels), cultivable area per agricultural worker and mechanisation (r = 0.43 significant at 5 per cent levels), ratio of pumps to net sown area and tractors and other implements (r = 0.68 significant at all levels), per capita net agricultural product and tractors and other implements (r = 0.56 significant at all levels), double cropped area and the proportion of area under cash crops (r = 0.47 significant at 5 per cent levels), net irrigated area to net sown area and tractors and other implements (r = 0.65 significant at all the levels).

The positive and significant relationship between the cultivable area per agricultural worker and credit facilities received by the farmers may be because the farmers receiving credit facilities for modernization and extension of agriculture, so both the variables are increasing. The same reason can be applicable for the second paired where net sown area, per agricultural worker and per capita credit facilities have a positive correlation.

The next paired variables double cropped area to net sown area and per capita net agricultural product show that with the increase of double cropped area, there is a corresponding increase in the total agricultural product of Kamrup district. Double cropped area to net sown area and percentage of area under cash crops are significantly and positively correlated. It implies that the area unddr cash crop is extending with the extension of double cropped area.

Ratio of pumps to net sown area and net irrigated area to net sown area with tractors and other implements also have a positive correlation. The higher use of pumps and the availability of irrigation facilities encourage the Kamrup farmers to adopt mechanism in agriculture and therefore their use is on the increasing side.

CHAPTER - VI

LANDOWNERSHIP PATTERN AND EXTENT OF INEQUALITY AMONG VILLAGE HOUSEHOLD - A SAMPLE STUDY OF SIX VILLAGES OF KAMRUP DISTRICT

This chapter analyses the existing pattern of land-holdings and the extent of inequality and concentration among the several groups defined by the landsize classifications in six sample villages selected from the Kamrup district of Assam. It is early noted that for the purpose of this study, the Kamrup district has been selected because it plays the singlemost important role in the overall economic development of Assam, agricultural as well as industrial. Moreover being historically the centre of socio-economic transitions and administration in the entire Brahmaputra valley, the data base for this district happens to be well developed, exhaustive and covers a wide-range of interlinked subjects mainly on the agricultural issues. Here any study pertaining to the agricultural as well as developmental issues shall remain incomplete and partial if the situations prevailing in the Kamrup district are not analysed in the proper perspective.

For the purpose of the sample for this chapter, all the villages in the Kamrup district have been categorised into three broad strata, these are,

(i) firstly, all those villages situated within a range of 10 km distance from their respective city and / or town headquarters, have been assumed to come into closer contact with and intense spell of the urban influence as reflected through the increased modernisation of the agriculture, relatively easier physical accessibility to the communicational facilities and the number of people working as salaried employees and / or in different commercial opportunities in the nearly urban centres;

(ii) In the second category, those villages have been clustered together which have evidenced a wide-scale in migration of the agricultural workers, that is, the second clustér covers those villages in the Kamrup district where emigrated population is a dominant social factor.

(iii) Thirdly, the agriculturally developed villages characterised by the intensive method of cultivation, multiple cropping system, high agricultural production including well organised market system and developed agricultural infrastructural facilities, have been combined together in one category.

Having clustered the villages in these three categories, the principal factor components determining the individual categories have been statistically tested to obtain ranks through Kendall's Rank Indices Method. Once the villages have been ordered, two highest ranking villages from each of these three clusters have been combined together to form the basic sampling frame of this chapter. These six villages are,

(i) Sawkuchi and Kanaikuchi from the first cluster;

(ii) Mergenda and Dangarkuchi from the second cluster;

(iii) Bangalpara and Barkura belonging to the third cluster.

These three groups will be henceforth referred as Cluster I, Cluster II and Cluster III respectively throughout this chapter. In the analysis, the sample data have been further divided into two groups : (i) the pattern of household distribution, and (ii) the pattern of total land-ownership, both of these distributions have been expressed in terms of land-size categories.

Before focussing attention to the stratification of the land holding, it will be a meaningful attempt to have brief discussion about categorization of farmers. The characterisation of farmers appears to be one of the most controversial issue of agrarian social scene today. The question is who are the farmers to be designated as a small, medium and large respectively? What criteria should be adopted to identify them as small, medium and large. A wide discussion about those are going from a long time and Economists, Social Scientists are pondering various suggestions time to time.

According to Khusro[1] on the income unit of land, the farm inputs are generally not purchased from the market in case of a large number of farm house-holds but supplied by the farm fairly inveriably. If the cost of these inputs are substracted from the crop output, then the net profits

[1]Khusro, A.M., (1973), Economics of Land Reform and Farm Size in India, Delhi, p.62.

come out to be very insignificant or often negative. The inputs also include the rent of land, interest on fixed capital, and imputed value of family labour. "But since, for a large majority of cases, the return of family labour, the interest on fixed capital and the rent on land accrue to farmer himself, a meaningful concept of farm business income can be had by adding together the value of family labour, interest on fixed capital, rental value and net profits if any."

According to the field study report of the Reserve Bank of India the family holding can be defined "as a holding that would yield adequate income to maintain an average farm family at the nutritionally desirable level of living. Cultivators with a holding less than such a size may be considered to be the small farmers. This method of stratification is liable to be criticised since the determination of the size of family holding itself may call for a detailed enquiry."[2] Such queries encompass the type of farming, the size of farm business, cropping pattern, irrigation facilities, use of inputs, fertility status of land, economic status of the farm households, climatic conditions and a host of others.

On the other hand, the concept of Economic holding has been defined and used by the Congress Agrarian Reform

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[2]The Small Farmers (1967-69), A Field Study Reserve Bank of India, Bombay 1977, pp.3-6.

Committee[3], 1951. But it has been spelled out in detail by the Hyderabad Agrarian Reforms Committee, 1949 which says that an economic holding in a normal year may give to a cultivator a surplus, after having met all the necessary expenses, just enough for a good standard of living for the family with a minimum comfort as per the Indian Standard and without being obliged to debts. In later stage, economic holding has been replaced by 'family holdings' by the planning Commission which according to the local condition and the existing conditions of technique decided to net income from agriculture for a family of average size to be Rs.1200/- per annum.[4] Now the question arise, should we call the farmer as small, having a holding size which is just below the size for earning the above yearly income according to the Planning Commission. The answer is obviously negative, since this size will differ from place to place to achieve this income. So a small farmer at one place may be called as the large at the other.

In the lights of the above comments on the economic holding and family holding, which fulfill only some, not all the norms such as work unit, plough unit or income unit,[5] one can say that in India no serious attempt has been made

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[3]Khusro, A.M., Op.cit., p.41.

[4]Ibid., p.41., See also for a detailed discussion a) Report of the Congress Agrarian Reform Committee, AICC (1951), p.8; b) Report of the Hyderabad Agrarian Reform Committee (1949), p.12.

[5]Khusro, A.M., Op.cit., p.44.

to define those limits of holding size in different soil-crop complexes, other than few exceptional cases. Hence it is wise to adopt acreage or hectare as the satisfactory measures of farm size to identify marginal, small, medium and large farmers in different places as per the local factories.

In the present case to stratify the sample farm households into small, medium and large, the arbitrary method has been adopted and its application been tested through empirical findings. Presuming the area under study as a homogenous physiographic unit where the physical parameters do not vary much, the arbitary method of stratifying the farmers hierarchically as small, medium and large would be the most suitable method rather than adopting the gross farm income in terms of output as the basis of their stratification. However, a little modification has been carried in the landsize limits from the agricultural census classification ofor different agricultural classes based on the landsizes as follows -

Land Size limits	Class Definition
0	Landless
0 to 0.5 hectares) 0.5 to 1.0 hectares)	Marginal and/or Small
1.01 to 2.0 hectares) 2.01 to 3.0 hectares)	Medium
3.01 to 4.0 hectares) 4.01 and above)	Large

The degree and the extent of the inequality in the existing pattern of landownership have been analysed with the help of Lorenz Curve, which is in wideuse for the graphical representation of the inequality aspect of the size distribution. A summary coefficient can also be estimated, the concentration ratio, to measure the degree of the inequality or the concentration. These two measures were evolved by Italian Statisticians Gini and Lorenz. The choice of Lorenz curve as a measure of inequality has one unique advantage because the measure does not depend on any distribution assumption. Theoretically, however, it has one serious limitation that the measure is based upon the unrealistic assumption that of either total equality as in the case for Lorenz Curve analysis or of perfect inequality as a frame of reference for Gini Concentration Ratio.[6] However, a measure of inequality is essentially a measure of deviation from an optimum distribution, which is itself hard to define short of complete equality as represented, say, by the Lorenz Curve.[7]

The Lorenz Curve can be obtained by plotting cumulative percentages of total land owned, $L_j = \sum_{i=1}^{j} l_i$ against any corresponding cumulative percentage of number of

[6] Santra, Biswanath (1970), Inter-Regional and Inter-Regional Inequality in Household Consumer expenditure in Rural India, Indian Journal of Agricultural Economics, Vol. XXV No.3, pp.92-99.

[7] Ranadive, K.R. (1965), The Equality of Incomes in India, Bulletin of the Oxford University of Economics and Statistics, Vol. 27, pp.119-134.

households, $H_j = \sum_{i=1}^{j} h_i$, for $j = 1, 2, \ldots\ldots 7$, the total of size classifications; and successively plotting and joining these points. The Egalitarian Line can be obtained by the point, $(H_o, L_o) = (0,0)$ by a straight line with an angle of 45^{o} degree from the origin.

Gini-Lorenz Ratio, or simply the concentration ratio, is defined as twice the area between the egalitarian line and the Lorenz Curve. By the trapezoidal rule, the concentration coefficient is given by,[8]

$$\text{or, } \left.\begin{array}{l}\underline{\text{Concentration Coefficient}}\\ \underline{\text{Concentration Ratio (CR)}}\end{array}\right\} = 1 - \sum_{j=1}^{7} h_j(L_j + L_{j-1})$$

The estimated value of the concentration ratio shall have an interval,

$$0 \leqslant CR \leqslant 1$$

that is, more the equal the landownership distribution, the closer the ratio is to zero and the greater the degree of inequality, the closer the ratio is to one.[9]

Another way of estimating the Gini-Coefficient of concentration can be defined by the relation,

$$\text{Gini C.R.} = 1 - \sum_{i=1}^{n} r_i f_{i-2}\left(\sum_{i=1}^{n} r_i F_{i-1}\right),$$

---

[8] Bhattacharya, N. and Mahalanobis, B. (1967), Regional Disparities in Household Consumption in India, American Statistical Association.

[9] Bal, H.S. and Singh, Gurbachan (1970), 'Pattern of Income distribution in Rural Areas; Indian Journal of Agricultural Economics, Vol. XXV, No.3.

where, ri is the relative frequency of the total number of households, fi is the relative frequency of total landowned, and Fi is the cumulative relative frequency of total land owned.[10]

An alternative method of computing the concentration coefficient can be expressed as,

$$C.R. = \frac{\sum_{i=2}^{K} H_{i-1}L_i - \sum_{i=2}^{K} H_i L_{i-1}}{10,000}$$

The estimated value from this ratio is found to be approximately similar to the earlier mentioned estimating equations.[11]

Furthermore, a two-way ANOVA model has been applied to the sub-classified data of total number of households and the total land owned separately for testing the significance of statistically differences in the inter and intra-regional distribution patterns. These are,

(i) Inter-village (between the columns) and Intra-village (between the rows) variations within a given cluster;

(ii) Inter-cluster (between the columns) and Intra-cluster (between the rows) by taking all the cluster together;

(iii) Inter-village (between the columns) and Intra-village (between the rows) variations by taking the sample of six villages as a whole.

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[10] Sen, A.K. (1973), On Economic Inequality, Oxford : Clarendon Press.

[11] Saha, C.H.(1976), Growth and Inequality in Agriculture; Indian Journal Agricultural Economics; Vol.XXXI, No.4,pp. 71-94.

Methodologically, the inter cluster/village (between the columns) mean variances are given by,

$$MS_c = SS_c \;/\; V_c = \frac{r \sum (\bar{X}_{\cdot j} - \bar{X})^2}{C - 1}$$

and the intra cluster/village (between the rows) mean variances are given by,

$$MSr = SSr \;/\; Vr = \frac{c \sum (\bar{X}_{i\cdot} - \bar{X})^2}{r - 1}$$

The residual or error mean square is given by,

$$MS_{\varepsilon} = SS_{\varepsilon} / V_{\varepsilon} = \frac{\sum_j \sum_i (Xij - \bar{X}_{\cdot j} - \bar{X}_{i\cdot} + \bar{X}_{\cdot\cdot})^2}{(c - 1)\,(r - 1)}$$

Hence, the total sum of square is given by

$$SS = \sum_j \sum_i (Xij - \bar{X}_{\cdot\cdot})^2$$

where, r = sample size of each jth column ($j = 1, 2, \ldots \ldots n$) representing the villages/ clusters.

C = sample size of each ith row ($i = 1, 2, \ldots\ n$) representing the given land sizes.

Xij = variate value at the ith row and jth column.

$\bar{X}_{\cdot j}$ = Mean of the jth column

$\bar{X}_{i\cdot}$ = Mean of the ith row

$\bar{X}_{\cdot\cdot}$ = Grand average for all observations

$(r-1)$ = degrees of freedom for the row effects = Vr

$(c-1)$ = degrees of freedom for the column effect = Vc

V_{ε} = degrees of freedom for the residual or error mean square = $(c-1)(r-1)$.

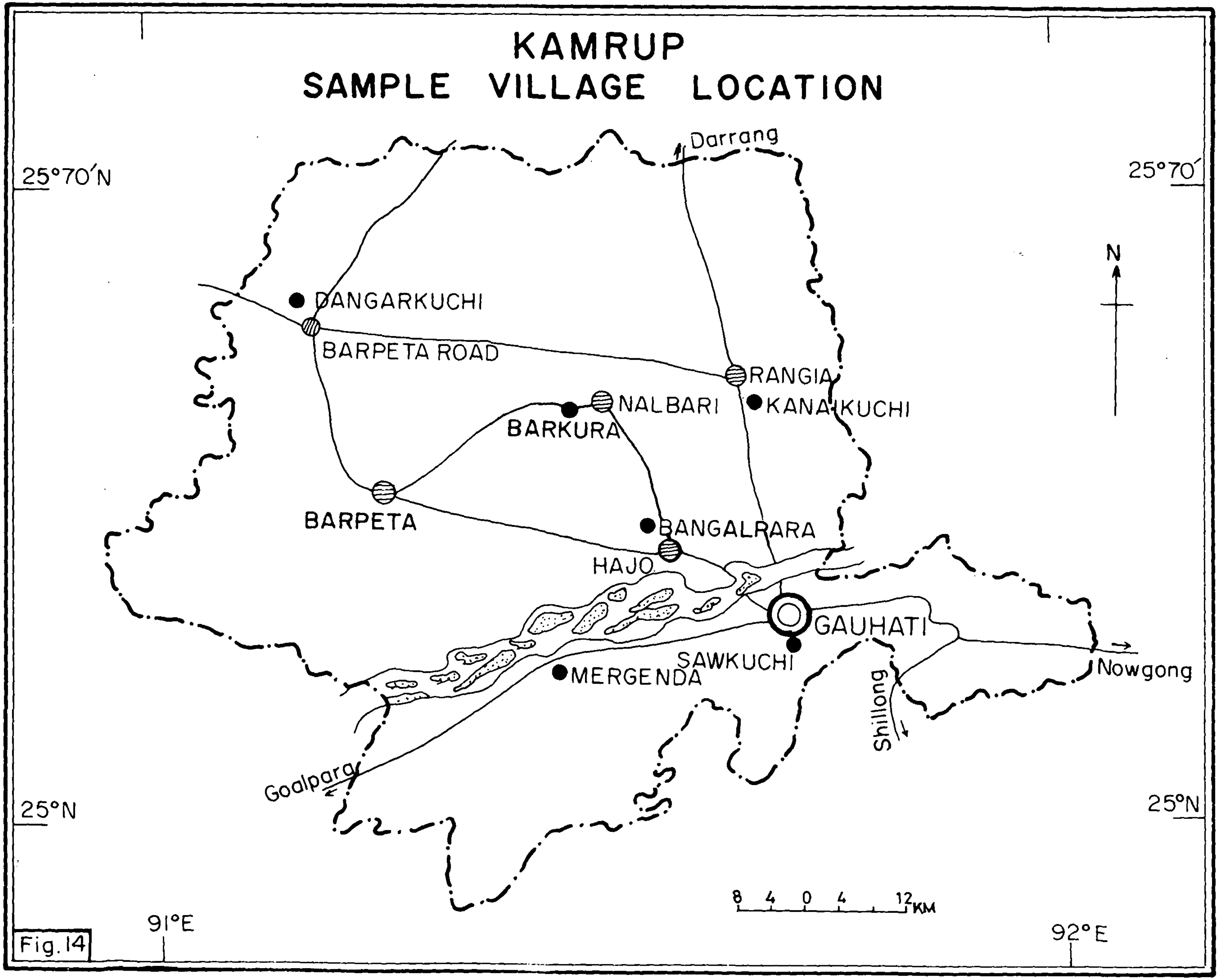

KAMRUP
SAMPLE VILLAGE LOCATION
Darrang
25°70′N
25°70′
N
DANGARKUCHI
BARPETA ROAD
RANGIA
NALBARI
KANAIKUCHI
BARKURA
BARPETA
BANGALPARA
HAJO
GAUHATI
SAWKUCHI
MERGENDA
Nowgong
Shillong
Goalpara
25°N
25°N
8 4 0 4 12 KM
91°E
92°E

Fig. 14

Lastly, to test the row effects, the first Fr* ratio has been computed as

$$Fr^* = \frac{MSr}{MS_{\varepsilon}}$$ with Vr and V_{ε} degrees of freedom at the appropriate level of probability.

and, the second Fc* ratio for testing the column effects is computed as,

$$Fc^* = \frac{MSc}{MS_{\varepsilon}}$$ with Vc and V_{ε} degrees of freedom at the appropriate levels of probability.

Two villages, Sawkuchi and Kanaikuchi of Cluster I represent the urbanised villages of the Kamrup district. Sawkuchi comes under Rani block approximately on 25°15' north latitude and 91°74' east longitude, and characterised by the plain surface land. The nearest urban centre from this village happens to be the capital city, Gauhati, and is connected with all-weather graveled, road.

The most important physiographic feature of this village is that it is located on an extensive alluvial plain tract of Brahmaputra, hence, the surface is characterised by an unvarying monotony of levelled tract, with total absence of natural undulations. The surface is well-drained and it has a gentle slope towards the south. The structure of soil also presents a monotonic character which is primarily sandy loam. The texture of the soil is generally light except that of the northern corner of the village where it is slightly heavier in nature. Rainfall is the sole dominant factor of the nature of the cropping pattern and extent of cultivation in this village. Due to the absence of any recorded rainfall data for this village, the rainfall recorded at Gauhati has been approximated as close proxy and the degree and intensity of the rainfall-crop landuse relationship have been worked out.

Sawkuchi has a total population of 1281 from 171 households and covers an area of 514.1 hectares of land distributed among 443 households. That is, 16.37 per cent households are landless. The village indicates a high degree of inequality in the land ownership pattern (Table-VI.1).

