Genesis and Characteristics of Wasteland In Birbhum District (West Bengal)

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MASTER OF PHILOSOPHY

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CERTIFICATE

This is certified that the dissertation entitled **"Genesis and Characteristics of Wasteland in Birbhum District, (West Bengal)"** submitted by **RUPSA BANERJEE**, in fulfilment of six credits out of total requirement of twenty four credits for the Degree of Master of Philosophy (M.Phil.) of the Jawaharlal Nehru University is a bonafide work to the best of my knowledge. It may be placed before the examiner for evaluation.

Date: 19.7.1991

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Last but not the least my sincere thanks to all my friends who had shared both moments of happiness and depressions, and made this work easy.

21.7.91.

Rupsa Banerjee.

Rupsa Banerjee

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CHAPTER I

INTRODUCTION

1.1 Statement of the Problem:

The problem of wasteland has started attracting lot of attention in the recent times it is more important in the context of India where presure on land is increasing with rapidly growing population. The demand of food and other requirments of increasing population can not be fulfilled by limited available usable land. The agricultural grrowth was 19.78 percent while population grew by 24.78 percent in India during the decade 1971-81. One of the ways to meet the increasing food demand is by increasing the area under cultivation. Agriculture contributes 34 percent of the national income of Indian economy. National commission on agriculture has estimated that by the year 2000, for a population of 1000 million India would require an additional 40 million hectare of land under trees for various purposes including fuel and 10 million hectare each for production of crops and fadder. An additional area needed for non-agricultural use has to be added to this. Therefore, the gap between future demand and peresent supply is a cause of concern.

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1. Saxena N.C. 1989. Regional Wood Energy Development programme in Asia. Field documents No. 15. Development of degraded village land in India. F.A.O., Bangkok, pp 1-2.

India needs more land to be put to use in order to meet the demand of growing population, to increase agricultural production for industries to increase fodder, timber and different forest productes and to provide land for settlement and other construction purposes. The lands already under use can not meet these requirements. Hense there is a need to tap unutilised land. Wastelands are precently lying unutilised due to different constraints. Therefor, efforts should be made to make these usable.

1.2 Definition of Wasteland: Different authors has given different definitions of wasteland among them a few are as fallows:

I. "The lands which have been previously used but which has been aboondoned and for which no further use has been found. "

II."Lands which are not available for cultivation or are left out of cultivation without being cultivated like fallows and culturable waste."

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2. Stamp L.D., 1948, The Land of Britain,It's use and Misuse. Mathuen, London.

3.Ministry of Food and Agriculture, 1961, Govt. of India, westeland Survey and Reclamation Committee; Report on Location and utilisation of wasteland in India. Part X p-2

iii. " It is that land which is degraded and is presently lying unutilised except as current fallow due to different constraints[4].

It can be concluded from above that wasteland constitute a category of land which is not suitable for cultivation or any other beneficial use under the existing conditions.

The land is generally classified into five main categories based on land use. These include land under forests, land not available for cultivation, other uncultivated land excluding fallows, fallows, net area sown. Among these five broad groups forest and net sown areas can not be used for other purposes as these already have great importance. Other three groups are further sub-divided among these-land put to non-agricultural use, permanent pasture and grazing ground and land under miscellaneous trees, groves have some other specific uses. current fallows are those lands which are kept current fallow to regain the fertility and after sometime these are again cultivated, so these again cannot be concidered wasteland.

But when fallow within a year are not brought back under cultivation due to some environmental or other problems of the farmers,

4.Ram Parsad. Technology of Wasteland Development Associate publishing Corporation, New Delhi, 1988.

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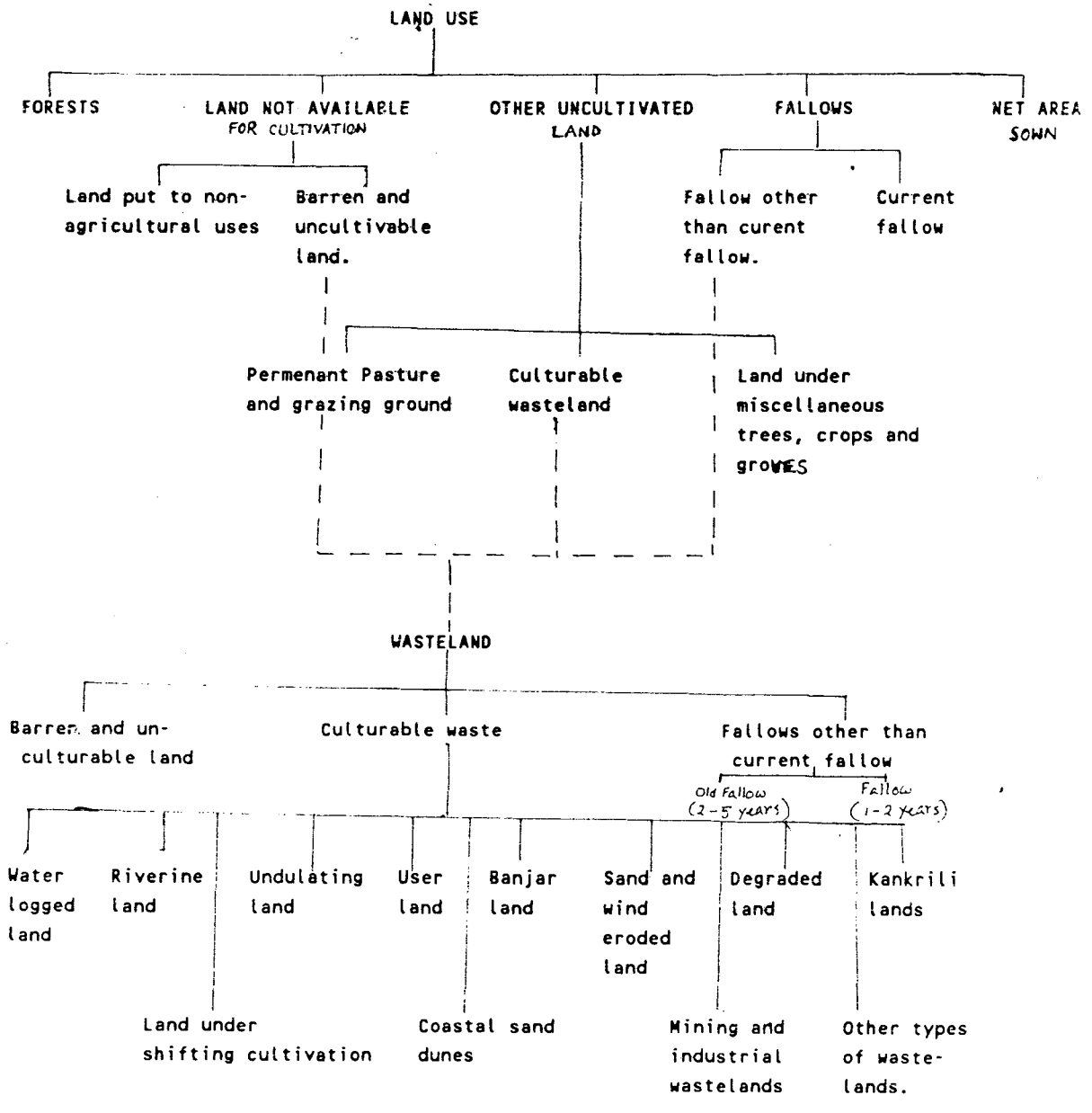
LAND USE
FORESTS
LAND NOT AVAILABLE FOR CULTIVATION
OTHER UNCULTIVATED LAND
FALLOWS
NET AREA SOWN
Land put to non-agricultural uses
Barren and uncultivable land.
Fallow other than curent fallow.
Current fallow
Permenant Pasture and grazing ground
Culturable wasteland
Land under miscellaneous trees, crops and groves
WASTELAND
Barren and un-culturable land
Culturable waste
Fallows other than current fallow
Old Fallow (2-5 years)
Fallow (1-2 years)
Water logged land
Riverine land
Undulating land
User land
Banjar land
Sand and wind eroded land
Degraded land
Kankrili lands
Land under shifting cultivation
Coastal sand dunes
Mining and industrial wastelands
Other types of waste-lands.

these are called fallows and thes can be condidered as wasteland. Like that, culturable waste include land which is available for cultivation but is not taken up for this purpose or has been abondoned after use of a few years. These two categories of wasteland can be put to use through proper management. Barren and unculturable lands are also wasteland as these lie unutilised and can not be brought under cultivation but can be used for some other purposes according to their capability. Among barren and unculturable land, culturable waste and fallow other than currunt fallow, the culturable waste and fallows are further classified into sub-categories. In order to reclaim wasteland, it is necessary to know their characteristics and genesis. Since each wasteland has individual characterictics thus each require specific reclamation measures. Remidial measures can be suggested only after comprehending the factors of genesis and the nature of wastelands.

A number of studies on genesis and characterstics of different types of wasteland have been carried out. Important among these have been received below.

1.3 Literature survey: The available literature relevant for the present study is mainly of three types:

i. Studies dealing with definition, classification and general characterstics of wasteland.

ii. Studies specifically on saline and alkaline wasteland.

iii. Studies concerned with soil conservation, afforestation programme and reclamation of degraded land.

i. Abhalakshmi Singh[5] in her work "The problem of wasteland of India with special reference to Uttar Pradesh" discussed the wasteland of India in general with reference to the wasteland of Uttar Pradesh in perticular. in this study she classified the whole wasteland of Uttar Pradesh into two broad categories such as Barren land and land infested with thick growth of jungle and shrubs. She discussed these two types of wasteland in detail and also suggested few reclamation measures since it is a broad level study many of the climatic and anthropogenic factors and their influence on these types of wasteland have not been discussed in much detail. In her another study[6] on " **Economics and geography of agricultural land**

5.Singh Abhalakshmi; The Problem of Wasteland in India with special Reference to Uttar Pradesh. B.R. Publishing Corp. New Delhi, 1985.

6.Singh Abhalakshmi; Economics and Geography of Agricultural Land Reclamation in Koil Tehsil of the Aligarh District, B.R.Publishing Corp. New Delhi, 1978.

reclamation in koil Tehsil of Aligarh District" she carried out a micro level study of all the 358 villages in the tehsil. In this study, the wastelands are classified into two categories namely uncultivated land excluding fallows and fallow other than currunt fallow. The main idea behind classifying the wasteland into these two categories, are to locate the large blocks of land available for reclamation and resettlement. Relief, drainage, soil and the climate are accounted in detail. Her suggestive measures on reclamation are based on the condition of the different areas. Her estimation on the economic aspects of the reclamation in terms of expenditure, addition to the food gain production, empolyment and income that would serve the settlers are highly appreciable. Center for science and Environment has prepared a paper ' Develping India's wasted land[7]'. It presents approximate esimates of wasteland of India, sufferers from the consequencies of degraded land and production ability of wastelands. It also highlights as to what Govt. has done and what voluntary agencies can do about it. National wasteland

7.Center for Science and Environment. Developing India's Wastedland; A Breifing paper. New Delhi, 1986.

Development Board[8] has put forward definition and classification of wastelands and have shown the importance of satellite immageries for wasteland mapping.

ii. Studies on saline and Alkaline wastelands are relatively more in number. The work done by Uppal[9], Kanwar[10] , Yadav and Aggarwa[11], provide measures to reclaim saline and alkali lands along with the assesment of their patential. Their economic aspects of utilisation have also been assessed. Adopting various reclamation measures like backing through irrigation and other scientific methods, have also been discussed like reclamation of saline land through Dainchq and gypsum application. Natural Resource Committee of the Planning Commission[12] has studied in details, the wasteland

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8.National Wasteland Development Board; Description, Classification, identification and mapping of Wasteland New Delhi.

9.Uppal H.L; Reclamation of Saline and Alkaline soils in India. Directorate of extension farm Bulletin, No. 66. N.D. 1961; p.30.

10.Kanwar J.S., Reclamation of saline and Alkali soils, Ammendments, kinds, ammounts costs. Presented in the symposium on Salinity and Alkalinity, I.A.R.I. N.D. 1962.

11.Yadav J.S.P. and Aggarwal R.B; Dynamics of soil changes in the reclamation of Saline, Alkali Soils of the Indo. Gangetie alluminium. Journal on Indian society Soil Science, 1959.