TABLE-VI.1

The Size Distribution of Total Households and Landowned in Sawkuchi

Land size (in hectares)	Percentage Total House-Holds	Percentage Total Land owned	
Landless	16.37	0	Concentration Ratio = 0.56
Below 0.5	26.32	7.00	
0.5 to 1.00	16.37	9.92	
1.01 to 2.00	14.04	13.62	
2.01 to 3.00	16.37	29.95	
3.01 to 4.00	8.19	28.03	
4.00 and above	2.34	11.48	

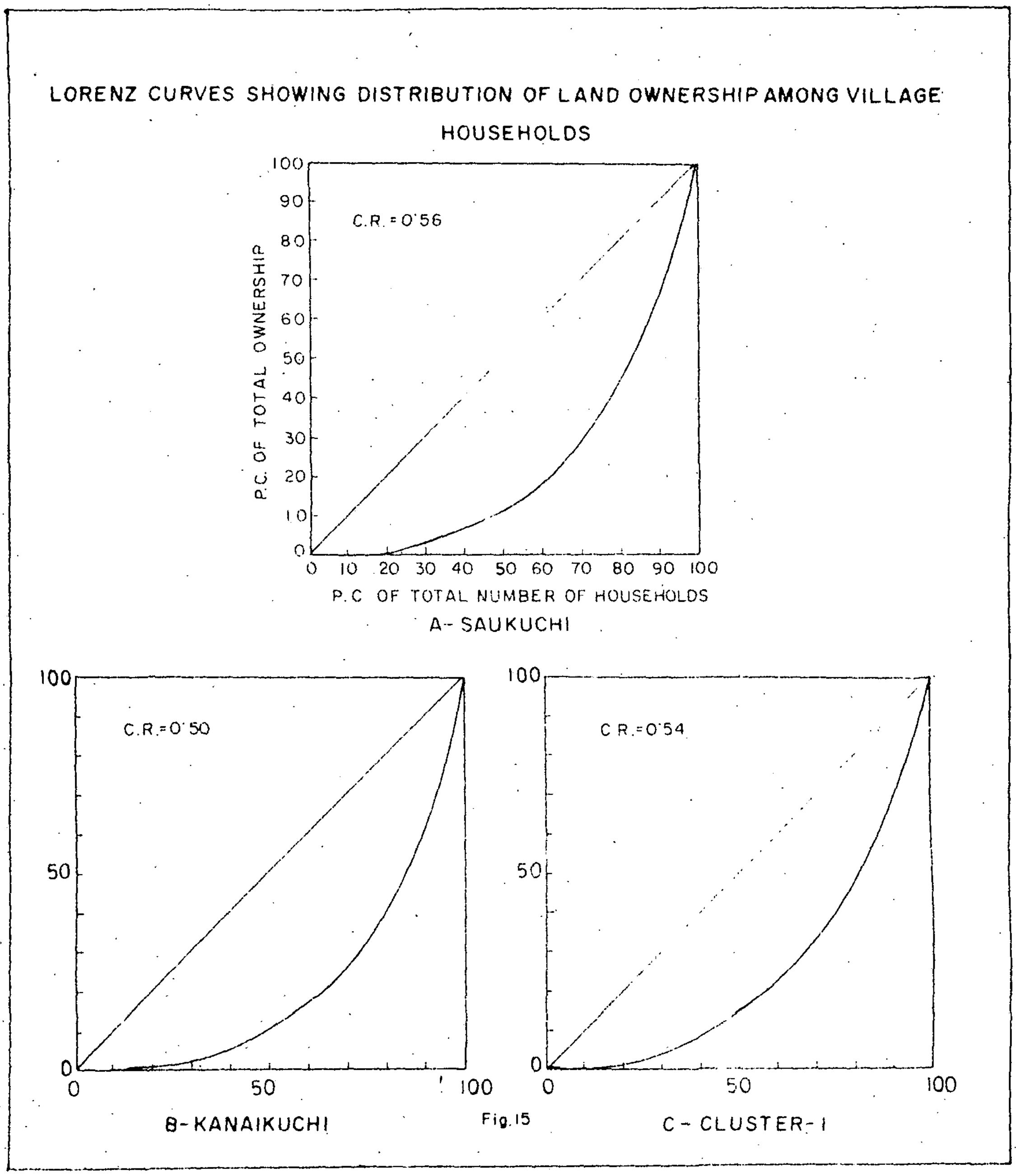
42.69 per cent households come under marginal and small categories with only 16.92 per cent total land, whereas

39.51 per cent of total land is owned by only 10.53 per cent households belonging to large size group. 30.41 per cent of total households can be referred as the middle level farming families owning together 43.57 per cent of total land. The concentration ratio has been estimated as 0.56 (Fig. 15A).

The second village of this cluster is Kanaikuchi which comes under Rangia block. It is situated approximately on 25°55' north latitudes and 91°74' east longitudes. It is characterised by a plain surface land. The nearest urban centre from this village is Rangia town and is connected with 6 km. long metalled road.

Physiographically, this village is closely related with the river Phutmari located approximately at one and half kms distance away. This river has a southward flow originating from Bhutan Himalayas which closely indicates the general slope of this village. The average elevation of the surface is below 130 m and while estimated on the basis of spot heights, it is about 128m. The 150m. contour line passes through a point about two and half kilometer north of the village. The range between the highest and the lowest elevated spots in the village is only about 2.5m.

The soil structure of the village is almost uniform, being predominantly the old alluvial type, which are more


LORENZ CURVES SHOWING DISTRIBUTION OF LAND OWNERSHIP AMONG VILLAGE HOUSEHOLDS
C.R.=0'56
P.C. OF TOTAL OWNERSHIP
0 10 20 30 40 50 60 70 80 90 100
P.C OF TOTAL NUMBER OF HOUSEHOLDS
A- SAUKUCHI
C.R.=0'50
0 50 100
B-KANAIKUCHI
C.R.=0'54
0 50 100
C - CLUSTER-I
Fig.15

acidic in nature. Texurally, the structure varies from sandy to clayey loam with high to low nitrogenic contents. The climatic pattern of this village follows closely to that of the entire Brahmaputra valley particularly with the Central Assam. On an average the temperature varies between 31.1°C to 10.2°C from summer in April to Winter of December - January period. The rainfall is comparatively low, the annual average being approximately 1827.41 mm.

Kanaikuchi has a total population of 668 with 87 households covering an area of 342.0 hectares. The village is dominated by the Hindus, among them, the Kalitas, a sect of higher cast Hindu, form the singlemost majority. They are followed by Kayasthas, Kumars and Keots.

The village is characterised by unequal distribution of land holdings line the other village in the same cluster (Table-VI.2). 9.2 per cent of the total households are landless while 40.23 per cent of them are marginal and small cultivating households owing only 12.30 per cent of total land. On the other hand, the large cultivators, constituting only 17.24 per cent of total households, own as much as 45.20 per cent of the available total land. About 33.33 per cent of the households can be classified as the middle level farmers with 42.00 per cent of total land among them. The estimated concentration ratio for this village has worked out to be 0.50 (Fig. 15B).

TABLE-VI.2

The Size Distribution of Total Households and Land owned in Kanaikuchi

Land sizes (in hectares)	Percentage of Total households	Percentage of Total land owned	
Landless	9.20	0	Concentration Ratio = 0.50
Below 0.5	27.59	6.42	
0.5 to 1.00	12.64	6.38	
1.01 to 2.00	18.39	17.50	
2.01 to 3.00	14.94	24.50	
3.01 to 4.00	13.79	32.08	
4.01 and above	3.45	13.12	

Though these two villages are combined together, within the same cluster, they do not present any uniform characteristic in the landownership pattern, except that both these villages consist of substantially large number of marginal and small level cultivating households. Variance-ratio test (Table-VI.3) indicates that the number of households within the Cluster I significantly differ at 1 per cent level of probability whereas the variations in total land owned according to the given land-sizes is also highly significant at 5 per cent level of probability. On the other hand between the land size distribution, the incidence of the number of households significantly varies at 5 per cent level of probability while it is highly significant

TABLE-VI.3

Two-way ANOVA Test For Sawkuchi and Kanaikuchi of Cluster I

A. Total Number of Households

Source	Degrees of freedom	Mean variance	F-Ratio
Column Effect(Villages)	1	504.0	14.5371 **
Row Effect(Land-size)	6	172.90	4.9870 *
Residual	6	34.67	-
B. Total Land owned			
Column Effects(Villages)	1	2092.3	7.8045 *
Row Effect(Land size)	6	4390.33	16.3763 **
Residual	6	268.09	-

*Significant at 5% level ** = Significant at 1% level

at 1 per cent of total landowned is considered between the landsizes (row effects). If the villages are considered together as a single system, the condition shows that (Table-VI.4), 13.95 percent households in Cluster I do not own any land of their own, when 12.79 per cent households own as much as 41.79 per cent of total land in the large size groups. The fact also emerges that the Cluster I villages are mainly dominated by the marginal and small cultivating households who as a group constituted 41.87 per cent of total households and own only 15.27 per cent of total land. The concentration ratio for the cluster is very high and estimated as 0.54 (Fig. 15C).

TABLE-VI.6

The Size Distribution of Total Households and Land owned in Cluster-I villages together

Land sizes (In Hectares)	Percentage of Total house-holds	Percentage of total land owned	
Landless	13.95	0	Concentration Ratio = 0.54
Below 0.5	26.75	6.77	
0.5 to 1.00	15.12	8.50	
1.01 to 2.00	15.50	15.17	
2.01 to 3.00	15.89	27.77	
3.01 to 4.00	10.08	29.05	
4.00 and Above	2.71	12.14	

Mergenda of Chayagaon block, situated at 25°17' north latitude and east 91°45' east longitude, is the first village of the Cluster II, representing a predominantly immigrant population. It is situated along Gauhati-Boko state highway, approximately 20 km. away from the right bank of Brahmaputra and 2 km away from the river Kulsi, a tributary of Brahmaputra. The nearest urban centre from this village is Palasbari town located approximately 40 km distance.

The surface features of this village are different from its surrounding areas. The village is located almost on a minor divide which separates the rivers Budhi on the east and the Pagla on the West, both of these are tributaries to the river Kulshi. The village surface is 132 meter above the sea level and has a general slope towards south-east from the north-eastern side. The composition of soil is characterised by the new-alluvium structure, the texture of which is mainly loamy and sandy-loamy with negligible acidic differences, and is enriched with phosphets, potash and calcium.

The climatic condition of Mergenda is more or less similar to that of the rest of the region but interestingly, the village receives less amount of rainfall annually than other four recording stations in the district, which is 1700 mm per annum as recorded at Boko, the nearest rain-gauge station.

The village covers a total area of 499.2 hectares of land with a total population of 1476 divided into multi-ethnic and multi-religious communities. The Bengali Muslims and the Bengali Hindus together constitute the majority of the population. These people have mostly emmigrated from the erstwhile East-Pakistan (now Bangladesh) around 1960-61 and immediately there had been an appreciable and noticeable shift in the agricultural landuse pattern. The village also consists of 11 Kachari households.

The distribution of households over the landsizes indicates a rare normal distribution with high degree of intensity at the marginal, small and medium levels(Table-VI.5). Only 3.02 per cent of total 102 households are without any

LORENZ CURVES SHOWING DISTRIBUTION OF LAND OWNERSHIP AMONG VILLAGE HOUSEHOLDS

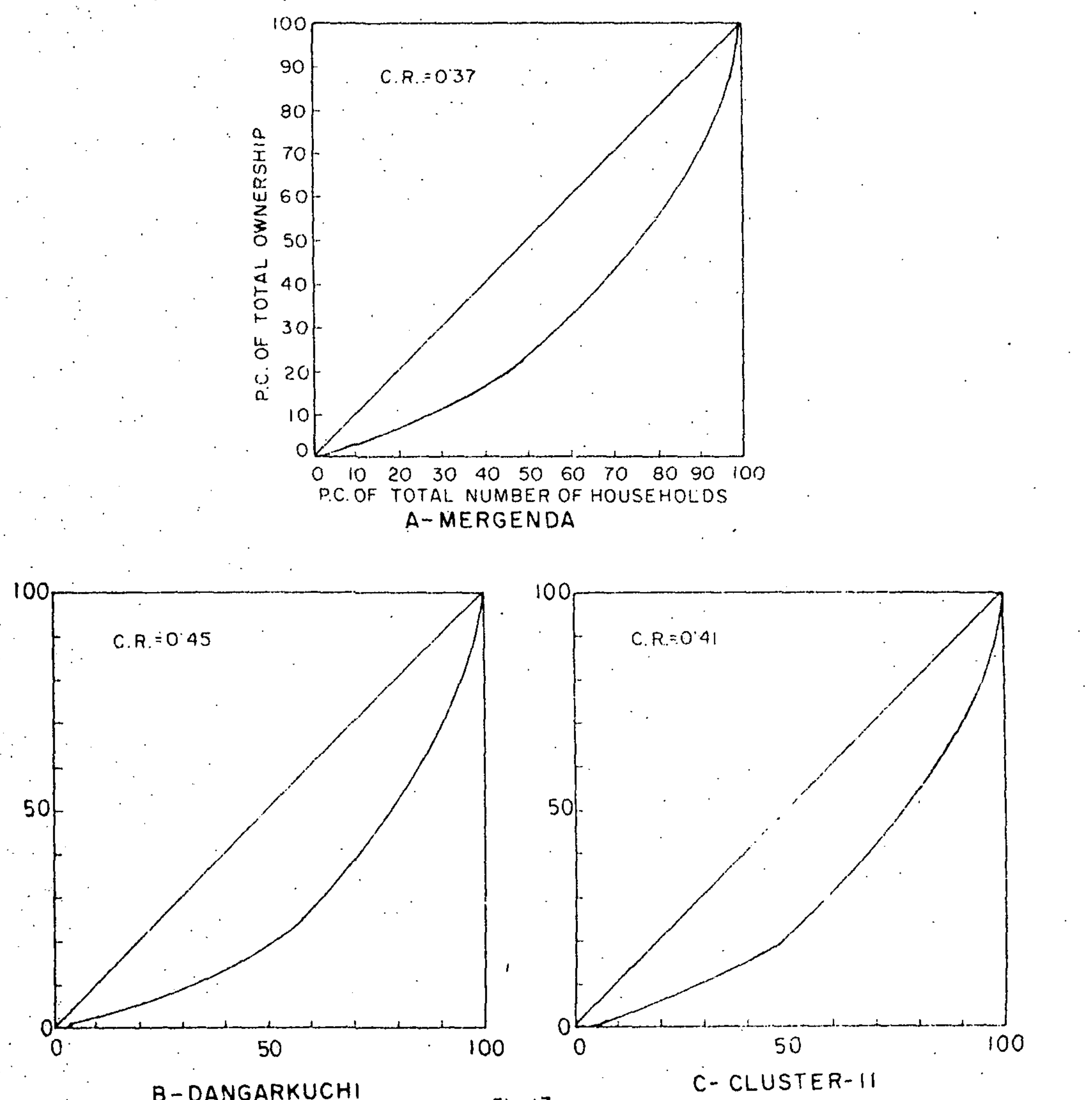


Fig. 17

land whereas 7.58 per cent households only form the large cultivator group owning about 24.49 per cent of total land. 40.91 per cent households belong to the marginal and small category with a total of 18.01 per cent land distributed among themselves. 48.49 per cent households can be categorised as the medium level cultivators with 57.62 per cent of land

TABLE-VI.5

The Size Distribution of Total Households and Land owned in Mergenda

Land sizes (in Hectares)	Percentage total Households	Percentage Total Land owned	
Landless	3.02	0	Concentration Ratio = 0.37
Below 0.5	14.39	5.21	
0.5 to 1.00	26.52	12.80	
1.01 to 2.00	34.85	36.55	
2.01 to 3.00	13.64	21.07	
3.01 to 4.00	4.55	10.47	
4.01 and Above	3.03	14.02	

holding. This aspect is reflected in the concentration coefficient computed for the village, which is 0.37, the lowest in this study (Fig. 16A).

The second village in this cluster is Dangakuchi of Barpeta block in the western part of the district. It is located between the Barpeta-Sarbhog state highway in the west and Barpeta-Sarupeta road in the east. It is about 3 km away from the nearest urban centre, Barpeta Road town and this incidentally serves as the main market centre for this villages. The exact geographical location of this village is on $25^{o}15'$ north latitudes and on $91^{o}10'$ east longitudes.

Like its counterpart of the same cluster, Dangarkuchi is also characterised by a relatively upland plain stretching from the N.E. Railway track in the north upto Barpeta-Sarbhog state highway having a general slope from north to south corresponding with the general slope of the north-bank of Brahmaputra and is perciptible to the naked eyes. The river Saru Manas (alias Mora Manas) is situated at about two and half kilometres distance towards the west of the village. The surface elevation of the village is about 120 m above the sea level and is well-drained except some water logged patches in the southern most corner, where the village boundary slopes into a marshy tract.

The structure of the soil in general, is loam and sandy loam and fertile in nature. But due to the frequent changes in the gap between the surface and the watertable, the colour and the texture of the soils present distinctly contrasting views. Though climatically the village does not differ greatly from the rest of the central part of the district, but on an average it receives a little higher amount of rainfall, which is slightly more than 2000 mm per annum.

Dangarkuchi has a total area of 449.09 hectares with 121 households, accounting for its total population of 1236. The village is mainly dominated by the immigrant Muslims, though a few Bengali Hindu families have also settled down here. These households are mainly large scale cultivators.

Dangarkuchi also presents an interesting landownership pattern (Table-VI.6), while 5.79 per cent households possess no land of its own, only 6.62 per cent of households belonging to the large size category own as much as 25.13 per cent of the total land. 42.97 per cent households come under marginal and small size category with 16.67 per cent of total land.

TABLE-VI.6

The Size Distribution of Total Households and Land owned in Mergenda

Land sizes (in Hectares)	Percentage of Total households	Percentage of Total land owned	
Landless	5.79	0	Concentration Ratio=0.45
Below 0.5	19.23	5.78	
0.5 to 1.00	23.14	10.89	
1.01 to 2.00	24.79	25.31	
2.01 to 3.00	19.83	32.89	
3.01 to 4.00	3.31	9.44	
4.01 and Above	3.31	15.69	

The village has a relatively large size of medium level cultivators, 44.62 per cent owning 58.20 per cent of total land available. The co-efficient of concentration of the land ownership pattern for this village is 0.45 (Fig.16B).

These two villages which are predominantly populated and inhabited by the emigrated families from the erstwhile East Pakistan indicate no significant variations between itself regarding the distribution of households and in the landownership pattern according to landsizes as both the F-Ratio are statistically insignificant (Table-VI.7). But on the other hand, between the land sizes variations within the villages show a statistically highly significant F-Ratios both in the distribution of households and Landownership pattern at 1 per cent level of probability. As a whole, only 4.35 per cent households remain landless while 7.11

TABLE-VI.7

Two Way ANOVA Test for Mergenda and Dangarkuchi of Cluster II

A. Total Number of Households

Source	Degrees of Freedom	Mean variance	F- Ratio
Column Effects (villages)	1	8.63	0.2863 ▭
Row Effects (Land size)	6	374.90	12.4386**
Residual	6	30.14	-
B. Total Landowned			
Column Effects(villages)	1	172.97	0.3170 ▭
Row Effects(Land size)	6	5624.57	10.3086**
Residual	6	545.62	-

**Significant at 1% level ▭ Insignificant

per cent households of the large category own 24.77 per cent of total land. This clearly indicates the nature of the dominant landbased households, that is, both the villages in this cluster are dominated by the marginal, small and medium size cultivating households and an attempt has been made in both these villages to accommodate maximum number of families in the available land, howsoever small, by restricting the degree and number of large cultivators in their share of land (Table-VI.8). The concentration co-efficient for this cluster is 0.41, the lowest among the three clusters analysed in this chapter (Fig.16C).

TABLE-VI.8

The Size Distribution of Total Households and Landowned in Cluster II Villages taken together

Land sizes (in Hectares)	Percentage of total households	Percentage of total Landowned	
Landless	4.35	0	Concentration Ratio = 0.41
Below 0.5	17.00	5.48	
0.5 to 1.00	24.90	11.80	
1.01 to 2.00	30.04	31.28	
2.01 to 3.00	16.60	26.67	
3.01 to 4.00	3.95	9.96	
4.01 and Above	3.16	14.81	

Cluster III is the combination of two villages, which together represent the agriculturally developed blocks in the Kamrup District. Bangalpara of Hajo block is the first village in this combination, situated at about 12 km away from its nearest urban centre, Hajo town, and is connected with all-season Hajo-Nalbari Road. Brahmaputra is located at about 10 km away towards the south of the village. The geographical situation of this village is on $25^{\circ}30'$ north latitudes and on $91^{\circ}60'$ east longitudes.

The village presents no characteristically distinct pattern from the physiographical point of view as it has an apparently perfect leveled surface which is significantly monotonic. One inch topographical sheet shows that the average elevation of the village is approximately 112 meter with a minor variations around one or two feet only. The village has a general slope from north-east to south-west and terminates into an old bed of Brahmaputra at a distance of 4 furlongs from the village boundary.

The soil is predominantly loamy except to that of a small area in the central portion where it is sandy loamy with moderate percentages of sand in the composition. The climatic condition of the village presents a similar pattern as to the overall condition of the entire district. Assamese-Hindu population dominates the demographic set up of the village. Among them, important caste structures in order of majorities are the Kaibratas with 67 households, Namasudras with 32 households and followed by the Ketos, Kalitas and Brahmins. The village is spread over an area of 415.8 hectares.