12.Indian Planning Commission: Natural Resource Committee; Study on Wasteland including Saline, Alkali, Water logged Land and their Reclamation. New Delhi, 1963. including their distribution in different parts of the country.

iii. Some studies emphasise the importance of soil conservation of degraded land. D.R. Bhumbla and Aravind Khere[13] have discussed the need for identification and estimation of degraded land. Ray Chowdhury,[14] and I.C.A.R[15]. have carried our survey of sails of india and have suggested sail conservation measures through the scientific reclamation of wastelands. Awanish K. Singh[16] has discussed environmental degradation resulting from deforestation, soil erosion or some other factor. He shows that it ultimately affects the poor people of the society environmental degradation resulting from deforestation, soil erosion or some other factor. He shows that it ultimately affects the poor people of the society specially the rural poor landless labourers who are being uprooted because

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13.Bhumbla D.R. and Khare Arvind; Estimate of Wasteland in India. Society for promation of Wasteland development. New Delhi.

14.Ray Choudhary S.P; Final Report on all India soil survey scheme, Bulletin-ICAR, 1952.

15.I.C.A.R. Final Report of all India Soil servey scheme;1958.

16.Singh Awanish Kumar; Protectors of Environment; Workshop on environment conservation and Wasteland development, 1989.

of the loss of soil fertility resulting in foodgrain

scarcity. N.G. Hedge[17] has suggested development of wasteland mainly through afforestation and has given some causes of wasteland formation. These include neglected agriculture in marginal and poor soil, estruction of ecology by mining, construction and other industrial project, excessive irrigation manly in clay soil; increasing demand for forest products etc. The author stresses on water resource development for developing wastelands as most of these except marshy, saline and usar suffer from water scrcity. Details about the tree species useful for wasteland have also been discussed. Anil Kumar Panday and R.N. Panday[18] have tried to find out as to why land is loosing its inhervest capability and have suggested posible landuse measures for reclamation such as terracing and pasture improvements etc. They have taken south-western Santhal Parganas for the detailed study.. Ministry of environment and Forests has brought out a book on landuse and wasteland development[19]. It highlights the role of social forestry project along with identification of wastelands in 127 districts.

17.Hedge N.G; Hand Book of Wasteland Development, ABAIF Publication; New Delhi, 1987.

18.Panday Anil Kumar, Panday R.N; Wasteland Management in India. Ashis Publishing House; New Delhi, 1989.

19.Ministry of Environment and Forests; NWDB; Developing India's Wasteland; New Delhi, 1989.

Ramesh Chandra's[20] (ed) book stresses the need of

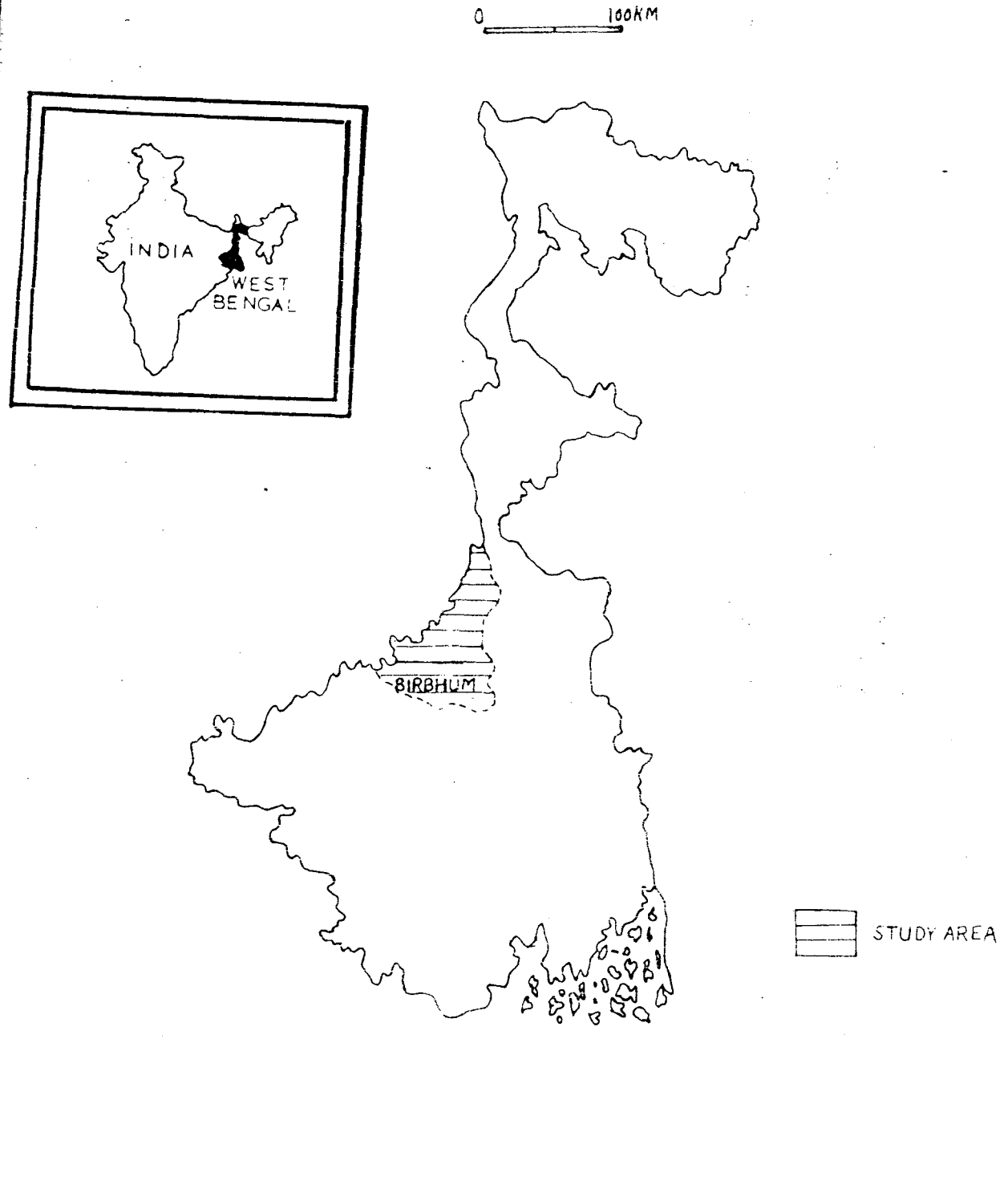
support from people at the grassroot or village level for wasteland development. The study puts greater share of responsibility on panchayats to act as leaders in taking up the programme and along with the help of other concerned agencies in the promotion of afforestation works. Malcom S. Adishesiah's edited book presents papers on economic problems of wasteland development, the need of natural resource management and to improve the productivity of all land water resources[21].