The pattern of landownership (Table-VI.9) indicates an almost negligible section of landless households, only 8.00 per cent of the total. At the same time, it also indicates a heavy concentration of land among the 1288 per cent households categorised in the large section owning 37.37 per cent of total land. Obviously the village is dominated by the marginal and small landowning households,

TABLE-VI.9

Size Distribution of Total Households and Land-owned in Bengalpara

Land Sizes (in Hectares)	Percentage of Total households	Percentage of Total landowned
Landless	8.00	0
Below 0.5	12.80	2.89
0.5 to 1.00	20.80	7.96
1.01 to 2.00	24.00	21.16
2.01 to 3.00	21.60	30.62
3.01 to 4.00	9.60	23.09
4.01 and Above	3.20	14.28

but with only 10.85 per cent of the total land. Most of the land available in this village is heavily concentrated among the medium level households, 45.60 per cent of the total households, owning as much as 51.78 per cent of total land. It indicate that the individual housewives in this category obviously owns a little more than 1 hectare of land on an average. The coefficient of concentration of the landownership distribution for this village is 0.46 (Fig. 17A).

LORENZ CURVES SHOWING DISTRIBUTION OF LAND OWNERSHIP AMONG VILLAGE HOUSEHOLDS

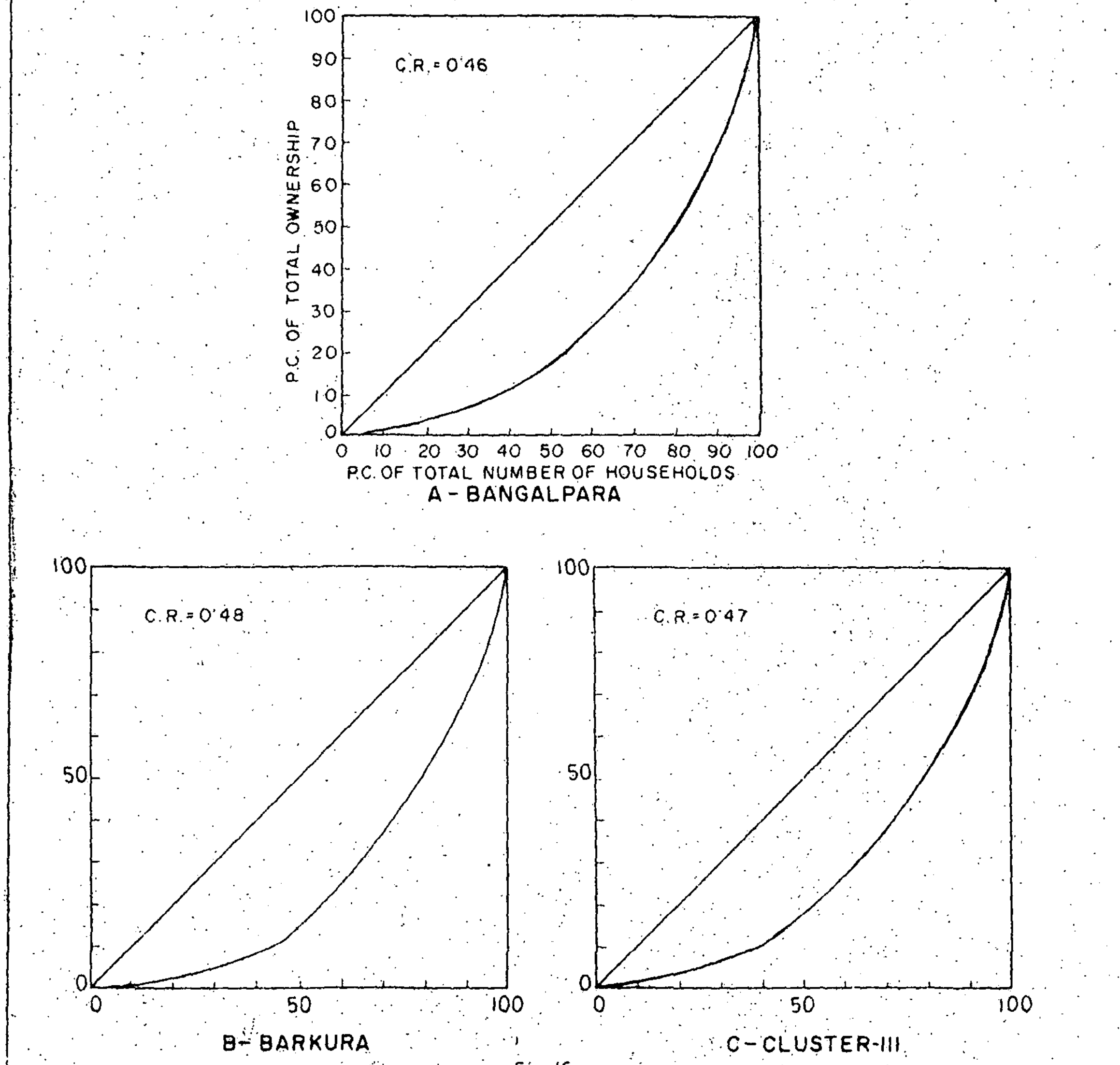


Fig.16

Barkura from the Nalbari block is the other village in the agriculturally developed cluster. It is situated at about 4 km. away from Nalbari town, a sub-divisional headquarter, and is connected with an all weather Pucca Road from this centre. The location of the village is on the eastern side of the devide between the rivers Burdai in the east and Mani in the west. Geographical situation of the village is at $25^{o}60'$ North latitudes and on $91^{o}50'$ east longitude.

The village is located on the south-eastern slope of the river Mani and covered by newer alluvium deposits. The only features breaking the monotonic surface conditions are some occasional mounds. The village is about 105 metre above the sea level. The two rivers, Burdai and Mani have brought forth a considerable change in the surface conditions of the village. Occasional floods in these two rivers have deposited a considerable amount of sand which has resulted into a significant modification in the texture of the soil, imparting a clay-loam structure to the soils. This phenomenon has been particularly beneficial for the village as the modified soil structure suits different varieties of crops.

Barkura has a total area of 452.24 hectares and 129 households consisting predominantly Assamese Hindu population out of a total population of 1073.

Unlike Bangalpara, the other village in this cluster Barkura has higher incidences of both the landless households, 9.3 per cent and largesize landowners consisting of 14373 per cent of total households holding about 41 per cent of total land (Table-VI.10). The middle size landowners, the majority in the village, own about 47 per cent of total land within 38.76 per cent households. The marginal and small size landowners are the second major group in the

TABLE-VI.10

<u>Size Distribution of Total Households and Land-owned in Barkura</u>

Land sizes in hectares	Percentage of Total households	Percentage of total land-owned	
Landless	9.30	0	
Below 0.5	15.50	2.26	
0.51 to 1.00	21.71	9.69	Concentration Ratio = 0.48
1.01 to 2.00	18.60	18.35	
2.01 to 3.00	20.16	28.75	
3.01 to 4.00	11.63	28.35	
4.01 and Above	3.10	12.65	

village, 37.21 per cent of households, owning only about 12 per cent of total land. This feature reflects the negligible amount of land at the disposal of this particular class characterising acute pressure on land from this section. The coefficient of concentration for this village is 0.48, which marginally higher than the other village of the same cluster (Fig. 17B).

The inter and intra-village analysis of Cluster III villages taken together show that (Table-VI.11) both the villagewise and sizewise distributions of total households have statistically highly significant variations at 5 per cent and 1 per cent level of probability respectively. On the other hand while the inter-village variations in the

TABLE-VI.11

Two way ANOVA Test for Bangalpara and Barkura of Cluster III

Source	Degrees of freedom	Mean variance	F-Ratio
A. Total Number of Households			
Column Effects (villages)	1	18.34	6.5971*
Row Effects (Land size)	6	166.45	59.8741**
Residual	6	2.78	-
B. Total Land owned			
Column Effects(villages)	1	95.01	1.1531 □
Row Effects (Landsize)	6	4832.48	58.6537**
Residual	6	82.39	-

*Significant at 5%　　**Significant at 1%
□ Insignificant

landownership pattern is statistically insignificant, the inter-size variations are highly significant at 1 per cent level of probability. This highlights the fact that though these two villages have been combined together into the agriculturally developed cluster, barring only the land ownership pattern between the villages, no other factor presents any similarity between these two villages.

In this cluster of agriculturally developed villages there is a significant tendency of relatively higher concentration of land holdings among comparatively fewer large-size category households, 39.25 per cent of land owned by 13.78 per cent households (Table-VI.12). In contrast, among the marginal and small scale section, 35.43 per cent households own only 11.41 per cent of total land, indicating a sharp inequality in the distribution pattern of land ownership. Moreover, this cluster also shows that 8.66 per cent of total households as landless, and in the middle-level category, 42.13 per cent households own 49.34 percent of total land. The concentration ratio for this cluster has been worked out to be 0.47, the second highest among the three clusters (Fig.17C).

TABLE-VI.12

The Size Distribution of Total Households and Land-owned in Cluster III villages taken Together

Land sizes (in Hectares	Percentage of Total Households	Percentage of Total land-owned
Landless	8.66	0
Below 0.5	14.17	2.55
0.5 to 1.00	21.26	8.86
1.01 to 2.00	21.26	19.70
2.01 to 3.00	20.87	29.64
3.01 to 4.00	10.63	25.81
4.01 and Above	3.15	13.44

A comparative analysis of all the three clusters taken together shows that the distribution of households as well as the landownership pattern between the clusters have no statistically significant variations indicating, more or less, an uniformity in the distribution patterns, whereas between the landsize categories, that is, within the clusters, the variations are statistically highly significant, both at percent level of probability(Table-VI.13). It seems from the estimated variance-ratios that the inter-village disparities in landownership pattern and the

TABLE-VI.13

Two-Way ANOVA Test for Inter-Cluster Variations

A. Total Number of Households

Source	Degrees of freedom	Mean vari-ance	F-Ratio
Column Effects(clusters)	2	1.01	0.0057 ▭
Row Effects(Landsize)	6	1071.87	6.0106**
Residual	12	178.33	-
B. Total Land owned			
Columns Effects(clusters)	2	361.97	0.1386 ▭
Row Effects(Landsize)	6	24470.19	9.3673**
Residual	12	2612.30	-

**Significant at 1%   ▭ Insignificant.

distribution of households according to landsizes within a given cluster have become approximately uniform at the aggregate level of inter-cluster analysis. This is further substantiated by the fact that the intra-cluster variations, that is, between the landsize variations, remain statistically highly significant. This aspect can be further tested if instead of aggregating the villages in the respective clusters, an intervillage analysis is carried out at the disaggregated level by considering all the six sample villages as separate primary units irrespective of their clusteral identities. Such an analysis shows that the inter-village variations in both the landownership pattern and the distribution of households according to land-size categories are both statistically highly significant at 1 per cent level of probability (Table-VI.14), while between

TABLE-VI.14

Two-way ANOVA Test for Inter-village Variations of the Sample as a whole

Source	Degrees of freedom	Mean vari-ance	F-Ratio
A. Total Number of Households			
Column Effects(villages)	5	588.582	11.6565**
Row Effects(Landsize)	6	127.56	2.5262*
Residual	30	50.494	-
B. Total Land owned			
Column Effects(villages)	5	6311.26	7.0053**
Row Effects(Land size)	6	6433.17	7.1406**
Residual	30	900.93	-

**Significant at 1%   *Significant at 5%

the land-size variations in these two classifications are significant at 5 per cent and 1 per cent level of probability respectively. Hence it is obvious that analytically significant disparities and inequalities get offset at

VILLAGEWISE DISTRIBUTION OF HOUSEHOLD ACCORDING TO LANDSIZE CATEGORIES

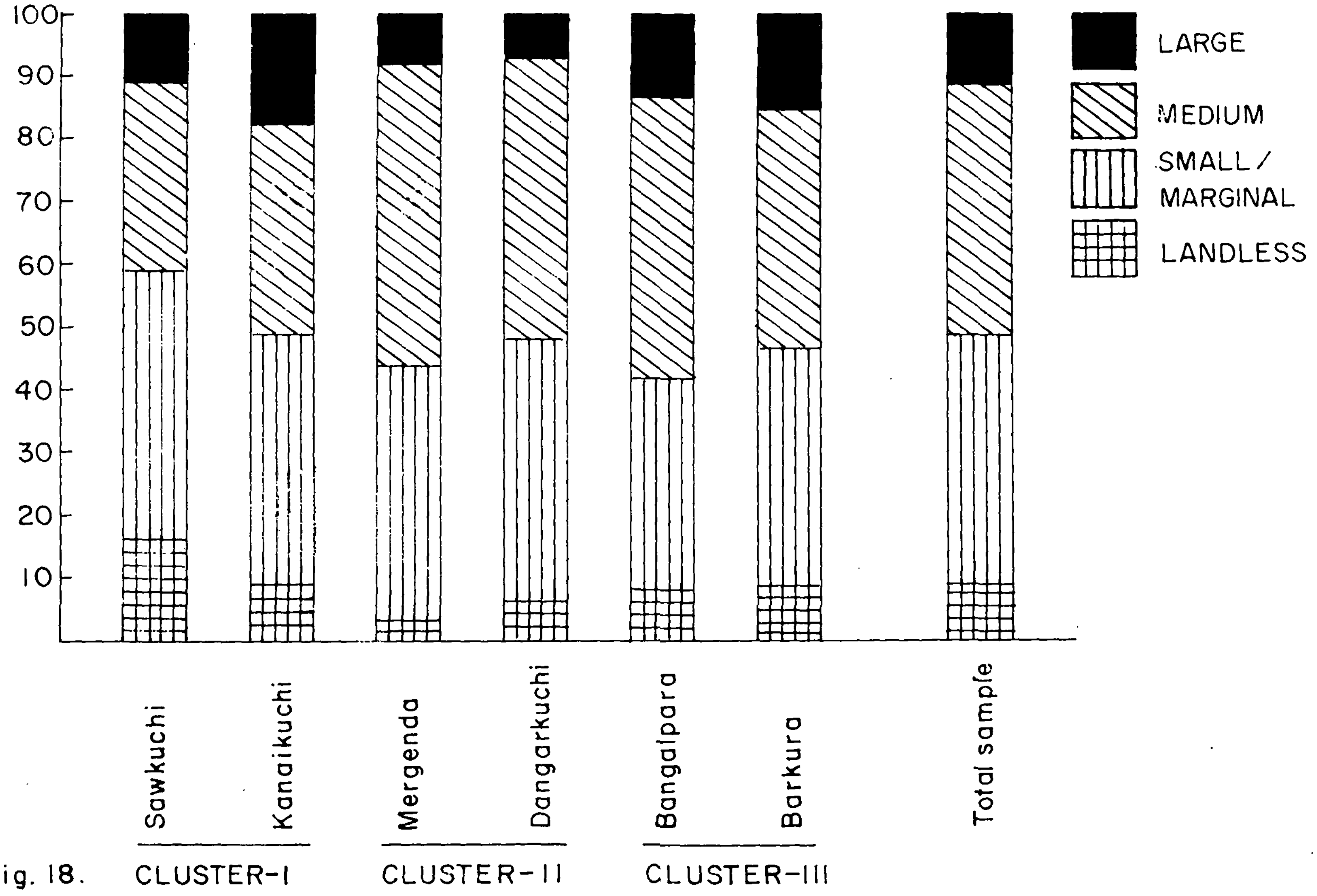


Fig. 18.

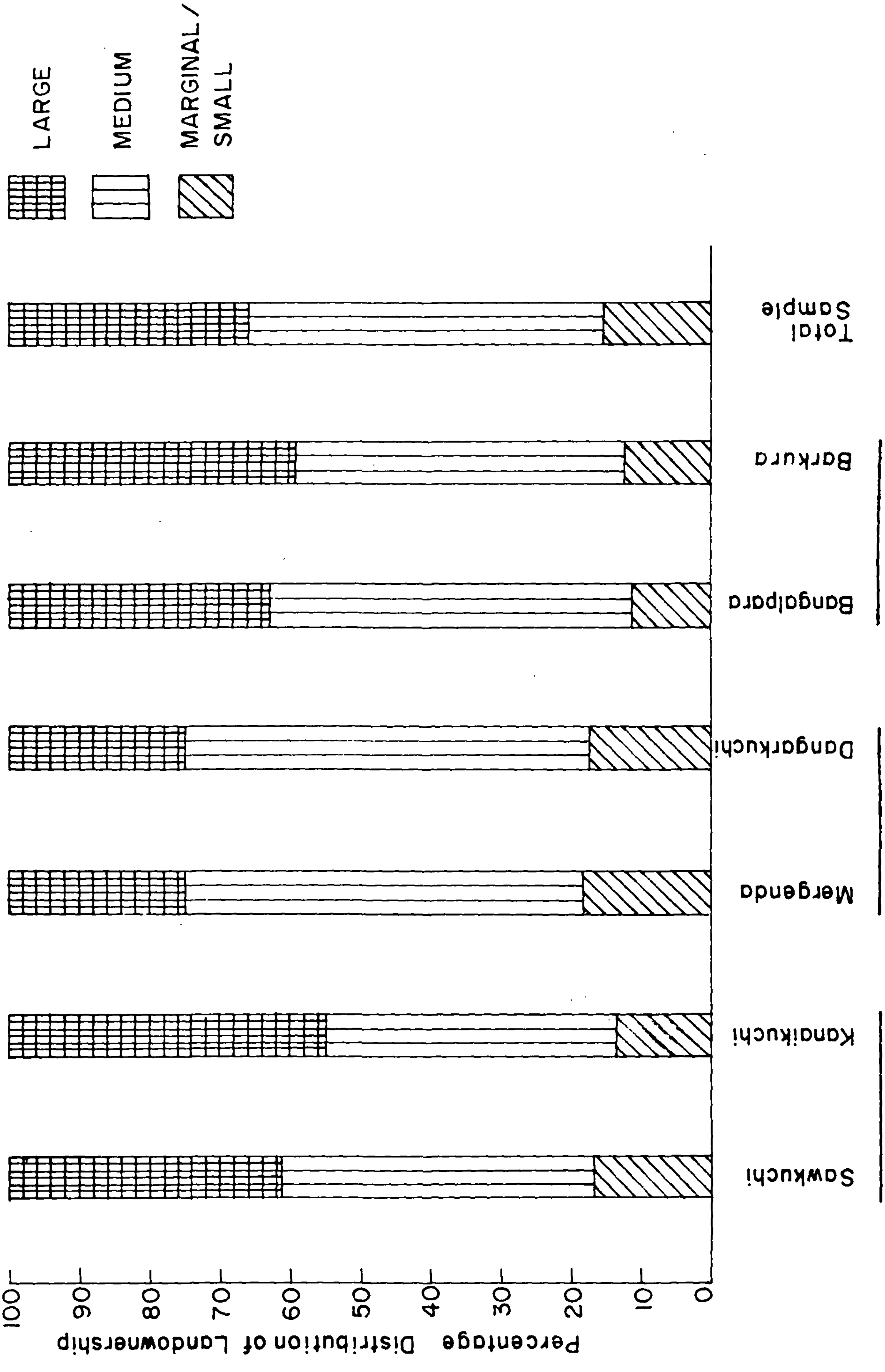

LARGE
MEDIUM
MARGINAL / SMALL
Percentage Distribution of Landownership
100
90
80
70
60
50
40
30
20
10
0
Sawkuchi
Kanaikuchi
Mergenda
Dangarkuchi
Bangalpara
Barkura
Total Sample
CLUSTER- I
CLUSTER-II
CLUSTER-III

Fig. 19.

the aggregate level of analysis. The inter-village comparison of the sample indicates that, in Sawkuchi, the incidence of landless households is the highest followed by Barkura and Kanaikuchi. Incidentally, the same village Sawkuchi also shows the incidence of the second highest percentage distribution of marginal and small cultivating households, the highest being the Cluster II village, Dangarkuchi while Mergenda of the same cluster stands third. The medium scale cultivating households have the highest incidence in Bangalpara village of cluster III, followed by the cluster II villages, Mergenda and Dangarkuchi. The percentage distribution of the households belonging to the large size category, classified according to land-size criteria, is the highest in Kanaikuchi, followed by Barkura and Bangalpara (Fig.18). The land ownership pattern of the villages shows that the percentage land holding among the marginal and small cultivating households is the highest in Mergenda followed by Sawkuchi and Dangarkuchi whereas the concentration of land among the medium scale households is the highest in Dangarkuchi, closely followed by Mergenda of the same cluster while Bangalpara stands third in the order. The percentage incidence of land ownership among the large size group is the highest in Kanaikuchi, followed by Barkura and Sawkuchi as close second and third villages in the rank (Fig. 19).

DISTRIBUTION OF LANDOWNERSHIP AMONG VILLAGE HOUSEHOLDS IN THE 6 VILLAGES AS A WHOLE

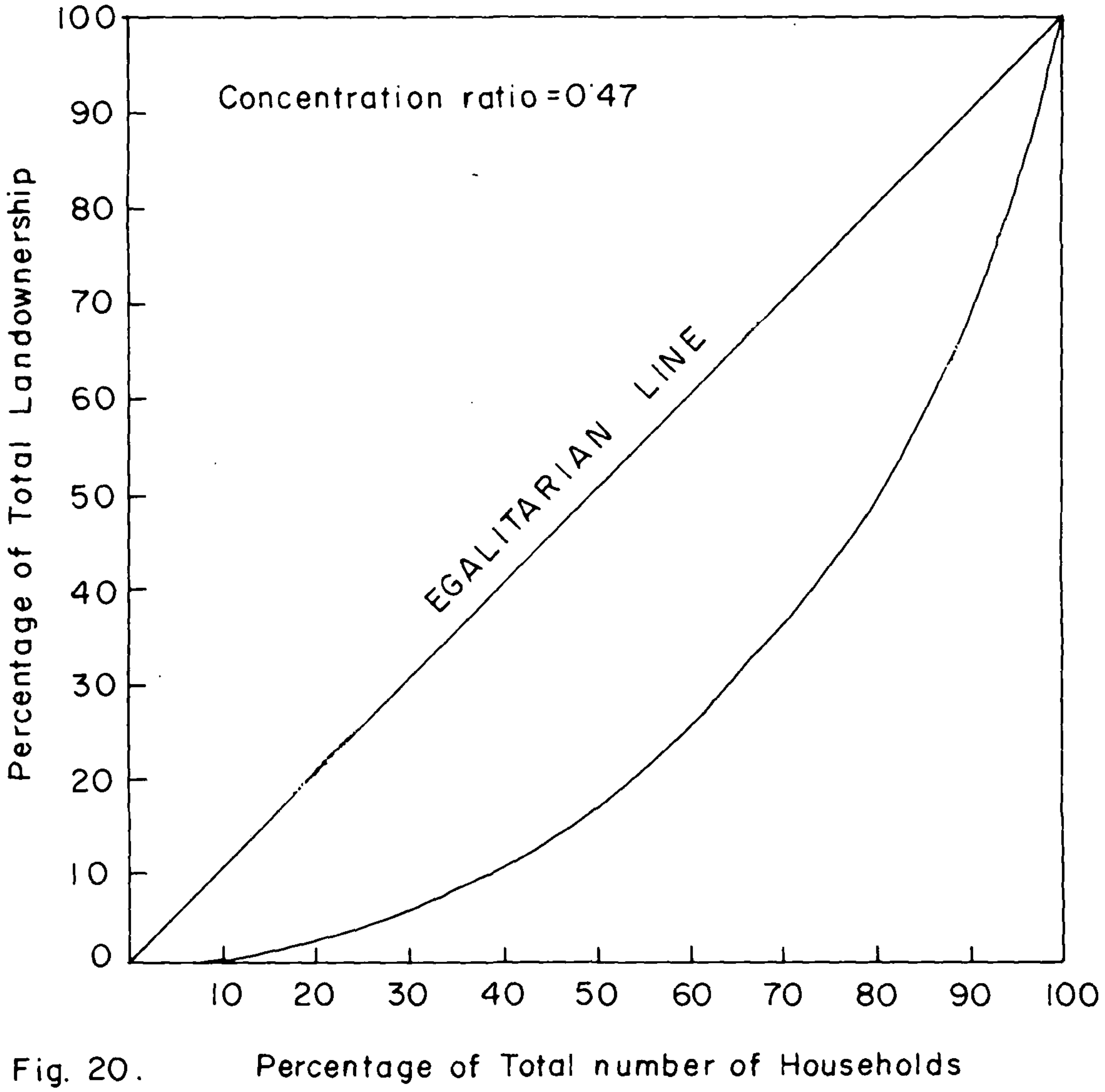


Fig. 20.

On the whole, this analysis includes a total of 765 households from six sample villages of Kamrup district covering an area of about 2674.23 hectares of land. These villages, as analysed above, differ significantly from each other in their physiographic characteristics as well as in their socio-economic conditions. It can be easily observed from the foregoing analysis that these villages are inhabited by predominantly marginal - small and medium-size cultivating households, together these constitute 79.74 per cent of the total sample households, that is, 39.74 per cent and 40.00 per cent for these classes respectively. Only 9.02 per cent of total households are landless (Table-VI.15) while only 11.24 percent households form the largesize category. The concentration coefficient

TABLE-VI.15

The size distribution of total Households and Land-owned in 6 sample villages taken together

Land sizes (in Hectares)	Percentage of Total households	Percentage of total landowned
Landless	9.02	0
Below 0.5	19.35	4.94
0.5 to 1.00	20.39	9.79
1.01 to 2.00	22.22	22.36
2.01 to 3.00	17.78	27.99
3.00 to 4.00	8.23	21.41
4.01 and Above	3.01	13.51

of the land ownership pattern over the household distribution is estimated as 0.47 (Fig. 20).

The existing pattern of percentage distribution of households over various landsize groups and the percentage landownership in different villages under this sample bring out several important aspects corroborating several doctrines and hypothesis; these are, mainly,

(i) rapid urbanisation and/or intense urban influences bring forth an increased magnitude of inequality and poverty in the satellite points or in the rural fringes of these urban centres, as evidenced in the prevailing conditions of Sawkuchi and Kanaikuchi.

(ii) The households and the land belonging to the medium size group are the most productive among other rural land-based classes because of intensive cropping pattern and the economy of land-size utilizations. This aspect has been witnessed in the agriculturally developed villages in our analysis, Bengalpara and Barkura and, lastly,

(iii) the pressure on land in the immigrant villages in commonly found to be very acute which results into the predominance of the marginal and small size landowning households in the total agrarian structure. This study corroborates this hypothesis, as in the case of immigrant villages Mergenda and Dangarkuchi, marginal and small size cultivating households dominate the land-based total agrarian system.

CHAPTER - VII

LAND UTILIZATION IN SAMPLE VILLAGES

To have a broad understanding of the pattern of diffusion and distribution of land utilization among the farmers, it is necessary to discuss in a smaller unit, in present study which is village level. Moreover it is more important where area under study as a homogenous physiographic unit where the physical factors do not vary much, but socio-economic set up differs very oftenly. And in the case of Kamrup where socio-economic and cultural profile are highly diversified, a micro level study is must. The present analysis highlights the general and agricultural land utilization of the surveyed villages first, then an attempt has been made to find out the distribution of land utilization under different land holdings, to ascertain the use and misuse of land in different size of farmers and the size of inter village inequality in a particular land use pattern. And ultimately this analysis seeks the difference of land utilization within the three clusters or socio-economic set up. This will lead to formulate the hypothesis that (i) the land use and cropping patterns of the region have been transformed under the impact of the immigrants (ii) the existing socio-economic and institutional attributes are helping in the adoption of new crops. (iii) the urban influence have impact on the cropping patterns.

General Land Use

The village wise land use discussion without proper understanding of different categories of classification cannot be a meaningful exercise as because the defination of the land use categories vary from place to place. Moreover it has been felt by the author that villagers do not know much about Ministry of Agriculture's recommended classification of the different categories of land, they have their own classification and grouping. So it will be noteworthy, to discuss in brief the various categories of land existing in the surveyed villages,

a) Net sown area - In this category there is no confusion, as it is defined by Ministry of Agriculture 'Net sown area represents the extent of cultivated area actually sown during the agriculture year.'

b) Land under non-agricultural use - Area under non-agricultural use covers all lands occupied by settlements, road railway, beds of streams, ponds, canals, pasture and grazing, tree crops and groves.

c) Fallow - Fallow lands comprises all lands which were taken up for cultivation, but are temporarily not sown for a period of not less than one year and not more than five years. Current fallow means, the land left unsown during the current agricultural year to regain fertility also included under this heading.

d) Forest - Forests cover any land classed or administrated as a forest under legal enactments.

Table-VII.1 gives an account of various uses of land, village wise.

TABLE-VII.1

Percentage of different landuse area.

Size groups	Net sown area	Double sown area	Non-agricul-ture use	Fallow	Forests
Saw Kuchi	60.57	21.30	27.33	11.10	1.00
Kanaikuchi	63.14	8.58	30.84	3.55	2.47
Mergenda	70.74	21.60	18.35	3.02	7.86
Dangerkuchi	70.89	16.74	26.12	2.99	-
Bangalpara	77.39	22.66	20.54	1.57	-
Barkura	63.95	29.95	22.16	13.89	-

It will be seen from Table-VII.1 that net sown area or net cropped area occupied more than 60 per cent in all the sample villages. It is interesting to note that the minimum and the maximum net cropped area vary between 60.60 per cent to 77.89 per cent for Sawkuchi and Bangalpara respectively. It appears from the Table-VII.1 though the village Sawkuchi situated very near to its state capital and biggest urban agglomeration of the region, still it could not mobilize the farmer to bring more than 60 per cent of land under plough. Considering the capabilities of the soil and favourable geographical conditions this poor performance is the result of a number of factors. Firstly a big chunk of the village area is occupied by a gravelled road and 4 big tanks and then a sizeable amount of land devoted to settlement. Moreover a good number of villagers in Sawkuchi village give up their agriculture practice and shifted as daily wage worker in Gauhati City, this increases the current fallow and fallow land in that village.

Kanaikuchi the next village from the sample survey showing even a relatively poor percentage. Some factors responsible for the low courage of cropped area. It reveals from the Table-VII.1 that Mergenda and Dangarkuchi both the villages having more than 70 per cent land under plough. As it is mentioned before that the major constituent of the population are immigrants, who are generally hard working people and they made every effort to bring maximum area under cultivation. Only such lands which were inevitable under non-agricultural use have been protected from the plough. As for example the author has been informed that there were 6 tanks earlier in village, and only 3 have been left now to serve the water supply for the population and the rest have been brought under plough.

The net cropped area is exceptionally high in Bangalpara village. 78 per cent of the total area of that village is regularly cultivated. This means the physical condition are ideal so that the major part of the land has been brought under the plough. Moreover a favourable agricultural inputs and infrastructural facilities helped the farmers to extend the agricultural land as much as possible.

From the Table-VII.1 it becomes quite clear that the village Barkura having a large amount of uncultivable land. Though this village has been selected from a most agriculturally developed block, but it appears that the surrounding development did not touch the village as effectively as it was expected.

Double Sown Area

Double sown area is an important indicator for assessing agricultural intensity of a village. Switching over to an analysis of the Table-VII.1 it is interesting to note that the minimum and maximum double sown area vary between 8.58 and 29.59 percentage for the villages Kanai Kuchi and Barkura respectively. Though the village Kanai Kuchi situated within a crow fly distance from Rangia town, but still showing an exceptionally poor picture for extension of double sown area, only 8.58 per cent of the net sown area again cultivated in this village due to some infrastuctural constraints. The lift irrigation facilities are almost water and river Phutmari cannot supply water in winter months due to low-level of water.

Significant enough to note that both the villages, Bangalpara and Barkura having more than 22 per cent of net sown area under double cropping. In the field survey author was informed that a good portion of this double sown area is devoted to High Yielding variety crops, mainly rice.

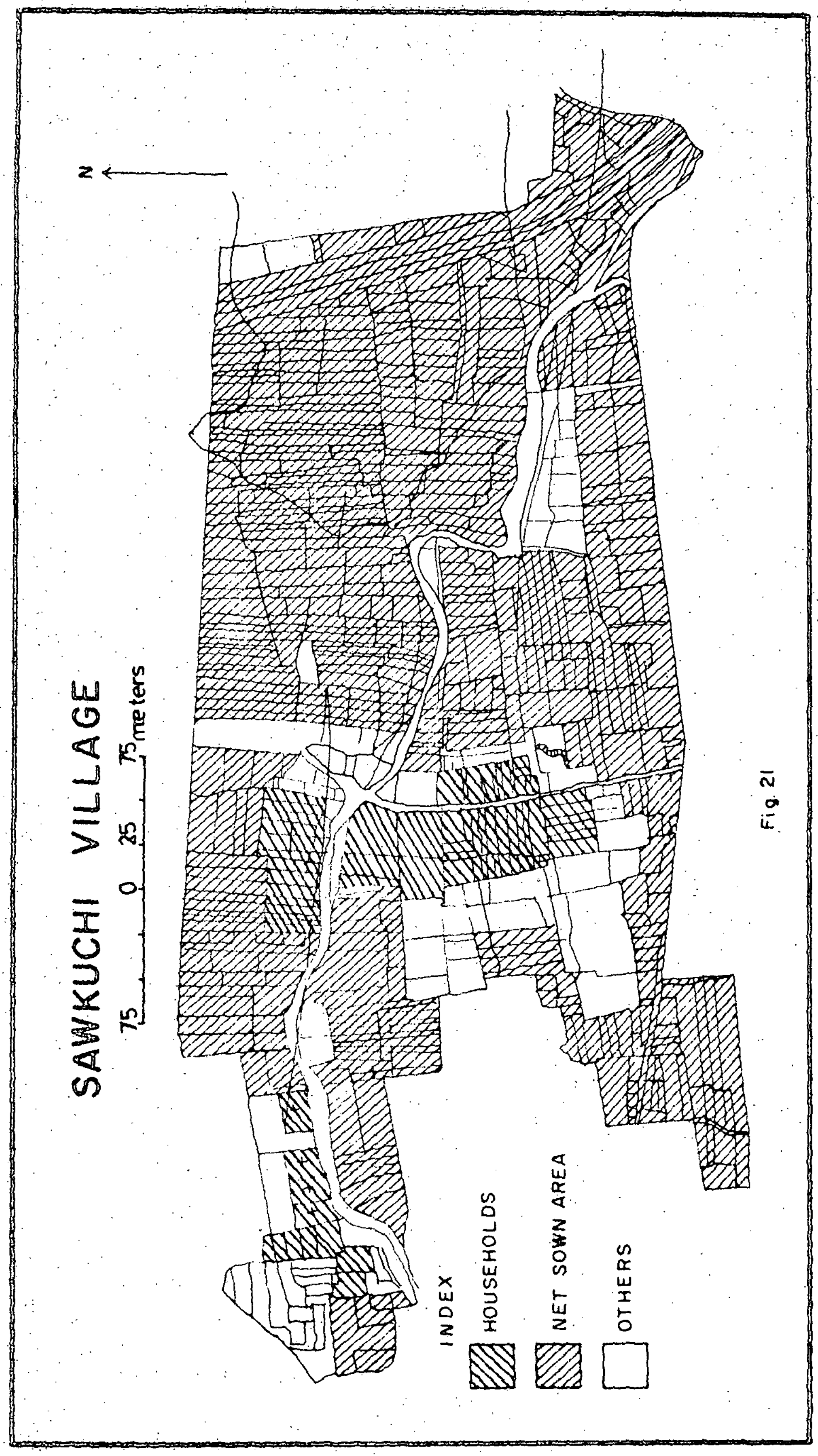

SAWKUCHI VILLAGE
75 0 25 75 meters
N
INDEX
HOUSEHOLDS
NET SOWN AREA
OTHERS

Fig. 21

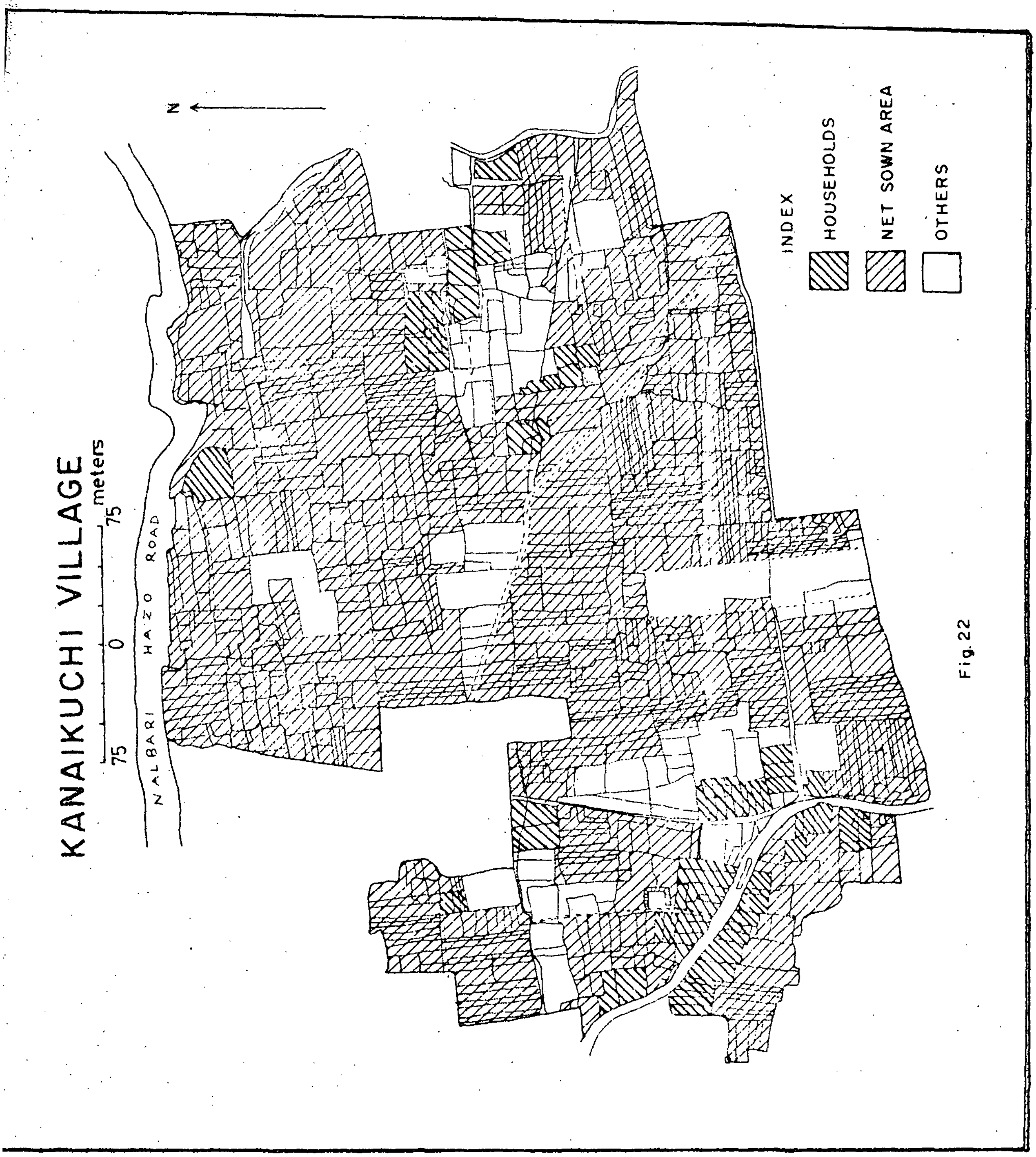

KANAIKUCHI VILLAGE
75 0 75
meters
NALBARI HAZO ROAD
N
INDEX
HOUSEHOLDS
NET SOWN AREA
OTHERS

Fig.22

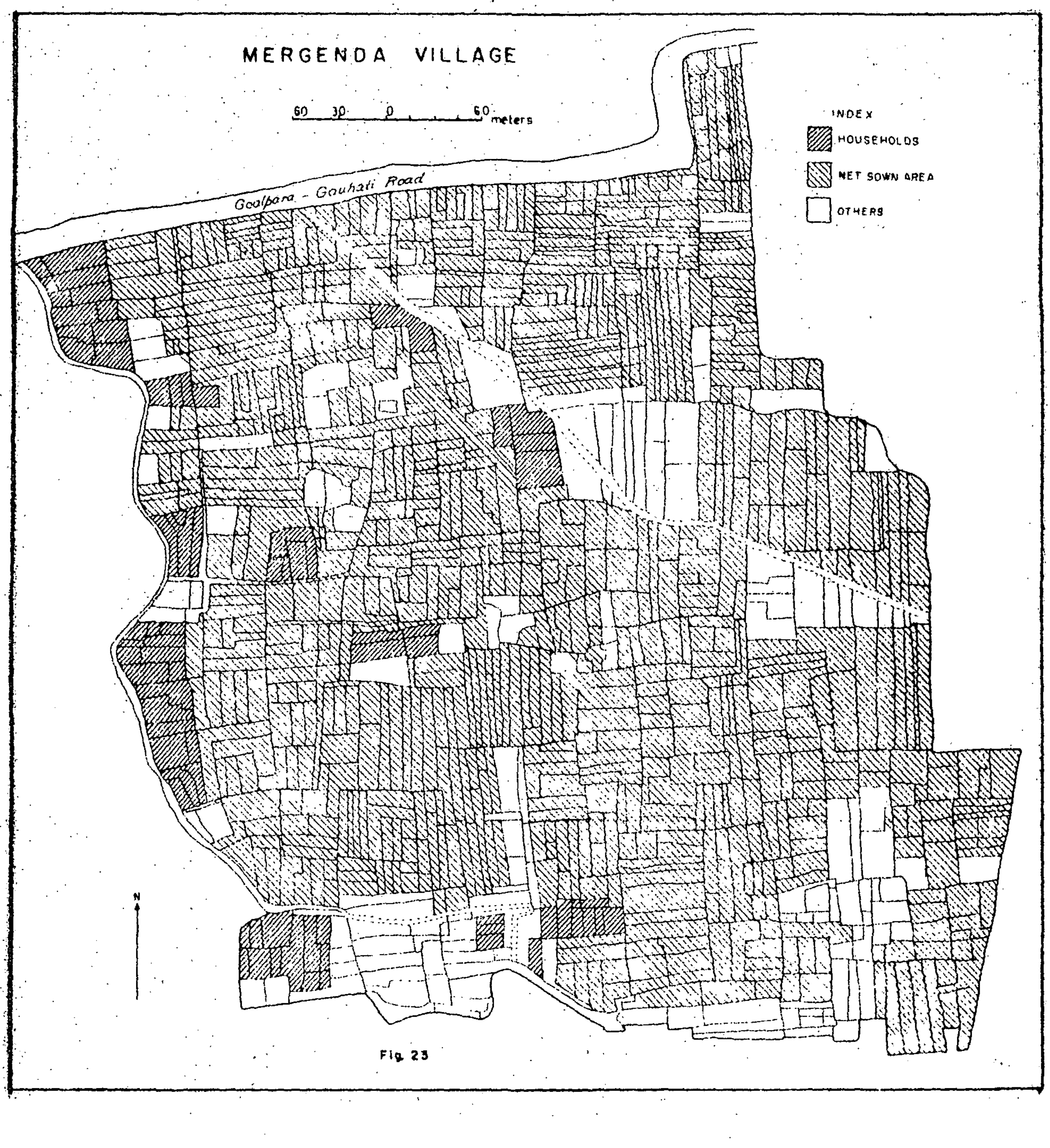

MERGENDA VILLAGE
60 30 0 60 meters
Goalpara - Gouhati Road
INDEX
HOUSEHOLDS
NET SOWN AREA
OTHERS
N