From the studies it can be imferred that many studies are only concerned with the spatial distribution of a perticular type of wasteland.It has been observed that very limited number of determinats have been taken into account in most of the studies. Anthropogenic factors, which is a major components of the formation of wasteland is absent in most studies madein. An attempt has been the present study to overcome lacuna of the previous studies by including anthropogenicfactor and a detail study of the environmental parameters.

20.Ramesh Chandra (ed); Role of Panchayat in Social Forestry and Wasteland Development; National Mission on Wasteland Development; N.D. 1990.

21.Malcom S. Adishesiah (ed); Economic of Wasteland Development; New Delhi, 1988.

LOCATION MAP



The present study intends to carryout the fallowing objectives:

i. To identify the spatial distribution of wastelands in Birbhum district.

ii. To understand the nature of relationship among various environmental and anthropogenic factors in different types of wastelands.

iii. To examine the extent of impact of these factors on the formation of wastelands. Hypotheses: Following hypotheses have been formulated for the present study keeping in view the above objectives.

i. Lower the slope more will be Kankrili wasteland.

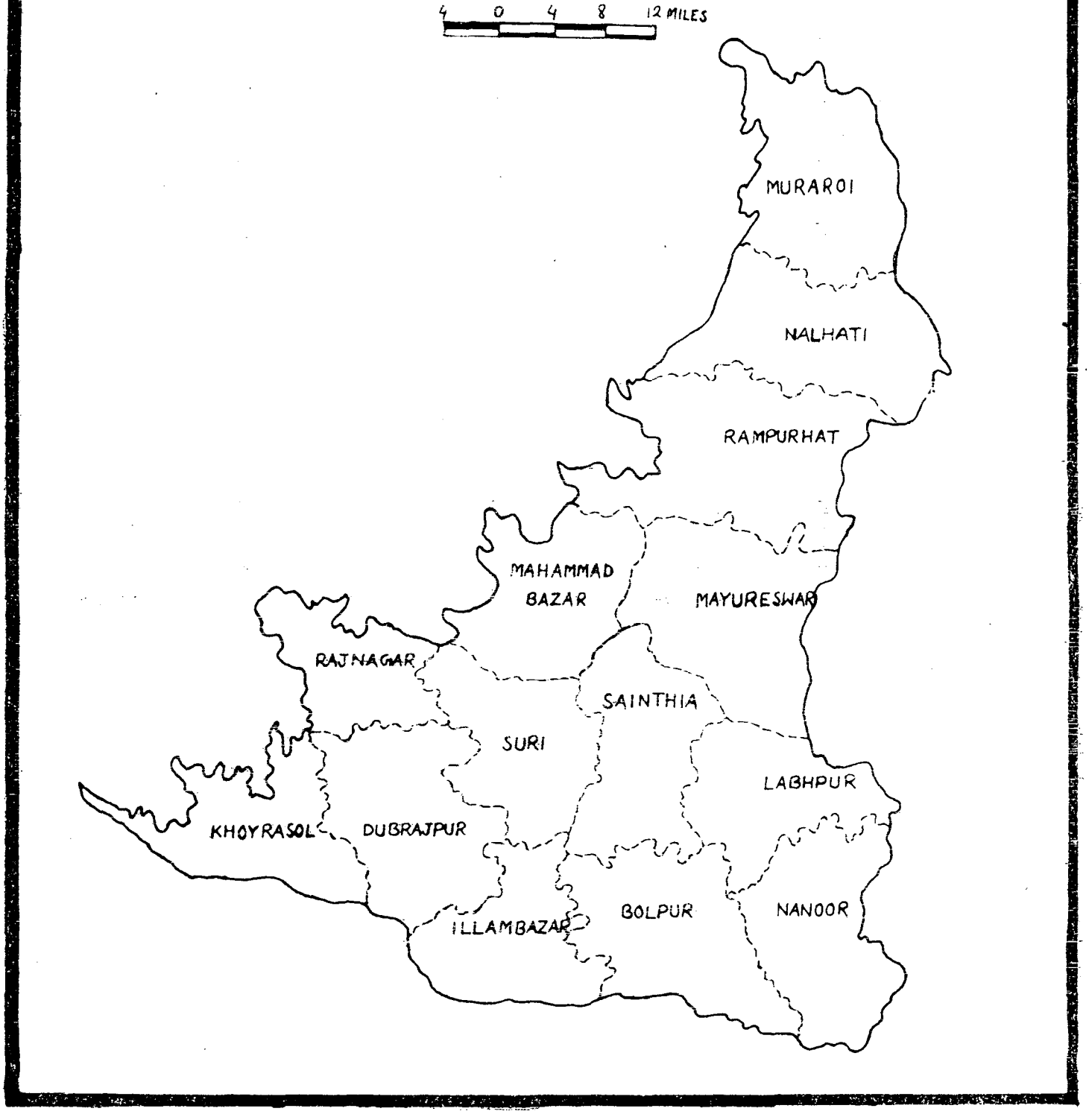
ii. In Birbhum district amount of wasteland will be positively related with land concerntration.

1.5 Study Area: The present study deals with the district of Birbhum of West Bengal. The wasteand amounts to 10.08 percent of its total geographical area[22]. The district extends from 23 32 30 N to 35 00 North and 88 02 40 E to 87 05 25 East and forms a part of the Ganga Plain. It covers an area of 4549 sq. kms. and is bound on the west by the district of santhal parganas of Bihar and by the districts of Murshidabad and Burdwan in the east and south respectively. The region is locally known as Rarh area.

22.Jha V.C. Wasteland types and their utilisation in Bisbhum District; The Deccan Geographer. vol. No. XXV, 1987.

BIRBHBUM DISTRICT

ADMINISTRATIVE DIVISIONS (POLICE STATION WISE)



The district contain there sub-divisions namely Bolpur, Rampurhat and Suri and fourteen police stations. There were 2461 villages, among these 2229 are inhabited and 232 uninhabited. The total population of the district was 2095 829 persons in 1981.

The average elevation of the district is about 80 meter above the mean sea-level. Except the western part where the topography is slightly undulating, rest is a featursless plain. The Ajay, the Bansloi, the Mayurakshi, the Bakreswar are important rivers flowing through the district. Lateritic nodules mainly covers soil of the district. Besides entel, metel, pilimati, doansh, bele, kankar are the other types of soil.

Wastelands are largely natural in Birbhum district but in some parts they are the product of imbalances resulting from either misuse or over-explaitation of land. There are mainly four types of wastelands in the district. These are - upland waste, stony waste, lateritie waste and anthropogenic waste[23].

Due to the non-availability of data, six villages of the district have been taken up for

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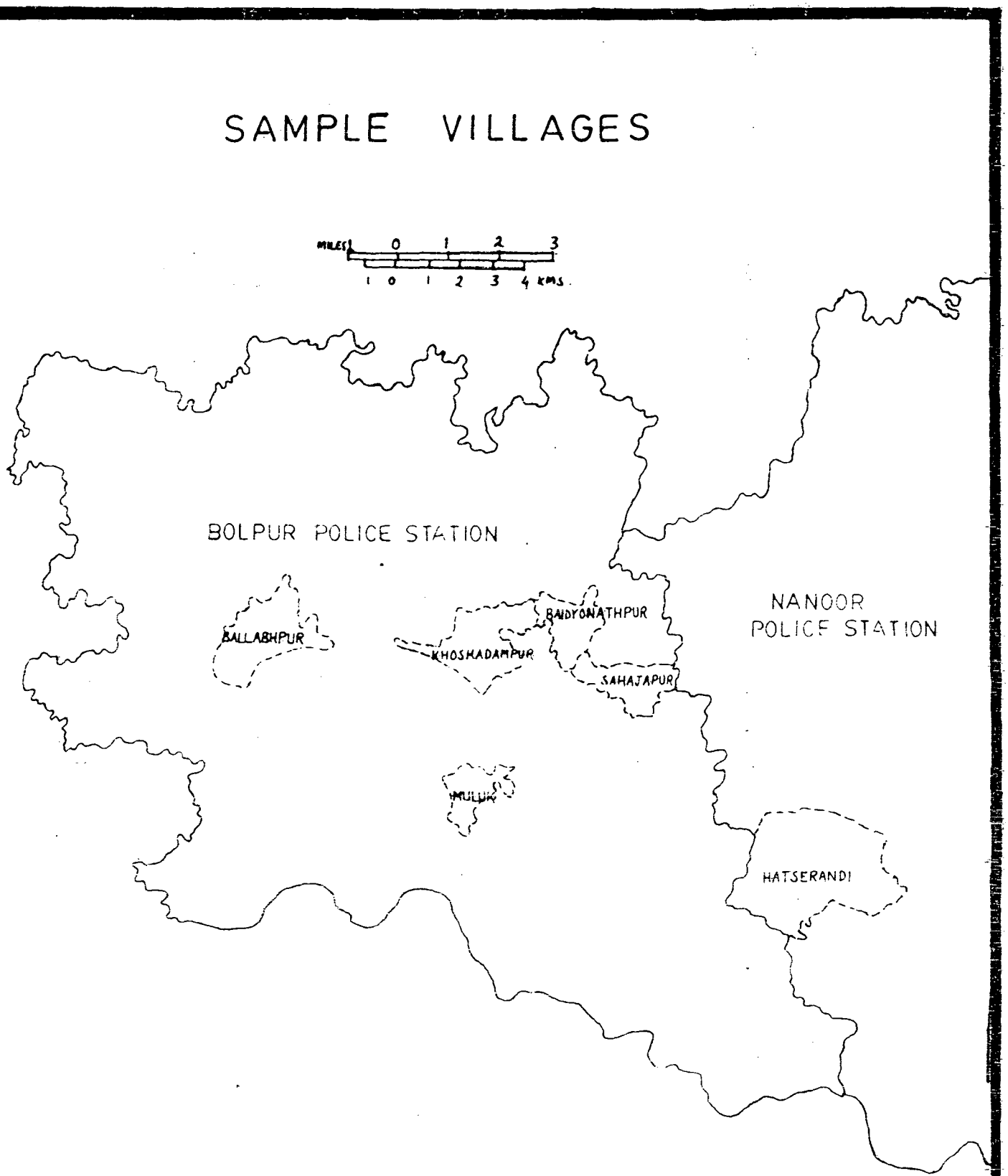
23. Jha V.C. Wasteland types and their utilation in Birbhum district; The decan Geographar; vol. XXV,1987.

SAMPLE VILLAGES



detailed study. The villages are - Baidyanathpur, Ballabhpur, Muluk, Khoskadampur, Sahajapur and Hatserandi. Five of the villages are under Bolpur police-station and one village that is Hatserandi comes under Nanoor police-station. As this study is based on secondary data and as detail information about all villages of the district are not available so this study could not choose villages according to its highest percentage of wasteland. For few villages detailed informations are available and among them these villages having higher proportion wasteland has been taken up for the present study. These villages are characterised by kankrili and Bele wasteland.

1.6 Data Base: (i) Data on the distribution of wasteland in different police station have been collected from the soil conservation office.

(ii) Toposheets has been used for a detail analysis of the district.

(iii) Climatic data has been collected from Sriniketan meteorological observatory.

(iv) Details of the six villages have been taken from the village survey report prepared by the department of geography, Visva-Bharti University.

1.7 Methodology: To identify the casual relationship between wasteland and factors responsible for their occurane into account, the

following variables have been taken, independent variables (a) Environmental- slope, man annual rainfall, (b) Anthropogeine- land concentration rates, distance of the field from canal. Dependant- Kankrili and bele wastelands.

To know the nature of masphomitric parameters of the district slope, relative relief and drainage density have been analyzed adopting suitable statistical cartographic techniques.

2. Land concentration ratio have been computed with the help of Gini's coefficient.

3. Simple correlation have been done using pearson's co-efficient of correlation to know the relation of individual independent factors to the different types of wasteland.