Fig. 23

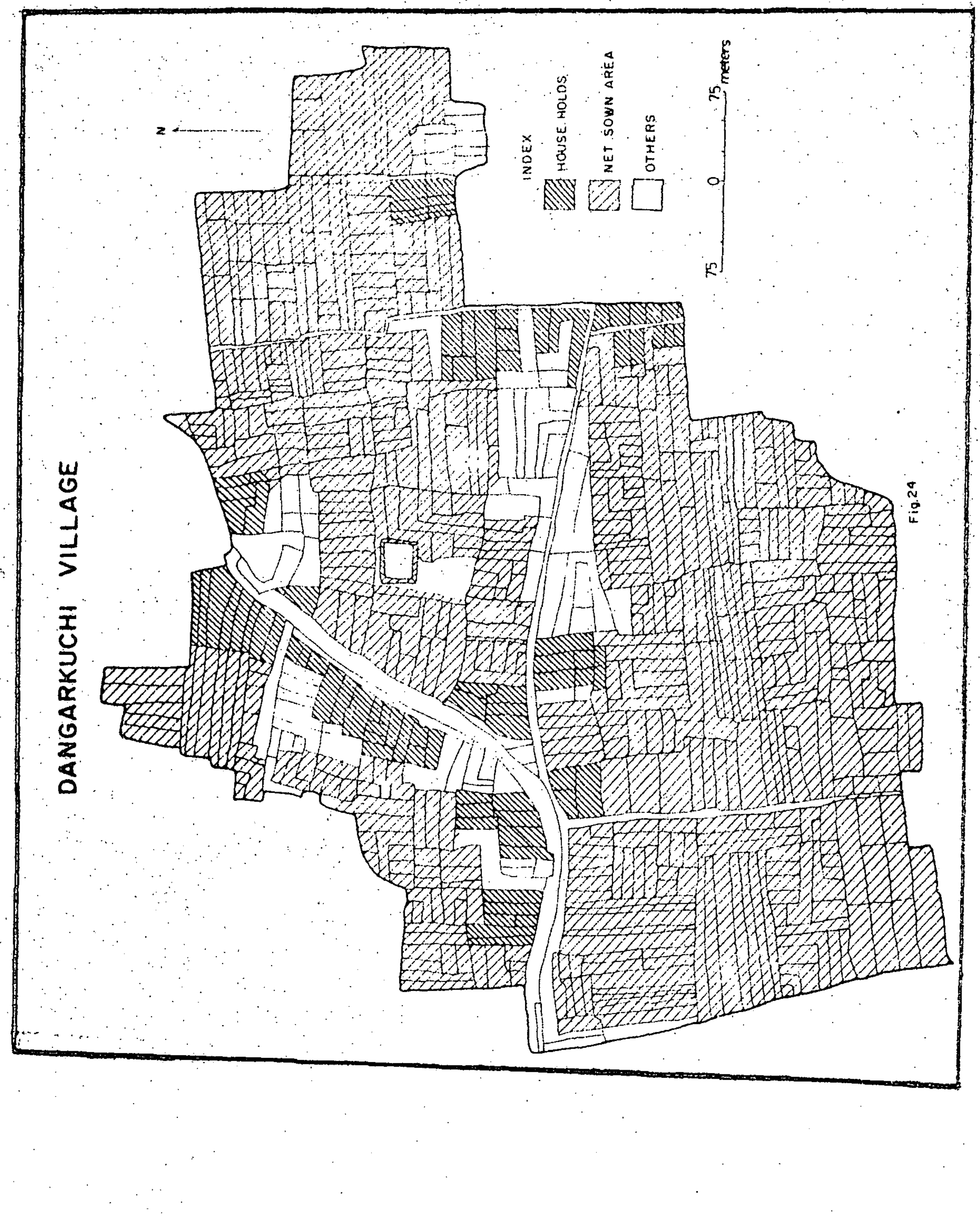

DANGARKUCHI VILLAGE
N
INDEX
HOUSE HOLDS
NET SOWN AREA
OTHERS
75 0 75 meters

Fig.24

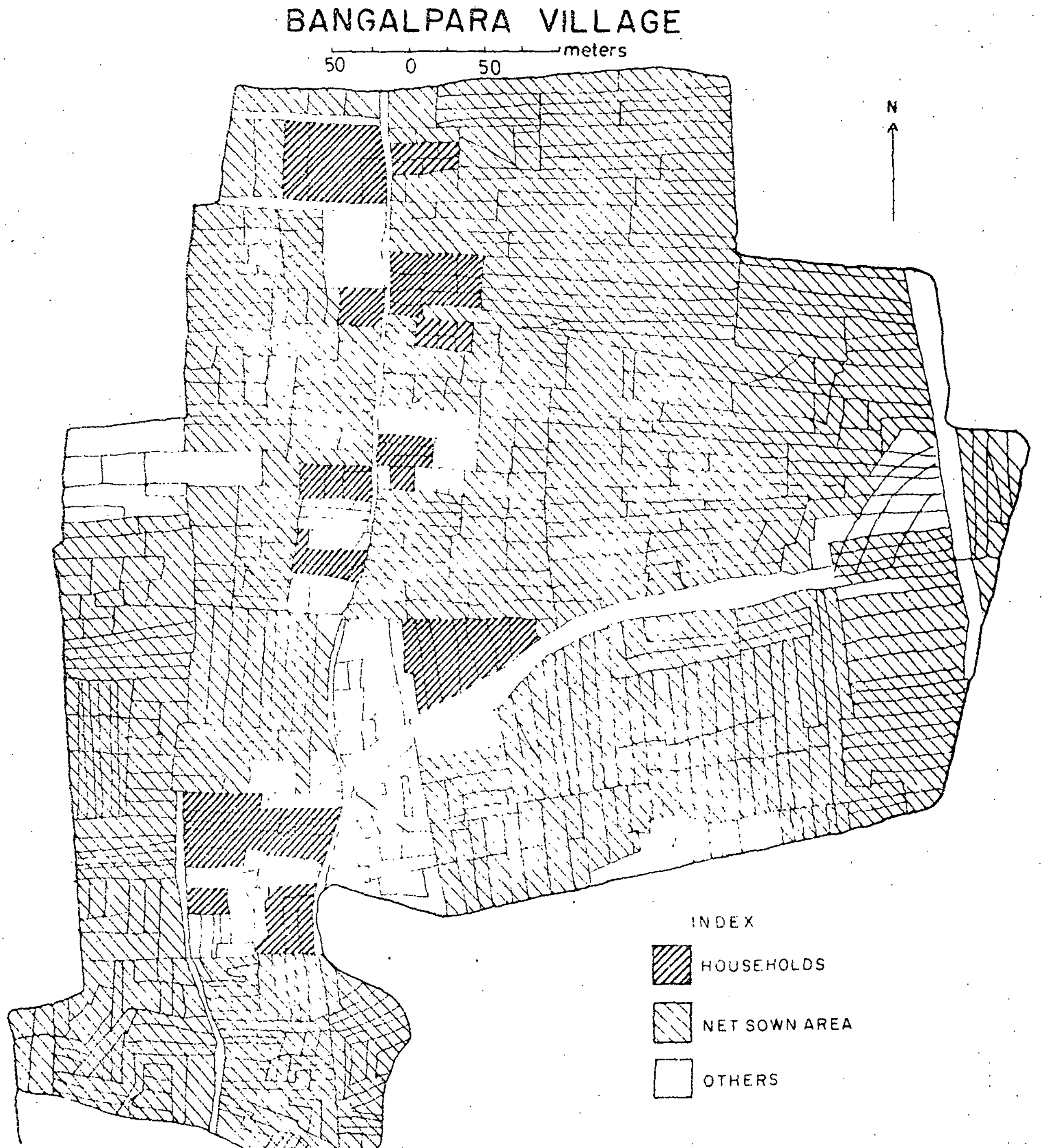

BANGALPARA VILLAGE
50 0 50
meters
N
INDEX
HOUSEHOLDS
NET SOWN AREA
OTHERS

Fig. 25

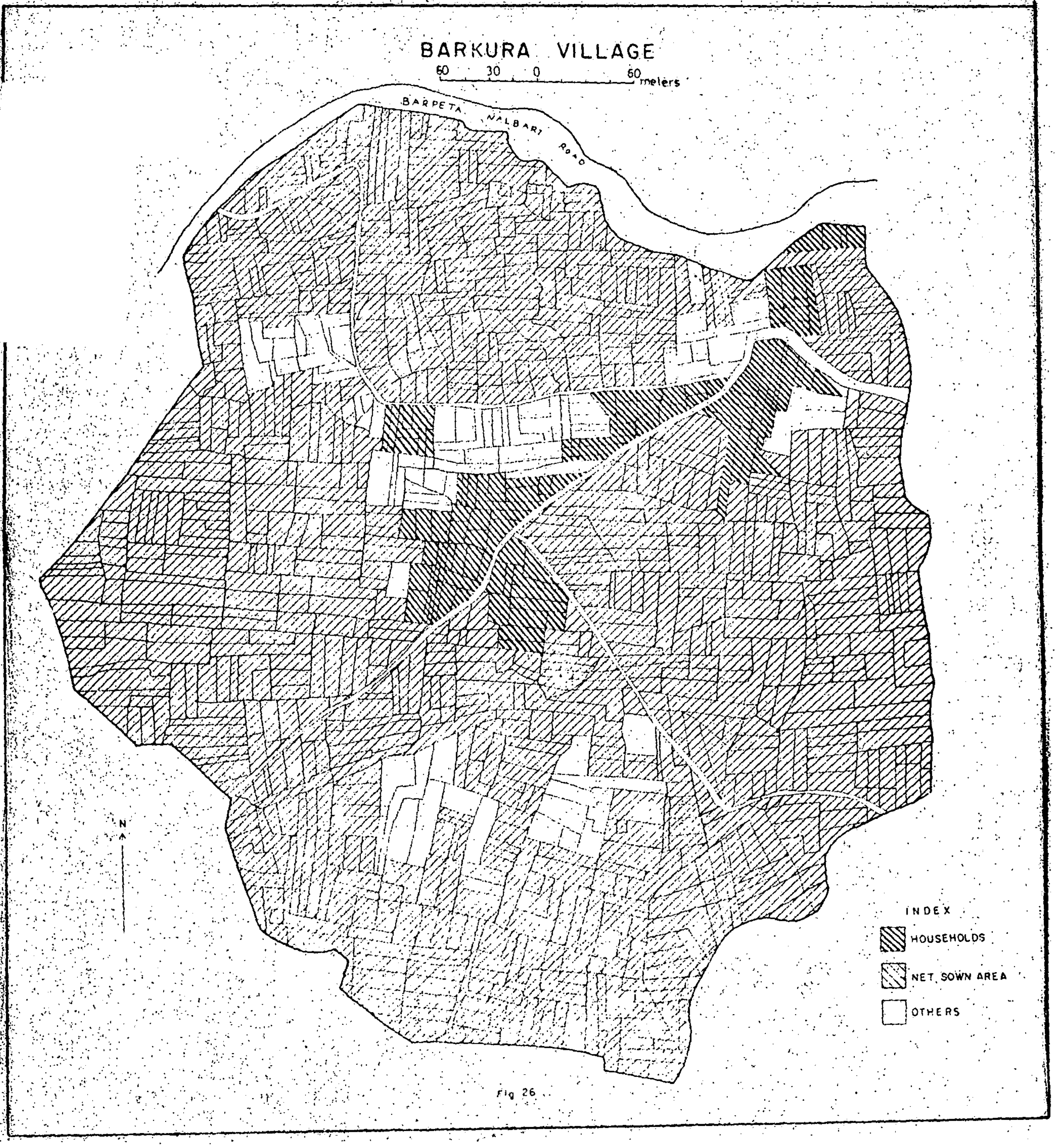

BARKURA VILLAGE
60 30 0 60 meters
BARPETA NALBARI ROAD
N
INDEX
HOUSEHOLDS
NET SOWN AREA
OTHERS

Fig 26

It will be seen from the table-VII.1 that the double sown area is relatively high in Mergenda and Dangarkuchi village, it is because, to feed a large amount of population size in these villages, multiple cropping is only alternative.

Non-Agricultural Use

Table-VII.1 presenting the distribution of land for non-agricultural use during 1981-82. When the field work was done. The outstanding concentration of non agriculture use has been found in Sawkuchi and Kanaikuchi villages. Earlier it is noted that these two villages located within Rangia and Gauhati urban influences and developed a moderate infrastructure which occupies such a large percentage of non-agricultural use land. In Kanaikuchi about one third of the total area of the village has been put to non agricultural uses. Among the different non-agricultural uses 80 per cent occupied by residential houses and the rest by the metalled road which connecting Kanaikuchi with Rangia town. The pressure of population is growing in this village and there is an increase in the share of non agricultural uses of land at the cost of best arable land, which are generally scattered around the main settlement area. The number of tanks is remarkably less in Kanaikuchi, which is major water source in other parts of the district. This has been possible due to the presence of river Phutmari which carries water for most part of the year. In Sawkuchi, the percentage of non agricultural use of land is more than 25 per cent of the total area of the village. Here even the largest share has gone to residential houses and village roads.

It reveals from the table VII.1 that the picture of non agricultural use of land is contrasting in Margenda and Bangarkuchi villages. In Mergenda it is as low as 18 per cent to the total area of the village, whereas in Dangarkuchi it is as high as 26 per cent only. A narrow unmetalled road, few residential houses, 4 tanks are the main non agricultural use of land. Dangarkuchi though it is largely population and immigrants dominated village, still non agricultural use of land occupies one fourth of the total area of the valley. A sizeable amount of non-agricultural use of land is shared by mango, Jack fruit, groves. Bangalpara and Barkura the two villages showing an uniform distribution of non-agricultural use of land which are 20.54 and 22.16 per cent respectively.

Fallow Land

The regional variation in the fallow land within these villages, ranges from below 2 per cent to over 13 per cent of the total area. The most interesting part of this distribution is that the maximum concentration of fallow land has been found in a village from an agriculturally developed region. The village Barkura in west Nalbari Community Debelopment Block facing floods every year by Burdani river, which prevents the farmer to increase their agricultural land. During the field work, author has been informed that, apart from their flood affected areas which are permanently fallow, there is also some current fallow area due to socio economic problem.

The area under fallow land is significantly high, 14 per cent in Sawkuchi village. It appears that good communication system, wide market like Gauhati and other facilities could not mobilize farmers to ~~an~~ extend the agricultural land as it was expected.

Fallow land is substantially less in Mergenda, Dangarkuchi and Bangalpara villages.

Land Utilisation by Size Groups

Land utilization of a village can be well defined, if it is treated according to different classes of holdings. The nature of intensification and the process of land exploitation are well marked in each size group of the distribution. The land belonging to one size group is highly intensive, as they grow not only paddy crops but devote their land to other cereals and mustard in the winter season. While in other size groups agriculture is not much diversified and consequently they could not intensify their cropping structure. On the contrary, maximum number of farmers put their land into cultivation for minimum number of times. As a result, the land rotation on crop priority seems to be very low, thereby indicating the predominance of a few field crops suitable for the land in the existing climatic and socio-economic environment. It further analyses how economic structure governing the pattern of land utilization.

Rice - Rice is predominantly grown and put under cultivation in all the sample villages and invariably exceeding 55 per cent of the gross cropped area. Among the three seasonal varieties of rice, winter and autumn rice are common. Sali (winter) rice is raised marginally by all sizes of farmers in all the villages in this study. Next to Sali, Ahu (autumn) rice is important variety, which is cultivated by all the sample villages. A few hectares of land devoted to Bao rice only in Sawkuchi village. Table-VII.2 shows the percentage of area under rice to the total cropped area by size groups for the six sample villages. It reveals from the Table-VII.2 that the area given to rice varies between as high as 89.43 per cent to as low as 56.07 per cent for Sawkuchi and Dangarkuchi respectively. In other villages where rice concentration is

TABLE-VII.2

Percentage of area under rice in size groups

Size Groups	Sawkuchi	Kanaikuchi	Mergenda	Dangar-kuchi	Bangal-para	Barkura
Below 0.5 hect	78.94	65.26	72.8	59.0	55.71	68.90
0.50 to 1.00	78.93	27.0	72.2	62.50	60.72	86.64
1.01 to 2.00	88.69	78.2	65.81	42.59	62.04	85.35
2.01 to 3.00	90.98	78.57	57.08	65.0	67.1	92.61
3.01 to 4.00	94.98	82.11	44.99	55.56	65.20	93.37
4.01 and above	91.43	68.62	65.77	52.41	75.83	90.61
Total	89.43	73.86	63.50	56.07	65.73	89.00

more than 70 per cent to the total cropped area are in Barkura (89 per cent) and in Kanaikuchi (74 per cent). In these villages rice dominated the whole agriculture as a mono crop. On the other hand, in Mergenda, Dangarkuchi and Bangalpara sample villages it is less than 65 per cent which showing a diversified agricultural mosaic.

In order to understand the intensity of rice cultivation area, it will be worthwhile to analyse different size group of farmers. Switching over to an analysis, it is interesting to note that the percentage of area under rice under different size of farmers are not in same manner distributed within the sample surveyed villages. It will be seen from the Table-VII.2 that marginal (below 0.5 hectare) and small (.50 to 1.00 hectare) farmers in first sample village Sawkuchi having less than 80 per cent of land under rice, whereas the high concentration of land given to rice has been found in medium (1.0 - 3.0 hectare) and large (4.0 and above) size holders, which is more than 90 per cent. Suitable physical frame and rice as a sole crop for the staple diet, farmers of this village never show any inclination towards other crops, except a few plots of vegetables mustand and pulses. However, a sizeable amount of area of this village has been introduced Heigh Yielding Varieties.

In the case of second sample village Kanaikuchi the picture is almost same like Sawkuchi, the concentration of area under rice within the medium and moderately large farmers are quite high. It is interesting enough to note that small farmers and large farmers of this village shifted from rice cultivation unexpectedly. Only 27 per cent of the total cropped area given for rice by the small farmers and cultivated vegetables, mustard and pulses substantially. In fact vegetable is the first crop in this size categories whereas large farmers of Kanaikuchi adopted wheat as a second largest crop.

In Mergenda and Dangarkuchi villages marginal and small farmers use a greater percentage of land for rice cultivation than the medium, and large farmers. Only 44.97 per cent of land devoted for the rice cultivation by the moderately large farmers in Mergenda, whereas the less area given for rice is 42.59 per cent by the medium farmers of Dangarkuchi village.