4. Coefficient of variation have been calculated to see the variation in distribution of independent and dependant variables.

1.8 Organization of Materials:

The present study "Genesis and characteristics of wasteland in Birbhum district" has been organized into five chapters.

The first chapter presents the significance of the study, review of related literatures, objective, hypotheses, area of the study, data base and methodology.

To know the genesis and characteristics of wasteland of Birbhum district a general understanding of the environment is needed. The second chapter therefore, deals with the environment of wasteland in the Birbhum district.

An attempt has been made in the third chapter to know the change in land-use pattern with the change in natural environment. In this chapter distribution of wasteland in Birbhum district and responsible factors for its genesis in the district has also been discussed.

To investigate the genesis of different types of wasteland, an attempt has been made in the fourth chapter to know the role of major factors in different wasteland types and finally some remedial measures have been suggested for the riclamation of wastelands.

Chapter five presents summary of conclusion.

CHAPTER II

THE ENVIRONMENT

Environment largely consisit of two components - physical and biological. The physical environment includes land, water and air. The biological environment refers to plants, animals and micro-organisms. These two elements of environment interact with one another and individual elements of environment are inter-related. So a single element of an environment depends on the other elements of it. The environment varies spatially and temporally.

Climate is an element of environment which is an important factor in shaping and modifying the landscape of a region. The intensity of different external forces over landscape is a phenomenon governed by climatic condition of the region. The temperature and precipitation of an area play important role in sculpturing the earth's surface.

Physical features of terrain evolve under different micro-climatic conditions over the varying lithology in a region. Landforms which have their individual distinguishing features depend upon the geomorphic processes for their development. It has been recognised that different geomorphic process produce different landforms at different stages of

landform evolution. Thus, the present day physical features of land configuration to a certain degree reflect the climatic conditions under which these have developed. It has also been observed that under the same climatic conditions different physical features may develop, thus bringing the importance of geological structure in land configuration. Therefore, different rock types and formations combined with the climate play an important role in the development of landforms.

Drainage of an area is the reflection of topographic, geologic, hydrologic characteristics of a region. Drainage lines are significant geomorphic tools of nature to sculpture the topography, particulary in a humid terrain. Therefore the study of drainage of a region is quite essential for the terrain evolution.

Soil constitute a major environmental element, influed by fertility and special qualities, soil not only decides whether a population can be fed, clothed and housed, but also determines the particular type of food and fibre or timber products that can be obtained from a region. The systematic study of soil is thus very important as it plays significant role in the economy especially of agricultural societies country like India.

Natural vegetation is another important element of environment. Plants as consumable and renewable sources of food, fuel, clothing, shelter and many other categories of life-essentials, form a great natural resource base that are essential to man. The physical form of individual plants and their assemblages vary spatially in systematic ways depending upon elevation, climate, soils and continental position of a given region. There are inter relations between vegetation, soil, landforms and climate. Thus, elements of environment are inter-related and they influence each other.

As the wastelands are the result of natural and human processes so it is necessary to study the physical elements of a region. For example formation of one type of wasteland may be a direct outcome of the oilof an area., but soil of that area is dependant on other properties of environment. When the formation of wasteland is dependant on human factor it means - over-exploitation or misuse of natural resources by man. So studies of land-utilization is also needed.

The district of Birbhun situated in the central-western part of West Bengal, has a combination of both undulations and plain lands. A detailed picture of physiography, drainage, climate, soil vegetation and land-use of the district has been presented in the present chapter.

GEOLOGY:

The following six geological formations starting from the youngest to oldest occur in the district. They are as recent Alluviun (Khadar), Bangar, Laterite, Rajmahal traps, Gondwana system, Archean Gniess.

The Archean Gneiss is mainly found in Suri sub-division. Dubrajjaur in particular which has big blocks of granite and gneiss. The Gondwanas of carboniferous-Permean age cover a small area along the Ajay River in the coal seams. The basaltic lavas of early cretaceous age (Rajmahal Trap) occur in Rampurhat and Nalhatic police-stations in the extreme western part. Laterite occupies large areas in the western and south-western parts particularly in Bolpur, Suri, Rampurhat, Dubrajpur, Rajnagar police-stations. The older alluvium of Pliestocene age, occurring in the northern and south-western parts of the district, is now being dissected by strean incision. Deposition of "Khadar" or "Recent Alluvium" is noted along all the major streams.

PHYSIOGRAPHY:

The physical landscape of Birbhum district is very much akin to the Rarh areas of Murshidabad, Burduran, Bankura, and Midnapore districts. The western portion comprising Khoyrasol, Rajnagar, Dubrajpur, Suri, Mahammad Bazar and Rampurhat police-

station are at the base of the heavily dissected plateau of santhal Paranas projecting south to south-east. Proceeding east-ward the projecting spurs become mere undulating. The highlands to the west are situated on the hard impervious crystalline rocks (Archean). While, the rest is made up of the Gondwana sediments, the laterites and the alluvium. These sedimentaries in turn are underlain by basic lava flows some outcrops of which are found in Nalhatic police-station. Almost throughout the entire area of the district, the surface is broken by a succession of undulations, the general trend of which is north-east to south-east. These rise into high ridges capped by laterite and separated by valleys a mile or more in width near the western boundary. These upland ridges and their ramifications towards south-east fade out and the valleys become shallow and gradually merge into the broad alluvial plains of the Gangetic delta. The larger spurs are covered with the Sal forest with only the bottom of the valleys being cultivated. As these become less steep, paddy is grown on terraces and the upper sides, are left untilled forming scanty pasture grounds during rainy season. The minor undulations are terraced upto the top.