In Bangalpara, area under rice uniformely distributed among the various size groups, and occupied area never exceeds 75 per cent. It shows that all the farmers of this villages cultivating more than one crop. It appears from the Table-VII.2 that despite her clay loam structure of soil, which support a variety of crops, and ideal geographical location, farmers of Barkura village are largely concentrated on rice except 20 households of submarginal farmers in all the categories rice overwhelmingly dominating and this dominance varies from 85 to 93 per cent of the total cropped area. Sali and Ahu both these varieties are growing in Barkura and 43 per centof the total rice area has been given to High Yielding Varieties.

Next position in respect of cropped area differs from village to village in this study. It is noted earlier apart from geographical factor, social and economical factors play a major role to decide the cropping pattern. Area under jute is absolutely nil in Sawkuchi, Kanaikuchi and Bankura villages, where as a substantial ampunt of jute is grown in Mergenda, Dangarkuchi and Bangalpara villages due to the presence of immigrated people. In such a case an arbitary choice is unavoidable for crop landuse discussion.

Jute - It will be seen from the Table-VII.3 out of six sample villages, only in Mergenda, Dangarkuchi and Bangalpara villages jute grows. It has been informed during the field survey that most of the farmers cultivate jute as a first crop in the paddy growing areas follows by Sali paddy in low land and as well as in well drained upland tracts. It is further told that jute being only cash crop in Kamrup district extending its area day by day, but due to process difficulties and involvement of higher labour, this extension restricted to medium and large size farmers.

In Mergenda except the marginal farmers, all other farmer groups are cultivating jute. The main concentration of jute has been found within the medium and large farmers, which is more than 25 per cent of the total area. The share of jute area decreasing corresponding with the decrease of holding size and small farmers (0.5 - 1.00 hectares) constituted 28 house holds of the Mergenda village devoted only 6 per cent of the total area for jute cultivation.

In the case of Dangarkuchi the distribution of jute area within the different categories of farmers are almost uniform pattern. Apart from the presense of immigrants people, who have brought this crop culture from Bangladesh, the location of the village, Barpeta road town where a small unit of jute mill is available for consumption of the jute production of the surrounding villages encourage farmers to grow jute.

TABLE-VII.3

Percentage of area under Jute in size groups

Size groups	Saw-kuchi	Kanai-kuchi	Mer-genda	Dangar Kuchi	Bangal-para	Bar kura
Below 0.5 hect	0	0	0	10.00	0	0
0.50 to 1.00	0	0	6.01	12.50	0	0
1.01 to 2.00	0	0	18.18	18.21	12.65	0
2.01 to 3.00	0	0	25.10	17.17	16.12	0
3.01 to 4.00	0	0	27.2	19.61	18.39	0
4.01 and above	0	0	22.81	20.34	8.33	0

In Bangalpara Jute cultivation is concentrated within the small, medium and moderately large farmers. However it appears from the Table-VII.3 that the large farmers of this village is less interested in jute cultivation, which is only 8 per cent of the total area owned.

Vegetables - Cultivation of vegetable is very common used of land in all the sample surveyed villages in this study. Vegetables grows both in rabi and Kharif season in the best quality of the land with the help of irrigation mainly through wells. Among the vegetables, potato, and green vegetables are chief crops.

TABLE-VII.4

Percentage of area under vegetables in size groups

Size groups	San-kuchi	Kanai-kuchi	Mergan-dai	Dangar-kuchi	Bang-alpara	Bori-gog
Below 0.5 hec	15.57	21.0	24.46	20.0	41.43	31.10
0.50 to 1.00	17.54	40.0	19.82	8.75	25.56	12.31
1.00 to 2.00	5.50	7.18	13.63	6.96	8.55	9.30
2.00 to 3.00	0	8.57	12.91	0.71	2.01	2.90
3.00 to 4.00	0	2.15	18.18	3.27	0	0.83
4.00 and above	0	0	7.60	3.43	0	0

It will be seen from Table.VII.4 that the distribution of area for vegetable cultivation showing a reverse trend, area under vegetables decreases with the increase of holding size. This indicates that the next to rice, vegetable is the main crop for the marginal and small farmers. In all the six villages the main concentration of area under vegetables are within the marginal and small farmers (below O.t hect and O.5 to 1.0 hectares). In some cases the percentage area under vegetables exceeding more than 30 per cent, as it happened with the marginal farmers of Bangalpara and Barkura villages and small farmers of Kanaikuchi village.

A steddy and consistant percentage of area under devoted to vegetables by the small farmers in all the sample villages which ranges 5 per cent to 14 per cent of the total area owned.

Table-VII.4 further shows that the vegetable cultivation is uniformly practised by all size classes of the Mergenda and Dangarkuchi villages, which reflects the agricultural diversification of the area.

Pulses - Like vegetables, pulses are also grown in Kharif and rabi season in the sample village. The author was informed during the field survey that the villager in all categories cultivated pulses for their own needs only, and that confined the farmers within a limited varieties. Generally Masur and Kalai are the main pulses of the surveyed villages.

There is no significant areal concentration of pulses has been seen in this surveyed villages, except the small farmers of the Kanaikuchi village. They utilised 23 per cent of the total area forr raising pulses. It is interesting to note that not a single hectare of land is spent for the pulses in Mergenda village.

Wheat - The extension of wheat cultivation is a recent phenomenon in Brahmaputra valley, which emerged from the end of sixties and expanding day by day. However the picture is not that encouraging in the sample villages surveyed in this study. Out of six sample villages only in three villages wheat cultivation is existing, and that also within the limited size groups of farmers. Area under this crop is the highest in the large farmers group (4.0 and above) and the lowest in the group of small farmers (0.5 - 1.0 hectares) which ranges between 1.78 per cent to 18.71 per cent. Wheat cultivation is not at all introduced with the marginal farmers. It is noticed from the Table-VII.5 that Bangalpara and Barkura villages are located in Agricuturally developed block and Kanaikuchi is located near Rangia town cultivated wheat in significant amount of area. And it happened after a long persuasion by the agricultural extension office and various agricultural development organisation.

TABLE-VII.5

Percentage of area under wheat in size groups

Size Groups	Sankuchi	Kanai-kuchi	Merg-enda	Dangar-kuchi	Bangal-para	Barkura
Below 0.t hect.	0	0	0	0	0	0
0.5 to 1.00 hect	0	0	0	0	0	0
1.0 to 2.00 "	0	1.78	0	0	11.84	0
2.0 to 3.0 "	0	7.14	0	0	8.67	2.75
3.0 to 4.0 "	0	8.62	0	0	8.28	2.93
4.0 and above	0	18.71	0	0	15.83	9.39

Mustard - Utilization of land under mustard in the sample villages never exhibits a promising picture, rather it shows a subsistance nature of agriculture where, to meet the own necessity is main object.

TABLE-VII.6

Percentage of Area under Mustar in size Groups

Size Groups	San-kuchi	Kanai kuchi	Mer-genda	Dangar-kuchi	Bangal para	Bar-kura
Below 0.5 hect	0	0	2.71	0	0	0
0.5 to 1.00 "	0	10.0	1.30	0	0	0
1.0 to 2.0 "	0	3.57	2.27	2.05	0	0
2.0 to 3.0 "	4.5	2.85	5.0	2.27	0	0
3.0 to 4.0 "	4.72	4.31	9.54	0	0	0
4.0 and above	0	6.23	3.80	0	0	0

It reveals from the Table-VII.6 that there is no uniform pattern in the distribution of area under mustard. Moreover in the last two sample villages Bangalpara and Barkura not a single hectare of land is devoted to mustard cultivation.

It will be seen from the Table-VII.7 that the net cultivated area of the sample villages showing a great disparity. Bangalpara is representative of a highly cultivated area with atleast 78 per cent of the total surface of the village brought under plough, whereas in Sawkuchi only 61 per cent of the land devoted for cultivation. More thann

TABLE-VII.7

Percentage of net sown area in Size Groups

Size groups	Saw-kuchi	Kanai-kuchi	Mer-genda	Bangar-kuchi	Bangal-para	Barkura
Below 0.5 hect	60.34	67.86	58.62	54.72	70.63	50.27
0.5 to 1.00 "	67.65	72.07	71.1	72.23	76.13	73.98
1.00 to 2.00 "	66.29	72.01	81.91	75.87	86.21	74.74
2.00 to 3.00 "	65.2	62.87	72.24	76.72	86.69	72.60
3.00 to 4.00 "	61.96	63.44	58.99	50.42	70.85	50.13
4.00 and above	44.69	44.38	50.03	66.51	62.0	52.18
Total	60.60	63.14	70.74	70.89	77.89	75.94

70 per cent of area under net cultivation has been found in 4 sample villages, they are Bangalpara, Barkura, Dangarkuchi, and Mergenda.

Switching over to an analysis, the distributional pattern of area under cultivation, according to size groups, it is interesting to note that the percentage of net sown area to that area owned by the marginal, small and medium farmers is quite high than the big farmers of all the surveyed villages. This indicates that large size holding is not necessarily a stable criteria for agricultural development.

In Sawkuchi the concentration of net sown area is uniformly distributed among all size of farmers, except large farmers. The concentration ranges between 60 per cent to 68 per cent. The maximum used of net cultivation area has been with the small farmers which is 68 per cent of the total area they owned. Large farmers (4.01 and above) of Sawkuchi village devoted only 45 per cent of land under cultivation. Table-VII.7 further shows that in this class the farmers spended 31 per cent of land for non-agricultural use and 19 per cent land kept fallow.

In the case of Kanaikuchi, the net sown area is much more concentrated in the lower strata, which means the marginal and small farmers used their land for cultivation as intensively as it is possible, which is more than 70 per cent of the total owned area. The medium and moderately large (3.01 to 4.0 hect) farmers constituted 25 per cent of the households and occupied 26 per cent of the total area of the village devoted more than 63 per cent of their land for cultivation. Large size (4.01 and above) farmers owned 13.88 per cent of the total areas and out of it, 44 per cent they brought under plough, 37 per cent under non-agriculture use which includes two ponds of the village and 11 per cent under forest. The fallow land is relatively less in this village (3.55 per cent), but out of this, 42 per cent area is with large farmer groups.

In next two villages Mergenda and Dangarkuchi, the distribution patterns of net sown area are almost in same manner. Here even the maximum utilization of land under cultivation occured within the small and medium size of households, which is more than 70 per cent of total owned area. These three size classes acquired 68 per cent and 69 per cent of the total area of Mergenda and Dangarkuchi villages respectively. Total share of the net sown area of these classes are 74.15 per cent in Mergenda and 73.28 per cent and Dangarkuchi village.

It is enough interesting to note that marginal farmers (below 0.5 hect) cultivated less than 60 per cent of their land in these two villages and kept 40 per cent of their land for non-agricultural use which is very much unusual in this size of farmers. The author has been informed that the marginal farmers of these villages received a sizeable amount of their land from the vested land acquired by the Government, and in their share they received generally the pasture and grazing land.

It reveals from the Table-VII.7 that the area under net sown is highly concentrated within the medium size farmers of the Bangalpara and Barkura villages. These two size groups owned 50.98 and 45.5 per cent respectively of the total area of the village and covered 56 per cent and 52 per cent of the total net area of the respective villages.

A slightly more than 50 per cent land is brought under plough by the moderately large and large size farmers of Barkura village, whereas it is more than 62 per cent in Bangalpara.

Double Cropped Area

Coming over to the distributional pattern of the area sown more than once in the different size class holders the following picture emerges. The percentage of area sown more than once ranges between 14 per cent to 30 per cent in the village Kanaikuchi of Rangia block and Barkura of West Nalbari block. The following Table-VII.8 gives a

TABLE-VII.8

Percentage of double sown area in size categories

Size groups	Sawkuchi	Kanai-Kuchi	Merge-nda	Dangar-kuchi	Bangal-para	Barkura
Below 0.5 hect	8.57	0	31.30	25.0	38.61	47.50
0.5 to 1.00 "	23.91	25.0	14.23	20.0	28.57	13.04
1.0 to 2.00 "	19.80	7.55	20.55	12.0	22.50	26.47
2.0 to 3.00 "	30.18	11.11	23.08	16.85	19.64	30.19
3.0 to 4.00 "	18.37	14.57	18.92	26.54	19.18	41.18
4.0 and above	15.15	33.14	31.50	16.00	29.03	30.67
Total	21.30	13.58	21.60	16.74	22.63	29.95

comprehensive picture of the distribution of area under double cropping among the different size of farmer of the six sample villages.

It will be seen from the Table-VII.8 presented above, that there is no uniform pattern among intra villages and inter villages in double cropped area distribution, except in few cases.

It is interesting to find the distribution of double sown area among the marginal farmers (below 0.5 hectares) of the sample villages. In Sawkuchi it occupied 8.57 percentage area to the net cropped area. Double cropped area is nil in Kanaikuchi village with this category. However in other four sample villages, marginal farmers cultivating a sizeable amount of land more than once, which exceeds more than 25 per cent of the net cropped area. In Bangalpara and Barkura villages the percentage of double cropped area area 39 per cent and 48 per cent respectively. The distribution of area sown more than once is relatively, uniformly distributed among the small and medium farmers of all the surveyed villages in this study. This indicates that these groups of farmers(marginal, small, medium farmers) who are fully depended on their agricultural land cannot neglect the optimum use of every piece of land. Constraints are with them in every step, uneven monsoon, lack of irrigation and poor economy, but still their share of double sown area is quite significant.

The moderately large and large farmers of all the sample villages having good percentage of double sown area. It is significantly high in Barkura village, where moderately large farmers cultivate 41 per cent area more than once, and large farmers cover 31 per cent.

In Kanaikuchi and Mergenda villages the large farmers growing crops more than once in 33 per cent and 31 per cent area respectively, with the help of irrigation. From the above analysis, it has been clear that the spatial distribution pattern of some of the major crops within the study area is not relatively, uniform rather it appears that there is a significant variation in area under crops and the size of holdings.

This aspect of spatial distribution has been analysed with the help of Lorenz Curve. In doing so all the six villages have been grouped under 3 clusters. Keeping in view of the fact that they represent different social and economic set up as well as their relative isolation from the urban influence.

Altogether four predominant crops are plotted in all the three clusters of villages (Fig. 27) showing the cumulative percentage of holding size and cumulative percentage of area under different crops along the two axis. It is assume that the diagonal will indicate even distribution of the holdings and of the area under crops. Any

TABLE-VII.9

Area under Crops (Cluster wise)

Size Groups	Rice %	c.f	Jute %	d.f.	Must-ard %	d.f.	Vegeta-vles %	d.f.	Pul-ses %	d.f.
					Cluster-I					
Belos 5 hectares	6.83	6.83	0	0	0	0	22.73	22.73	0	0
0.5 to 1.00 "	8.11	14.94	0	0	10.0	10.0	40.91	63.64	0	0
1.00 to 2.00 "	17.42	32.36	0	0	20.0	20.0	18.18	81.82	5.0	5.0
2.00 to 3.00 "	28.30	60.66	0	0	40.0	60.0	13.64	95.46	25.0	30.0
3.00 to 4.00 "	30.01	90.97	0	0	30.0	90.0	4.55	100.00	40.0	70.0
4.01 and above	9.34	100.00	0	0	10.0	100.00	0	100.00	30.0	100.0
					Cluster-II					
Below .5 hectare	7.36	7.36	1.30	1.30	4.48	4.48	14.38	14.38	0	0
0.5 to 1.00 "	14.07	21.43	6.48	7.78	3.59	8.07	17.92	32.30	0	0
1.00 to 2.00 "	31.21	52.64	33.94	41.72	28.25	36.32	35.18	67.48	0	0
2.00 to 3.00 "	27.91	80.55	31.22	72.94	35.87	72.19	14.82	82.30	0	0
3.00 to 4.00 "	7.02	87.57	11.66	84.60	18.83	91.09	11.06	93.36	0	0
4.01 and above	12.66	100.00	15.41	100.00	8.94	100.00	6.64	100.00	0	0
					Cluster-III					
Below .5 hectare	2.91	2.91	0	0	0	0	22.67	22.67	0	0
0.5 to 1.00 "	10.07	12.98	0	0	0	0	32.5	55.17	3.78	3.78
1.00 to 2.00 "	20.21	33.19	22.96	22.96	0	0	29.72	84.89	26.18	29.96
2.00 to 3.00	32.77	65.96	40.0	62.96	0	0	13.81	98.70	17.69	80.46
3.00 to 4.00	22.74	88.70	29.63	92.59	0	0	1.65	100.00	17.69	80.46
4.01 and above	11.30	100.00	7.41	100.00	0	0	-	100.00	20.52	100.00

KAMRUP
LORENZ CURVES

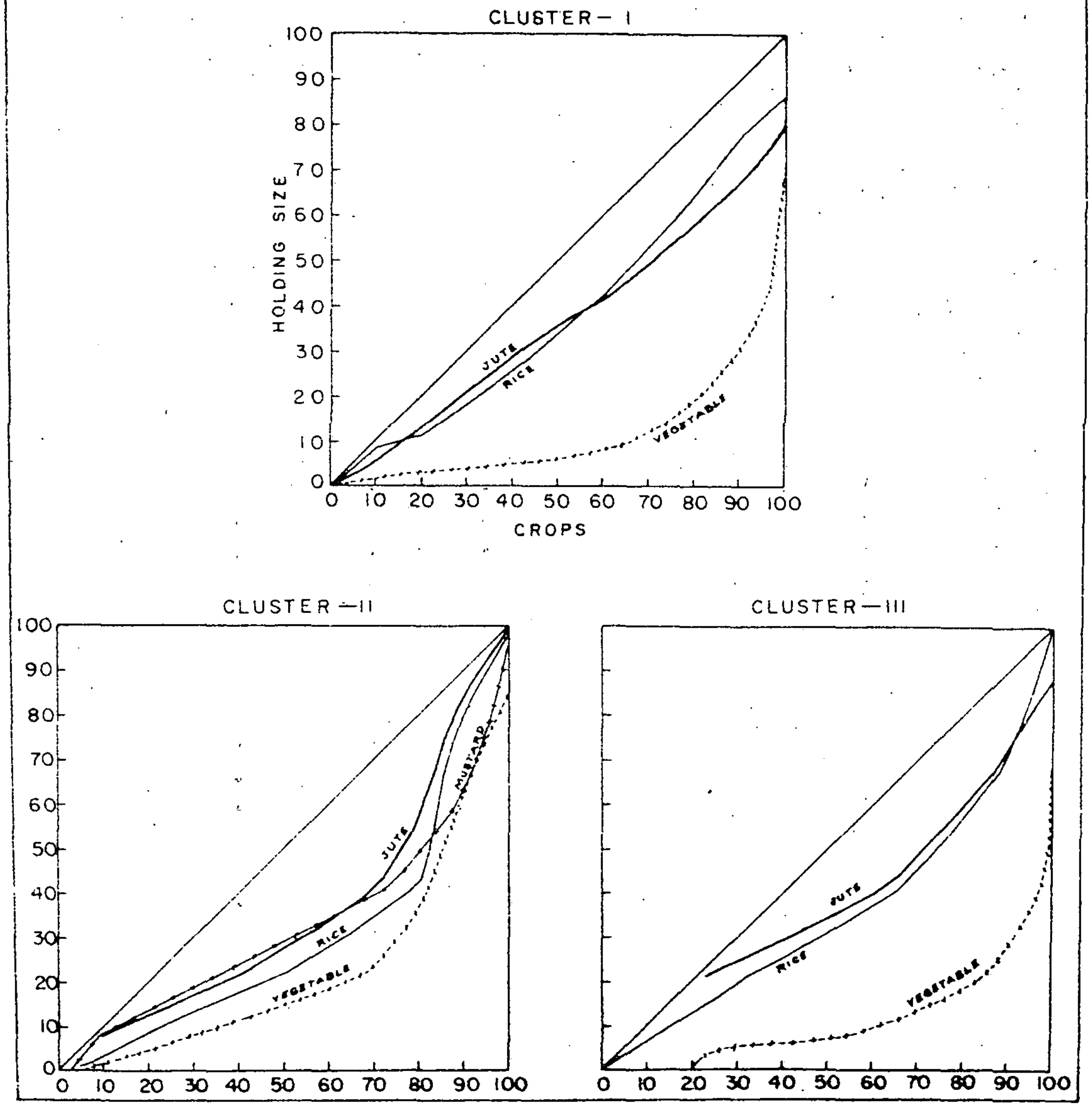


Fig.27

departure from the diagonal is a measure of concentration of area under different crops within some specified sizes of land holdings.

The spatial distribution of rice which is one of the most common crops of the study area represents relatively same type of distribution, except in the II clusters. In the II clusters of villages which is marked by dominant immigration population, rice is lagging behind some other crops like jute and mustard.