The rapidity with which hillocks change to the ridges, ridges to remified undulations and to the level country, the terrain vary considerably. The

ridges are high and amount almost to hills in the extreme north of Rampurhat sub-division. Being extensions of the low Rajmahal hills, these hillocks are of basaltic formation. These cease abruptly and throughout the greater part of the Nalhatic and Rampurhat police-station the surface, almost from the foot of the Chhotanagpur plateau, is only slightly hummocky. There are few detached hillocks in Nalhatic police-station such as Seurapahari, Kantapahari, Nanchppahari and Kajalpahari. The western portion of Mahammad Bazar and Suri are covered with high spurs extending many miles to the south-east but in the northern part of this tract these are succeeded at once by perfectly level ground. And these sink into undulations on the south of the valley of Mayarakshi, and after nearly disappearing rise again to the dimensions of low hillocks. The ridges on the south bank of Mayarakshi pass into flat country rest of Suri but again swell into well raised upland near Sainthia. The tertiary and Pliestocene deposits are mostly covered by a variable thickness of laterite which even envelop some portions of the peneplained and highly weathered gneissic terrain to the west. The land is absolutely flat along the north of Ajoy river to the south of Labhpur and Bolpur. The hollows between the ridges form natural drainage channels and in wider valleys flow streams of considerable volume and in a

few cases these expand into broad rivers. These have a small and shallow current throughout the greater part of the year even within Birbhum.

To get a clear idea of the relief features of a region an analysis of relief has been attempted. Absolute relief is the maximum height from mean-sea level per square unit area. It can be measured on a topographic map with the help of contour of maximum value of spot height. The absolute relief of the region also indirectly gives an idea about the climatic and vegetal conditions of the area. For example - high absolute relief is an indicator of cold climate with sparse vegetation. This analysis has been done only for the southern part of Birbhum district as the toposheets of northern part are mostly restricted.

TABLE 2.1

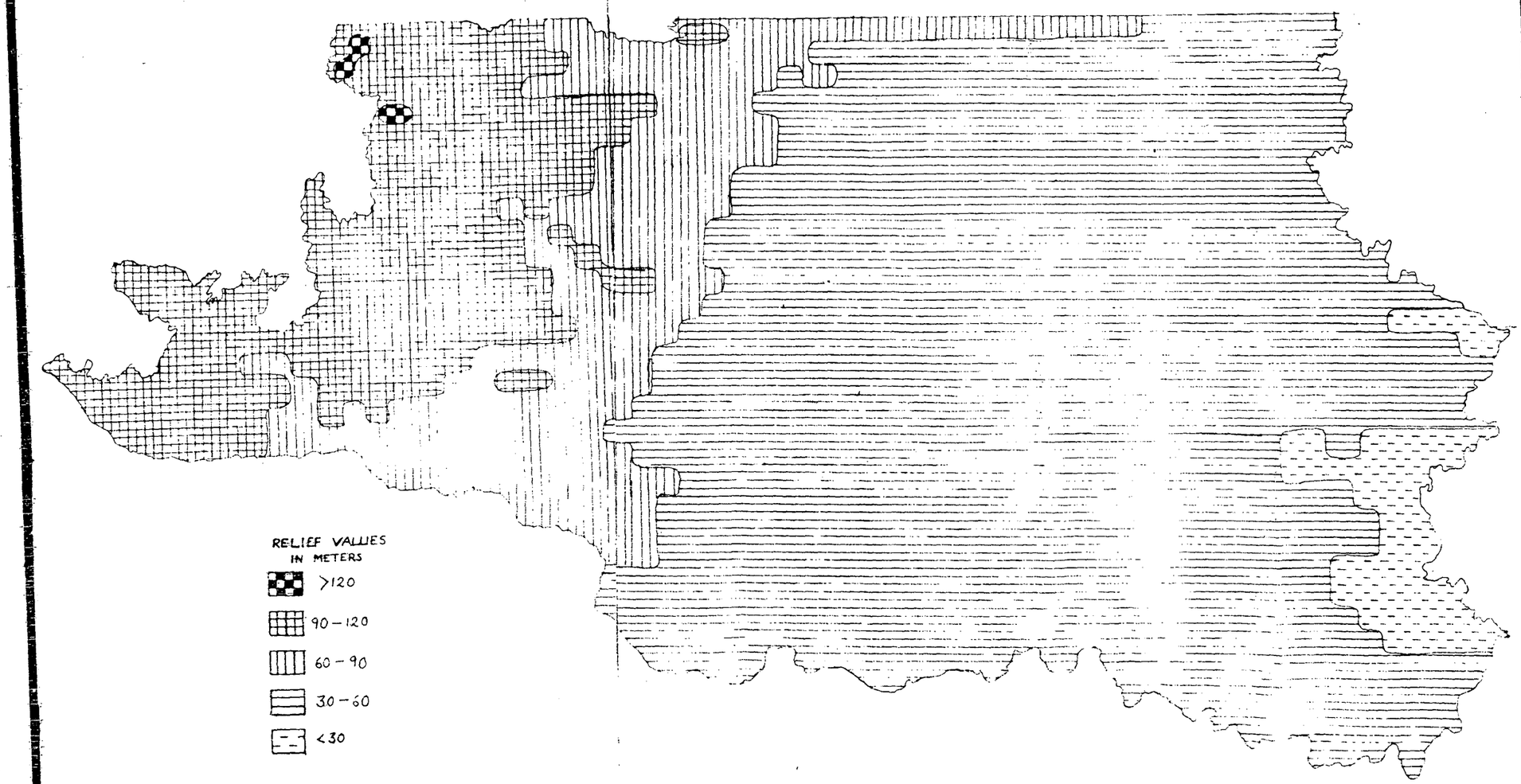
ABSOLUTE RELIEF

Range of absolute height	Area in sq. km.	Percentage of total area
< 30	68.8	3.9
30-60	1128	64
60-90	267.2	15.34
90-120	272	15.62
> 120	4.2	0.27

SOUTHERN PART OF BIRBHUM DISTRICT

RELIEF

0 6·4 k.m.



The absolute relief of the study area varies from a maximum of 140 m to a minimum of 20 m. The above table and the map No. shows that the distribution of absolute relief is very much uneven in the southern part of Birbhum district. The places where the absolute relief is less than 30 m, covers 68.9 sq. km. whereas, the values more than 120 m occurs on 4.2 sq. km. Maximum portion i.e. 1128 sq. km. is covered by highest relief ranging between 30 m to 60 m. Areas having an absolute relief of 60 m to 90 m and 90 to 120 m absolute relief covers 267.2 sq. km. and 272 sq. km. respectively.