Conspicuously the moderately large farmers are not in favour of putting the land under rice cultivation (7.02 per cent) for reasons best known to them.

The distribution of jute reveals some interesting patterns. The crop is totally absent in the Cluster I villages, whereas it becomes the most commonly and evenly distributed crops in the other two clusters irrespective of the size of the holdings. The cause for total absence in Cluster I may be attributed to the cultural attitude of the people, who generally do not accept the jute culture borrowed mainly from Bangladesh. This point is further substantiated by the predominance of jute culture in the other two clusters of villages. As has been mentioned earlier Cluster II villages is dominated by the immigrants (95 per cent) mainly from Bangladesh, and Cluster III villages also marked by the influence of immigrants. Another interesting feature of jute cultivation is that the crop is not generally grown by the sub-marginal and marginal farmers, less preference is given by the large farmers and the crop is quite popular among the medium and moderately large size holdings (2.0 to 4.0 hectares). Different reasons may be attributed, while the poor farmers may not be in a position to invest the money required for pre and post harvesting operations. The farmers with medium size of holdings may be in a better position to invest both capital and labour.

Mustard is most evenly distributed crop among all the holding sizes in Clauster-I villages, moderately specialized in Cluster II villages, whereas the crop is totally absent in cluster III villages. As jute indicates mustard is also generally not grown by the farmers and the maximum concentration is found among relatively large farmers. The total absence of crop in cluster III villages may be attributed to local physical conditions. The spatial distribution of vegetables is rather interesting. It is the most unevenly distributed crop among all the poor major crops of the study area. The crop is neither grown by the landless farmers nor generally by the big farmers. Except these two categories of farmers, rest of the farmers are attached with more or less same significance. The reasons for the specialized distribution of vegetables may be due to the fact that the crop needs special care and attention which the landless farmers cannot afford to pay and the large farmers may not be interested for cultural reasons.

A meaningful and comprehensive conclusion can be drawn from the above discussion that the rice is the main field crop, grown in all the villages by all size of farmers, irrespective of their holding sizes, socio-economic background and cultural variation. This is true may be because rice is the staple food crop for whole Brahmaputra valley. Jute is predominantly grown in this villages, either exclusively occupied by the immigrants and by those villages which are coming into contact with the agricultural development. The crop is totally absent in the indigenous Assamese villages. Mustard is also grown in some villages without any significant pattern. But vegetables appears to be the most specialized but uniformly grown crop in all the villages. The analysis also indicates that except adoption of wheat there is no significant urban influence on agricultural landuse pattern in Kamrup district, which m nullified the earlier mentioned hypothesis that the urban influence have an impact on cropping pattern. However it is proved that agriculture is much more diversified in Cluster-II villages, occupied by the immigrants. The analysis further approves that socio-economic and institutional attributes are helping in the adaption of new crops, as it is found in the case of cluster III, where medium and large farmers are cultivating jute and wheat substantially.

CHAPTER - VIII

CONCLUSION

The present work is an attempt to analyse the Spatio-temporal changes in general landuse and cropping pattern of Kamrup district and secondly this study highlights the pattern of inequality of landholding size and land utilization in six sample villages. Agriculture has the privilege of being the most significant thread in the wrap and woof of the district as well as the states economy. The emerging patterns of landuse has been examined with the set aim of investigating into the possible imbalances between the population and the basic resources of the region. It, therefore, is the main purpose of present work to ascertain the levels of development in different blocks of the district and to make certain specific suggestions in light of the findings of the study for the maintenance of eco-system and economic balance between agriculture, forestry, grazing and other related human activities.

The impact of geographical conditions viz., geology, geomorphic features, climate and soils, on the present utilization of land of the region is carefully studied and supplemented with a number of maps. The affect and effect of these conditions on agricultural practices is also examined. The study reveals that the general landuse in Kamrup District is the result of Physico-Socio economic factors and historical processes. Relief, drainage and rainfall, however have played the most important part in the determination of the extent of agricultural landuse and cropping pattern in the district.

(i) It has been found that the geology and structure of the district has a great bearing on the patterns and problems of landuse.

(ii) The region being an alluvial plain is characterised by an extremely flat surface except the northern and southern border, and has given a wide opportunity to Kamrup farmers to extend their cultivable land. The gradient of the plain is extremely low, from about 1.5m. per kilometer in the northern part of Kamrup District and around 2m. in the southern part.

(iii) The Brahmaputra, along with its numerous affluents and distributaries constitute the principal features of drainage of the region. Though the development of agriculture in this district largely depends on the optimum utilization of drainage system, still it is found that no serious attempt has been made to utilize it. So instead of helping the farmers it brings sorrow by causing floods.

(iv) The Kamrup district falls within a zone of stable climatic limits which is of great significance to reflect the intensity of landuse. An analysis of the rainfall statistics of the region during 50 years period 1931 to 1980 shows that the highest rainfall intensity is observed in the months of June, July and August. Another meteorological quantification has been done with the data of annual precipitation and the change of mean annual temperature, which indicates that the water surplus in this region is much prominent than deficit.

(v) Soil is also an important factor in determining the patterns of land utilization in Kamrup District. Genesis of the soil is purely alluvial, except in the northern and southern fringe. A soil nutrient indices at Community Development Block level showing that out of 15 blocks taken for this study, 11 are having high and very high fertility status.

Having examined the physical aspects of the environment pertaining to landuse in a region, it was essential to deal at some length, the landuse problem and the related tenural status. The tenural system of land in Assam date back to the annexation of Assam by British in 1826 prior to which Assam was under Ahom dynasty right from the third decade of the thirteen century.

(i) In Assam, because of high pressure of population on land, several legislative measures in connection with the problem of land reforms have been enacted since 1947, so as to abolish the existance of intermediaries, to eliminate the fear of insecurity of tenancy to consolidate the uneconomic fragmented holding and to distribute the surplus land among the landless cultivators and the labourers and so on.

(ii) In Kamrup District it is interesting to note that 75.90 per cent of the total holdings are in the wholly owned group, 15.57 are wholly rented group and the remaining 8.53 per cent are partly owned and partly rented category. In 1960-61 about 40 per cent of the holdings were below one hectare which rose to 52 per cent in 1970-71.

The pattern of general landuse in Kamrup examined in space and time, with the background of physical setting and cultural meliеu.

So far the distributional pattern of general land-use is concerned, about 17.28 per cent of the total reporting area was under forest in this district during 1964-65, which has been reduced to 12.80 per cent in 1974-75. About 9.13 per cent of the total area of the district is waste-land which is less than half of the national average of 20.23 per cent, and this indicates high intensity in agricultural land utilization in this district. Area under pastures and grazing grounds was about 4.39 per cent of the total reporting area in 1974-75 as against 15 per cent in 1964-65. In the ten years time of study, a significant decrease in the cultivable land to wasteland has been recorded. This decrease is quite substantial, being 44 per cent in Borketi, 36 per cent in Chayegaon, 35 per cent in Tihu and 33 per cent in Pchim Nalbari. The tremendous increase of population in the plain areas have helped in bringing the wasteland under cultivation. The proportion of fallow land (fallow and current fallow) is about 9.04 per cent, which is quite significant in a fertile region like Brahmaputra Valley. In Kamrup 58.82 per cent of the reporting area is under plough, which is quite higher than the national average of 44.5 per cent. The net sown area increased by 5.82 per cent from 1964-65 to 1974-75. The striking feature in Kamrup agriculture is that 26 per cent of the arable land was double or multiple cropped in 1974-75, while for the state it was 6.5 per cent only.

Land utilization in both Kharif and rabi season is generally confined to the production of rice, vegetables, jute, sugar cane and pulses. Rice is the dominant crop in all the component areal units occupying 62 per cent of the gross cropped area in Karara to 91 per cent in Borigog. Jute is an important cash crop in Hazo, Chamaria and Barpeta Community Development Blocks. It is interesting to note that jute and vegetables cultivation is significant in the areas dominated by the Bengali speaking population. The main findings of Chapter IV are,

(i) Firstly, the temporal change occured in the general landuse pattern in 1964-65 and 1974-75. The proportion of net sown area and double cropped area increased substantially at the cost of fallow and cultivable wasteland due to increasing pressure of population. The results of the inter correlation support this by showing a negative correlationship between these categories. Net area sown and old fallow (r=-0.36) net area sown and culturable waste (r=-0.14), area sown more than once and old fallow (r=-0.50).

(ii) Secondly, the temporal change occured in the cropping pattern during 1964-65 and 1974-75 show that a slow rate of change has been taking place in Kamrup District. Cultivation of six crops (rice, vegetables,

> jute, sugarcane, wheat, oilseeds) has increased rapidly. Wheat, the only Green Revolution'sn crop, recorded a simple growth rate of 88 per cent and rice, 8.58 per cent in 1974-75 over the base year of 1964-65. This supports the earlier mentioned hypothesis that the farmers of the Kamrup District are moving slowly from the subsistance farming to the market oriented economy.

An analysis of Chapter V reveals that in all the blocks of Kamrup District, the cropped area exceeds the net sown area because there is always a part of latter which is sown during both the crop season. In Kamrup the intensity of cropping varies from slightly above 109 to over 151 per cent, exhibiting a regional disparity. The highest agricultural intensity (about 148.0) has been seen in Barpeta, Rupti, Chenga, Jalah, Bagli, Bhavanipur, Gobardhana, Mandia, Hazo, Barketi and Tihu blocks. As a whole, agricultural intensity is satisfactory in Kamrup District as compared with other districts of Assam. Double sown area increased by 16.7 per cent during 1954-55 to 1964-65 and 11.6 per cent during 1964-65 to 1974-75.

While ascertaining the Spatio-temporal changes of the intensity of agriculture in Kamrup District an attempt has also been made in this chapter, to determine levels of inequality in agricultural development. The levels of development indices vary between as low as 57.5 to as high as 211.5 for the blocks of Dimoria and Borigog. In accordance with Kendall's method, areal differentiation in agricultural efficiency has attained the highest level of agricultural development, while Dimoria having the lowest index, appears to be agriculturally least developed area. The relative levels of agricultural development has been found in Tamalpur, Rani, Pub and Pchim Nalbari, Rangia and Hazo blocks. Rest of the areal units are lying in low and low medium levels of agricultural development.

On the basis of relative importance of crops in the agricultural economy of the different portions of Kamrup district, the following five crops association regions could be established,

a) Rice belt (mono culture region) (Pchim Nalbari, Borigog, Rangia, Tamalpur, Tihu, Barketi, Hazo, Rani, Boko, Kamalpur).

b) Rice and Vegetables (Barpeta, Rupti, Chenga, Jalah, Bagli, Chayagaon, Chamaria, Karara).

c) Rice - Vegetables - Jute (Bhavanipur, Mandia).

d) Rice - Vegetables - Sugarcane (Bobardhan).

e) Rice - Vegetables - Rape and Mustard (Pub Nalbari).

The following conclusions can be drawn from this chapter,

i) Cropping intensity increases in Kamrup District due to the high growth of rural population (7.39 per cent).

ii) The disparity in the spatial dimension of agricultural development is quite high.

iii) Crop combination in Kamrup District shows that still subsistance traditional agriculture is prevailing there. The overwhelming position of rice as a mono crop reveals the backwardness of agriculture, though mono-cropping can be a symbol of extreme specialization and modernization in the modern concept of agricultural geography.

Chapter VI analyses the existing pattern of land holdings and the extent of inequality and concentration among the several groups defined by the size classification in six sample villages selected from Kamrup District of Assam. The inter-village comparison of the sample indicates that in Sawkuchi, the incidence of landless households is the highest followed by Barkura and Kanaikuchi. Incidentally, the same village Sawkuchi also shows the second highest percentage distribution of marginal and small cultivating households, the highest the cluster II village Dangarkuchi, while Margenda of the same cluster stands third. The medium scale cultivating households have the highest incidence in Bangalpara village of cluster III, followed by cluster II villages, Margenda and Dangarkuchi. The percentage distribution of the households belonging to the largesize category, classified according to landsize criteria, is highest in Kanaikuchi followed by Barkura and Bangalpara. The land ownership pattern of the village shows that the percentage land holding among the marginal and small cultivating households is the highest in Margenda followed by Sawkuchi and Dangarkuchi.

whereas the concentration of land among the medium scale households is highest in Dangarkuchi, closely followed by Mergenda of the same cluster while Bangalpara stands third in the order. The percentage incidence of land ownership among the large size group is the highest in Kanaikuchi, followed by Barkura and Sawkuchi as second and third villages in the rank.

On the whole, this analysis includes a total of 765 households from six sample villages covering an area of about 2674.23 hectares. These villages, as analysed before, differ significantly from each other in their physiographic characteristics as well as their socio-economic conditions. It can be observed from the discussion that these villages are inhabited by predominantly marginal, small and medium size cultivating households, together these constitute 79.74 per cent of the total sample households, that is 39.79 per cent and 40.00 per cent for these classes respectively. Only 9.02 per cent of the total households are landless, while only 11.24 per cent households are from large size category.

The analysis bring out several important findings; these are mainly -

i) rapid urbanisation and/or intense urban influences bring forth an increased magnitude of inequality and poverty in the satellite points or in the rural fringes of these urban centres, as evidenced in the prevailing conditions of Sawkuchi and Kanaikuchi.

ii) The households and the land belonging to the medium size groups are the most productive among other rural land based classes, because of intensive cropping pattern and the economy of landsize utilizations. This aspect has been witnessed in the agriculturally developed villages in our analysis, Bangalpara and Barkura, and lastly,

iii) The pressure on land in the immigrant villages is commonly found as very acute which results into the predominance of the marginal and small size land-owning households in the total agrarian structure.

An analysis of the general landuse in Chapter VII reveals that the minimum and the maximum net cropped area vary between 60.80 per cent to 77.89 per cent for Sawkuchi and Bangalpara respectively. It indicates that all the six sample villages devoted more than 60 per cent of their land for cultivation. However this wide difference showing that, apart from the physical factors there must be some other factors which are controlling the extension of agriculture. The minimum and maximum double sown area vary between 8.58 per cent and 29.59 per cent for the villages Kanaikuchi and Barkura respectively.

While ascertaining the village level landuse pattern in Kamrup an attempt has also been made in Chapter VII to get a vivid picture of different size of holding and their intensity of landuse. In fact within the size of farmers, the attitude towards different crops also differ. Moreover, it differs from village to village as because the advantageous location, social-cultural bindings and economic status.

Rice is the main field crop, grown in all the villages by all size of farmers, irrespective of their holding sizes, socio-economic background and cultural variation. However, concentration of area under rice varies between as high as 89.43 per cent to as low as 56.07 per cent in Sawkuchi and Dangarkuchi respectively. Concentration of rice is relatively less in Mergenda and Bangalpara villages, whereas in Barkura it is 89 per cent and in Kanaikuchi 78 per cent. Area under rice under different size of farmers are not uniformly distributed. Marginal farmers in all the sample villages kept a sizeable amount of land for other crops. A significant amount of land is given for vegetables and pulses in other sample villages by marginal and small groups of farmers. Medium and moderately large farmers in all the sample villages behaved in some manner except two villages - Mergenda and Dangarkuchi. In these two groups rice concentrated largely, in more than 90 per cent of the total land of Sawkuchi and Barkura villages. In Mergenda and Dangarkuchi, this percentage is less because, jute, mustard and pulses are grown substantially by these farmers. Except Sawkuchi and Bakura, large farmers of other villages are given a significant amount of land for jute, wheat and mustard cultivation. Large farmers of Dangarkuchi village devoted only 56 per cent of their land for rice cultivation whereas they are growing jute in 20 per cent and pulses in 13 per cent of land. This group of farmers in Kanaikuchi and Bangalpara adopted wheat in 19 per cent and 16 per cent of their land respectively.

i) Rice is the main field crop, grown in all the villages by all size of farmers, irrespective of their holding sizes, socio-economic background and cultural variation.

ii) Jute is predominantly grown in these villages, either exclusively occupied by the immigrants or by those villagers who are coming into contact with the agricultural development. The crop is totally absent in the indigenous Assamese villages.

iii) Vegetable appears to be the most specialised but uniformly grown crop in all the villages.

A clusterwise study in the last part of the discussion reveals that, though Kamrup District is physiographically a homogenous area, some sharp differences exist there from area to area for adopting a new crop or commercialization.

i) There is no significant urban influence on agricultural landuse patterns in Kamrup District, which nullified the earlier mentioned hypothesis that the urban influence have an impact on cropping pattern.

ii) However, it is proved that agriculture is much more diversified in cluster II villages, occupied by the immigrants.

iii) The analysis further approves that socio-economic and institutional attributes are helping in the adoption of new crops, as it is found in case of cluster III, where medium and large farmers are cultivating jute and wheat.

Although there are speculations on the transformation, extension and performance of landuse pattern in Kamrup District the study reveals that the region is lagging behind mainly in three fields, those are cropping intensity, adoption of commercial crops and pragmatic use of land. On the basis of this study, the author ascertained that the region has an ecological set-up to reduce these laggings and there is great scope for the diffusion of cultivating commercial crops. In order to obtain the desired results, more research however, is to be done both on the agro-climatic set-up and the physiology of crops on one hand and social and economic condition of the region on the other.

The following suggestions as the opinion of author will go a long way for transformation and extension of agriculture in the highly fertile and extensively cultivated tract of Kamrup District.

The absence of an adequate meteorological information keeps the farmer in predicting the weather condition. Installation of more meteorological and rainfall recording stations is therefore, a pre-requisite for the success of crops as well as for proper use of land. Such climatic data will help to make timely and more realistic forecast, enabling the farmers to adjust and regularise their agricultural operation accordingly. A similar point is observed about the properties of soil. The soil regional laboratories have got enough data but the information need to be plotted on large scale maps and explained to the respective farmers, so that they may apply the deficient components of soil materials in right proportions.

From the study made the author has arrived at the result that the land tenancy and size of holdings are not satisfactory enough to handle the present rural instability and inequality. The land reform measures are expected to create favourable conditions for evolving as speedily as possible, an agrarian economy with high levels of efficiency and productivity and to eliminate all elements of exploitation and social injustice within the agrarian system. It is to be realised that delaying in implementation gives scope for evasion creates feeling of uncertainty and retards agricultural development.

It has been felt by the author that probably it is the hightime to give immediate attention for increasing the total agricultural output. In fact, if irrigation facilities are developed, a short duration leguminous crop or wheat can be harvested in the fallow land during the rabi season which shall increase the total production of farmers, and shall provide them additional agricultural income. So the surplus workforce can get employment during the off season.

The extension of financial institution and development organisations should be most extensive and efficient. The optimum use of inputs can be made with the perfect co-ordination between farmers, extension agent, farm supervisors, technologists, researchers, planners and administrators.

The author has a strong believe that the modern enterprises in agriculture are confronted with socio-cultural and economic resistance of the farming community in Kamrup District. It has been concluded from the sample village study that a large section of the farmers are not having any educational background. So an effective implementation of High Yielding varieties and other agricultural extension programme must be introduced to coordinate the linkage of production inputs with technical know-how and skill of the farmers through a planned and organised Training Programme. And it can be supported by the documentary film and radio broadcast.

Apart from these the other major problems in the agrarian scene of Kamrup District include land fragmentation, less employment opportunities, poor organisation of social institutions such as credit facilities, low level of mechanization and less generation of surplus in production, absence of larger commercial centres and poor communication facilities which have almost retarded the extension and development of agriculture. It is felt that the role of Community Development Block is not at all satisfactory, because it has failed to bring the coherence between illiterate and semi-illiterate farmers and extension services. After having examined, the situation is not very satisfactory in the agricultural scene. The author extends suggestion that a transformation from the traditional to its modern counterpart can only be brought in the agriculture of the rural areas of Kamrup District, through an organised and systematic execution of agricultural policy. And this needs a perfect coordination between the cultivators, administrators, researchers, other committed agencies and the communication media, and as it is mentioned earlier more research and investigation should be made to decide how this coordination can be achieved.

APPENDIX

Soil Nutrient Index

	Nutrient index Nitrogen (N)	Nutrient index Phosphorous (P)	Nutrient index Potassium (K)
Barpeta	2.54	1.73	1.72
Rupti	2.44	1.86	2.1
Bagli	2.95	2.06	1.11
Mandia	1.7	2.12	1.43
Tamalpur	-	-	-
Borigog	2.4	1.67	2.37
Borketi	2.29	1.76	1.43
Rangia	2.13	1.81	1.7
Hazo	2.13	1.54	1.13
Rani	2.48	1.58	1.73
Boko	2.51	1.64	1.51
Chayagaon	2.28	1.64	1.76
Rampur	2.24	1.69	2.16
Kamalpur	2.07	1.83	1.51
Chamaria	2.10	1.42	1.49
Dimoria	2.00	1.91	2.23

General Land use - 1963-64

Blocks	Net area sown	Area sown more than once	Current Fallow	Old Fallow	Cultivable Waste	Land put to non-agricultural use	Barren	Permanent pazes pasture	Forest	Tree crops
Barpeta	60.80	22.72	2.8	4.9	2.6	4.4	17.62	6.06	0.6	1.0
Rupti	60.19	21.8	2.5	4.4	2.4	4.4	16.63	5.6	3.0	1.0
Chenga	60.16	23.8	2.7	4.8	2.6	4.4	17.6	6.3	-	1.15
Jalah	42.03	17.8	1.7	2.9	1.4	3.1	11.6	3.7	32.6	0.7
Bagli	57.48	23.4	2.9	4.8	2.3	4.3	17.5	6.9	-	1.2
Bhavanipur	59.87	22.9	2.6	4.8	2.7	4.6	17.5	6.8	-	0.8
Gobardhana	35.71	15.3	1.8	3.7	1.5	2.8	11.3	3.7	38.0	0.7
Mandia	57.80	25.8	2.9	5.8	2.9	4.4	16.6	5.9	-	1.3
Tamalpur	59.71	48.7	1.8	1.9	1.9	5.2	3.8	8.7	11.4	5.1
Borigog	70.57	25.9	1.2	2.8	4.1	8.0	3.0	4.5	-	4.9
Tihu	71.12	52.3	1.2	3.8	3.7	6.2	1.2	7.5	2.1	2.8
Borketi	47.70	23.0	6.6	7.8	1.1	9.6	7.8	4.7	nil	4.3
Pub-Nalbari	63.24	9.9	6.2	7.5	2.9	8.4	7.2	3.8	nil	1.4
Pchim-Nalbari	63.55	23.6	2.0	0.3	1.7	18.9	1.5	8.5	nil	3.2
Rangia	66.49	25.6	1.8	2.1	2.4	10.2	3.7	4.2	nil	8.9
Hazo	55.59	20.2	3.0	4.3	3.6	7.7	8.6	9.2	2.4	5.2
Rani	37.97	2.93	1.6	2.8	5.4	4.1	3.5	4.2	35.68	4.4
Boko	39.50	13.1	0.2	1.7	3.8	13.0	3.8	0.3	34.2	3.1
Chayagaon	41.05	12.2	0.7	0.6	1.2	3.9	20.4	5.5	0.4	25.1
Rampur	37.93	3.2	4.0	1.9	5.4	9.2	10.2	4.4	22.2	7.5
Kamalpur	60.0	21.4	3.4	2.4	2.3	6.7	7.1	2.5	6.0	9.3
Chamaria	57.64	8.5	1.5	6.7	8.4	17.2	4.5	3.2	nil	0.5
Dimoria	35.50	5.7	4.5	3.8	2.4	9.8	16.20	1.6	10.5	15.4
Kamrup	50.17	19.7	2.4	3.5	2.7	7.0	10.3	5.0	13.6	5.2

Agricultural Land Use - 1963-64

	Ahu rice	Sali Rice	Boro rice	Total Rice	Wheat	Gram	Mati Kalai	Pulses	Potato	Rape & Mustard	Sugar cane	Jute	Tobacco	Vegetables
Barpeta	32.41	33.86	0.16	66.44	1.88	1.76	2.20	3.24	1.03	3.59	4.79	4.57	0.36	13.36
Rupti	31.93	38.99	0.25	71.09	1.83	0.97	1.92	3.64	1.13	3.32	4.51	4.94	0.30	13.00
Chenga	32.03	36.87	0.23	69.13	1.84	1.07	1.60	3.51	0.97	3.20	4.83	4.82	0.30	12.97
Jalah	30.26	35.32	0.19	65.77	1.85	0.90	1.76	3.27	0.80	3.39	4.47	4.46	0.25	12.05
Bagli	33.99	38.99	0.22	73.21	1.54	1.35	1.83	3.59	1.15	3.48	4.51	4.62	0.29	13.31
Bhavanipur	31.19	38.59	0.24	70.04	1.73	2.30	2.06	3.67	1.12	3.24	5.00	5.00	0.30	14.0
Gobardhana	34.61	40.81	0.23	75.66	2.21	1.29	2.20	3.57	1.08	4.08	5.25	5.16	0.24	13.59
Mandia	31.96	38.14	0.21	70.32	1.89	1.93	2.05	3.44	0.97	3.79	4.75	4.94	0.24	13.13
Tamalpur	40.15	38.69	0.03	78.89	1.52	0.50	0.64	2.15	0.50	5.93	0.28	0.32	0.31	0.00
Borigog	34.82	54.95	1.01	90.79	0.05	0.00	0.00	0.32	0.53	1.73	1.34	1.73	0.25	3.90
Tihu	39.06	46.86	0.20	86.13	1.00	1.13	1.38	2.15	1.30	2.26	0.29	1.24	0.38	13.94
Borketi	22.48	46.21	0.30	69.0	1.85	0.00	0.00	4.05	1.37	10.73	4.87	5.42	0.43	0.00
Pub-Nalbari	27.59	32.04	3.32	62.97	5.94	0.00	0.00	3.88	0.00	5.57	1.24	1.68	0.60	0.00
Pchim-Nalbari	33.36	51.42	1.09	85.88	0.59	.048	0.49	0.21	2.17	2.17	0.22	0.29	0.70	4.85
Rangia	34.60	41.98	0.07	76.65	2.36	0.15	1.02	4.75	0.68	3.67	0.51	1.76	0.16	11.46
Hazo	26.78	41.48	1.37	69.64	2.46	0.47	1.24	4.96	2.15	3.25	0.39	5.71	0.11	6.92
Rani	5.48	72.75	3.12	81.37	0.00	0.41	0.61	0.15	2.15	1.42	0.29	0.40	0.08	5.08
Boko	29.48	62.28	0.68	92.45	0.49	0.18	0.00	1.01	0.57	5.78	0.25	0.84	0.00	11.22
Chayagaon	22.46	38.87	0.08	61.43	0.00	0.74	3.62	0.00	0.46	6.15	0.32	4.00	0.23	6.88
Rampur	6.28	67.19	1.30	74.78	1.91	2.68	0.47	2.63	0.93	1.83	0.84	1.83	0.03	7.30
Kamalpur	26.89	52.77	1.15	80.82	4.17	0.00	0.23	5.71	0.16	4.29	0.53	1.29	0.05	3.67
Chamaria	31.73	27.70	1.03	60.48	3.69	4.07	0.68	6.20	8.09	5.64	0.05	5.49	0.15	6.71
Dimoria	16.76	43.86	11.88	72.51	0.35	0.02	0.02	0.71	0.48	1.04	0.22	0.35	0.01	0.00
Kamrup	30.31	42.07	1.07	73.62	1.67	0.92	1.18	2.76	1.20	3.85	2.10	2.96	0.26	8.26

	Cultivable area(Hac)per agricultural worker	Net sown area (Hac)per agricuture worker	Double sown area (Ha) to net sown area	Net irrigated area to net sown area(Ha)	Wage rate of agricultural worker in Rupees	Consumption of fertilizer per hectare of Net sown area	HYV to net sown area(Ha)	Per capita Net Agriculture product (Money)	Ratio of pumps to net sown area	Per capita credit in Rupees	Tractors and other implements	Percentage area under cash crops to Net Sown area (Ha).
Barpeta	.74	.72	43.60	8.98	8.50	-	9.60	245.90	16	57.96	2	14.25
Rupti	.60	.59	43.59	-	8.00	.88	8.20	132.31	2	30.30	-	14.26
Chenga	.68	.68	43.0	-	8.50	-	9.34	145.71	11	34.28	-	14.28
Jalah	1.79	1.66	43.65	-	8.00	.14	5.61	157.77	10	37.46	1	23.80
Bagli	.87	.87	48.80	6.26	8.50	.56	11.56	244.12	31	125.53	4	14.26
Bhevanipur	.53	.51	43.80	-	8.50	.63	11.18	151.32	3	41.57	-	8.01
Gobardhana	1.37	1.30	46.80	4.49	8.00	-	5.41	164.33	9	47.95	1	14.26
Mandia	.71	.70	44.95	1.10	8.00	17	5.93	124.06	4	18.45	-	14.26
Tamalpur	1.05	1.04	52.12	9.21	8.00	.01	11.00	163.26	20	59.89	2	1.68
Borigog	1.20	1.11	34.75	12.31	8.50	.75	16.48	518.86	44	40.54	6	11.59
Tihu	.42	.42	59.75	4.01	8.50	.46	14.70	147.37	19	35.93	-	3.69
Borketi	.95	.97	51.76	.59	8.50	.36	14.05	305.77	85	87.19	4	15.81
Pub-Nalbari	.99	.97	31.68	1.65	8.50	.61	9.98	426.6	20	80.67	3	5.61
Pchim-Nalbari	.97	.78	36.52	6.93	8.50	.10	9.75	282.0	28	59.66	4	1.92
Rangia	1.01	.99	40.00	.79	9.00	.10	13.10	200.14	24	37.17	6	3.51
Hazo	.88	.90	41.0	-	9.00	.50	14.21	268.42	28	53.38	4	9.37
Rani	1.66	1.63	8.89	-	8.50	.17	3.06	266.0	24	166.6	3	1.40
Boko	1.78	1.11	38.62	-	9.00	.24	22.10	334.2	28	86.73	4	8.96
Chayagaon	.85	.84	29.28	3.00	8.00	-	9.88	213.0	12	24.2	-	6.69
Rampur	.80	.77	8.49	4.87	8.00	-	5.79	336.0	2	34.93	-	4 .00
Kamalpur	1.10	1.09	15.76	8.27	9.00	.40	12.82	522.5	25	119.14	2	2.26
Chamaria	.94	19.04	19.04	5.37	8.50	.35	8.09	296.7	4	58.30	2	8.12
Dimoria	.43	22.85	22.85	2.74	8.00	.12	6.68	97.0	6	6.70	-	.89

Blocks	1964-65 Gross Cropped Area	1964-65 Net Sown Area	1974-75 Gross Cropped Area	1974-75 Net Sown Area
Barpeta	19127	13924	21431	14924
Rupti	20214	14829	22677	15792
Chenga	21336	15275	22926	15965
Jalah	56072	39327	57565	40087
Bagli	17457	12403	19336	13883
Bhavanipur	16039	11594	17342	12494
Gobardhana	36779	25748	42862	29848
Mandia	39855	27541	43858	30542
Tamalpur	44273	32643	47270	34740
Borigog	14342	11142	16362	12142
Tihu	19044	13190	20733	14030
Borketi	23585	15896	25430	16736
Pub-Nalbari	14386	11356	15876	12056
Pchim-Nalbari	18409	13420	19687	14420
Baska	45715	30894	19687	30894
Rangia	39304	28352	41407	29455
Hazo	27290	20010	28681	20321
Rani	9621	8931	10705	9831
Boko	42229	31700	45399	32750
Chayagaon	25827	19837	27069	20938
Rampur	10958	10088	12030	11088
Kamalpur	17477	12877	17805	12877
Chamaria	18897	16477	20086	17352
Dimoria	28819	24815	29999	25115
Karara	16090	13097	16090	13037
Kamrup	664844	476916	771488	501441

Area in Hectares

Percentage of area under main land uses to the total area by size group

Size groups in hectares	No. of house-holds	Total cropped area	Net sown area	Area sown more than once	For non-agricultural use	Fal-low	Forests	Total operational holdings
1	2	3	4	5	6	7	8	9
Village-Sankuchi								
Landless	28	-	-	-	3.2	-	-	3.2
Below 0.50	45	19.0	17.50	1.50	9.6	1.90	-	49.50
0.50 to 1.00	28	28.50	23.0	5.50	9.0	2.00	-	68.0
1.01 to 2.00	24	36.30	30.30	6.00	12.39	3.02	-	88.01
2.01 to 3.00	28	66.39	51.0	15.39	18.20	19.00	.10	160.08
3.01 to 4.00	14	58.0	49.0	9.0	18.69	11.39	.90	146.90
4.01 and above	4	19.0	16.50	2.50	13.42	7.00	2.10	60.02
Total	171	227.19	187.30	39.89	84.50	34.31	3.10	575.71
Village-Kanaikuchi								
Landless	8	-	-	-	-	-	Nil	-
Below 0.50	24	9.5	9.5	0	4.5	0	-	23.5
0.50 to 1.00	11	10.0	8.0	2.0	2.5	.60	-	23.10
1.01 to 2.00	16	28.0	26.50	2.0	9.6	.70	-	66.80
2.01 to 3.00	13	35.0	31.50	3.50	16.90	.90	.90	88.70
3.01 to 4.00	12	46.40	40.50	5.90	18.94	3.0	1.10	115.50
4.01 and above	3	16.03	12.04	3.99	10.09	2.0	3.0	47.15
Total	87	145.40	128.04	17.39	62.54	7.20	5.0	365.10
Village-Mergenda								
Landless	4	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Below 0.5	19	18.39	6.39	2.0	4.29	.22		31.29
0.5 to 1.00	35	30.30	26.0	3.70	10.00	.55		70.77
1.01 to 2.00	46	88.0	73.0	15.0	13.46	.66	2.00	192.12
2.01 to 3.00	18	48.0	39.0	9.0	7.39	1.05	3.05	107.49
3.01 to 4.00	6	22.0	18.5	3.50	4.00	2.96	5.90	56.86
4.01 and above	4	26.30	20.0	6.30	8.26	2.36	9.36	72.58
Total	133	233.09	182.89	39.50	47.43	7.80	20.31	531.11

Table contd..

Table contd.

Size groups in hectares	Rice			Jute	Mustard	Vege-tables	Pulses	Sugar care	Wheat
	Ahu	Sali	Boro						
	10	11	12	13	14	15	16	17	18
Village-Sankuchi									
Landless	-	-	Nil	nil	nil	-	-	nil	nil
Below 0.50	-	15.0			nil	3	1.0		
0.50 to 1.00	1.00	21.50			nil	5	1.0		
1.01 to 2.00	2.00	30.20			nil	2	2.1		
2.01 to 3.00	8.00	52.39			3.0	nil	3.0		
3.01 to 4.00	4.00	51.10			1.0	-	1.90		
4.01 and above	-	18.0					1.0		
Total	15.0	188.19	Nil	nil	4.0	10.0	10.0	nil	nil
Village-Kanaikuchi									
Landless	-	-	nil	nil	nil	-	-	-	-
Below 0.50	nil	6.20			-	2.0	1.30	-	-
0.50 to 1.00	nil	2.7			1.0	4.0	2.3	-	-
1.01 to 2.00	nil	21.9			1.0	2.0	2.6	-	.50
2.01 to 3.00	nil	27.50			1.0	3.0	1.0	-	2.50
3.01 to 4.00	nil	38.10			2.0	1.0	0.90	-	4.0
4.00 and above	nil	11.0			1.0	-	1.0	-	3.0
Total	nil	107.40			6.0	12.0	10.0	-	10.0
Village-Mergenda									
Landless	nil	nil	nil	nil	nil	nil	nil	nil	nil
Below 0.5	nil	12.39		nil	.50	4.50			-
0.5 to 1.00	1.0	20.90		2.0	.40	6.00			-
1.01 to 2.00	6.0	52.0		16.0	2.0	12.0			-
2.01 to 3.00	4.0	23.40		12.0	2.4	6.20			-
3.01 to 4.00	1.0	8.90		6.0	2.1	4.0			-
4.01 and above	1.0	16.30		6.0	1.0	2.0			-
Total	13.0	134.99		42.0	8.40	34.70	nil	nil	-

Percentage of Area under main land uses to the total area by size groups

Size groups in hectares	No.of house holds	Total cropped area	Net Sown area	Area sown more than once	For non-agricultural use	Fallow	Total operational Holdings	Ahu
1	2	3	4	5	6	7	8	9
Vill. Dangarkuchi								
Laneless	7	nil	nil	nil	.04	nil	.04	nil
Below 0.t hect	24	10.0	8.00	2.00	6.06	.56	26.62	nil
0.5 to 1.00 "	28	24.0	20.0	4.00	7.03	.66	55.69	nil
1.01 to 2.00"	30	56.0	50.0	6.00	15.0	.90	125.79	nil
2.01 to 3.00"	24	70.46	60.30	10.16	16.30	2.0	159.18	nil
3.01 to 4.00"	4	15.30	12.10	3.20	10.0	1.90	42.50	nil
4.1 and above	4	29.0	25.0	4.00	11.20	1.39	70.59	nil
Total	121	203.76	175.40	29.36	64.63	7.41	482.48	nil
Vill. Bangalpara								
Landless	10	nil			.39		.39	
Below 0.5 hect	16	7.0	5.05	1.95	2.10	nil	16.10	nil
0.5 to 1.00 "	26	18.0	14.00	4.00	4.39	nil	40.39	nil
1.01 to 2.00"	30	49.0	40.0	9.00	6.00	.40	104.40	3.2
2.01 to 3.00"	27	67.0	56.0	11.00	8.00	.60	142.60	4.0
3.01 to 4000"	12	43.5	36.5	7.0	14.00	1.02	102.02	2.0
4.1 and above	4	24.0	18.6	5.4	10.00	1.40	59.40	1.8
Total	135	209.63	170.15	38.25	44.88	3.42	465.30	11.0
Vill. Barkura								
Landless	12						nil	
Below 0.5 hect	20	8.36	5.66	2.70	3.60	2.0	22.32	1.00
0.5 to 1.00 "	28	26.0	23.0	3.0	6.09	2.0	60.09	2.0
1.01 to 2.00"	24	43.0	34.0	9.0	8.49	3.0	97.49	9.71
2.01 to 3.00"	26	69.0	53.0	16.0	12.00	8.0	158.0	14.0
3.01 to 4.00"	15	48.0	34.0	14.0	19.4	14.42	129.82	11.90
4.01 and above	4	21.30	16.30	5.0	8.32	6.62	57.24	3.0
Total	119	215.65	165.96	49.70	57.90	36.04	524.90	41.61

Table contd..

Percentage of Area under main land uses to the total area by size groups

Size groups in hectares	No.of house holds	Total cropped area	Net Sown area	Area sown more than once	For non-agricultural use	Fallow	Total operational Holdings	Ahu
1	2	3	4	5	6	7	8	9
Vill. Dangarkuchi								
Laneless	7	nil	nil	nil	.04	nil	.04	nil
Below 0.t hect	24	10.0	8.00	2.00	6.06	.56	26.62	nil
0.5 to 1.00 "	28	24.0	20.0	4.00	7.03	.66	55.69	nil
1.01 to 2.00"	30	56.0	50.0	6.00	15.0	.90	125.79	nil
2.01 to 3.00"	24	70.46	60.30	10.16	16.30	2.0	159.18	nil
3.01 to 4.00"	4	15.30	12.10	3.20	10.0	1.90	42.50	nil
4.1 and above	4	29.0	25.0	4.00	11.20	1.39	70.59	nil
Total	121	203.76	175.40	29.36	64.63	7.41	482.48	nil
Vill. Bangalpara								
Landless	10	nil			.39		.39	
Below 0.5 hect	16	7.0	5.05	1.95	2.10	nil	16.10	nil
0.5 to 1.00 "	26	18.0	14.00	4.00	4.39	nil	40.39	nil
1.01 to 2.00"	30	48.0	40.0	9.00	6.00	.40	104.40	3.2
2.01 to 3.00"	27	67.0	56.0	11.00	8.00	.60	142.60	4.0
3.01 to 4000"	12	43.5	36.5	7.0	14.00	1.02	102.02	2.0
4.1 and above	4	24.0	18.6	5.4	10.00	1.40	59.40	1.8
Total	135	209.63	170.15	38.25	44.88	3.42	465.30	11.0
Vill. Barkura								
Landless	12						nil	
Below 0.5 hect	20	8.36	5.66	2.70	3.60	2.0	22.32	1.00
0.5 to 1.00 "	28	26.0	23.0	3.0	6.09	2.0	60.09	2.0
1.01 to 2.00"	24	43.0	34.0	9.0	8.49	3.0	97.49	9.71
2.01 to 3.00"	26	69.0	53.0	16.0	12.00	8.0	158.0	14.0
3.01 to 4.00"	15	48.0	34.0	14.0	19.4	14.42	129.82	11.90
4.01 and above	4	21.30	16.30	5.0	8.32	6.62	57.24	3.0
Total	119	215.65	165.96	49.70	57.90	36.04	524.90	41.61

Table contd..

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