The map showing the distribution of absolute relief shows that the whole eastern and middle part of the south Birbhum have a maximum height ranging between 30 to 60 m except the south-eastern portion where it is less than 30 m. The west and north-western portion have absolute relief ranging between 90 m to 120 m. Three small patches occur in the extreme corner of the north-western portion with absolute relief being greater than 120 m and in the central western part there is a big patch of absolute relief which is between 60 m to 90 m. Small patches with maximum height of 120 m are found inside this patch in northern and central portion which can be clearly seen from the distribution map (Map No. ; page No.).

Average slope, defined as an angular inclination of terrain between the hill and valley bottoms, results from the combination of many causative factors such as absolute relief, relative relief, dissection index, drainage texture and stream frequency, climate, geology and tectonics etc. operating in the area.

Various scholars have developed methods of representing slope categories. the computation of average slope from the topographic maps having contours, involves the contribution made by Wentworth, Miller etc. Wentworth's formula has been slightly modified by K.P. Dhurandhar[1]. The scheme developed by Wentworth has been used by Indian geographers frequently and the same has been used in the present study.

Wentworth's formula of slope is;

$$\tan\theta = \frac{\text{Number of contour cuttings per mile} \times \text{contour intervals}}{3361 \text{ (constant)}}$$

The average slope of the study area varies from minimum 0^{o} to a maximum of 0^{o} 12.8". The table 2.2 shows that the minimum values of slope covers maximum area of the southern part of the district, that is 1451.2 sq. km. accounting for the 83.36 percent of

1. K.P. Dhurandhar (198); A M.more Rational Approach to the Determination of Slopes of Landforms. The Indian Geographical Journal. No. 1, pp-194-202.

total area. Slope values of 0^{o} 14.27" to 0^{o} 2′ 8.53" covers 256 sq. km. (14.70 percent) and maximum slope of the region that is 0^{o} 2′ 8.53" to 0^{o} 3′ 12.83" covers minimum area 33.6 sq. km. which accounts for 1.93 percent of the total area. The map of average slope shows that the minimum value of slope coverage is in the entire eastern, southern western, and central portion of the district where the area is almost a plain land, except some patches where the slope varies from 0^{o} 1′ 4.27" to 0^{o} 2′ 8.53". It is noticed that in the north-western portion slope values ranges from a minimum 0^{o} to maximum0^{o} 3′ 12.83". Mainly this portion is dominated by slope values of 0^{o} 1′ 4.27" to 0^{o} 2′ 8.53" and other values of slope occur there as patches.

TABLE 2.2

SLOPE

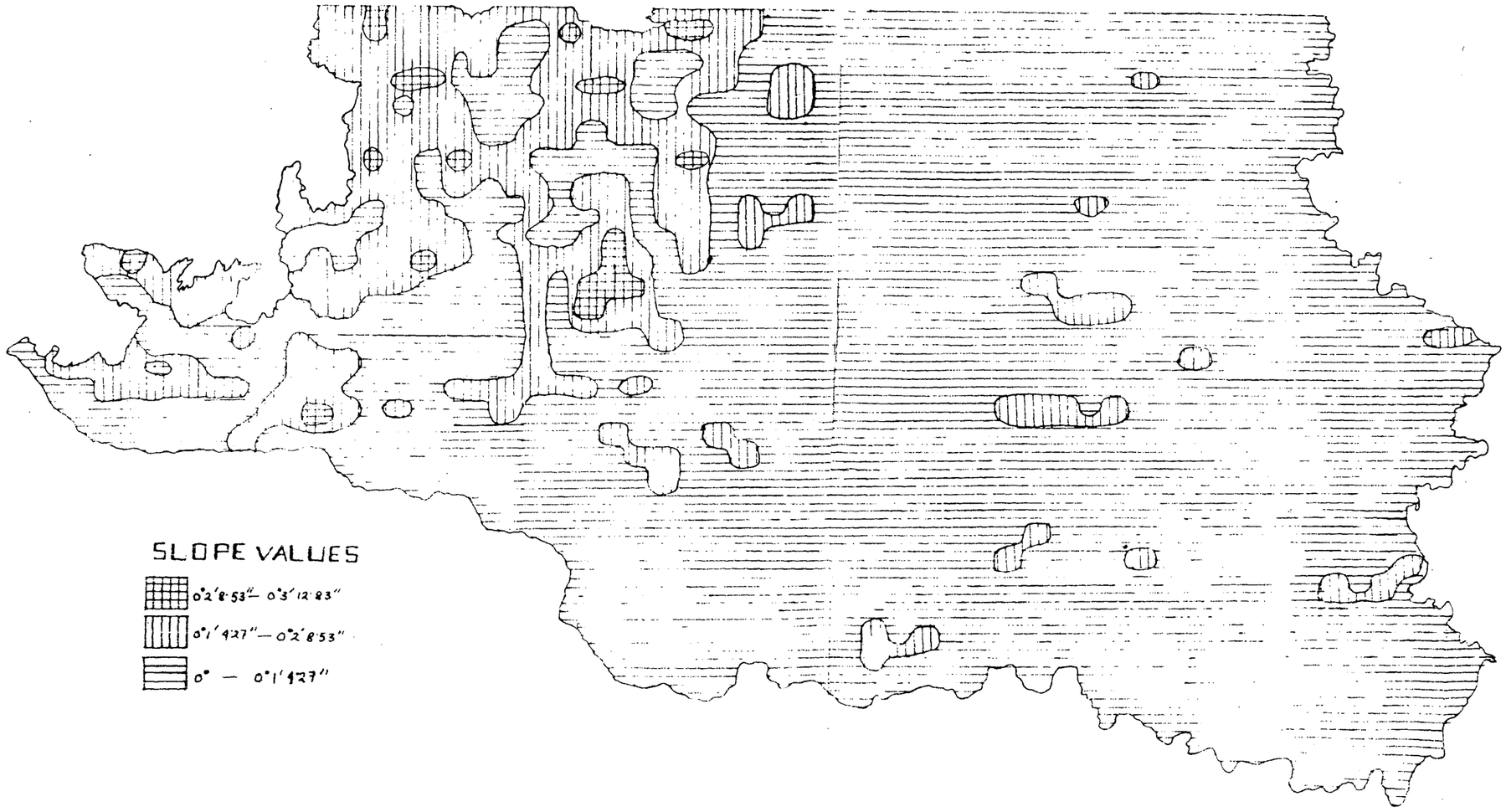
Range	Area (sq. km.)	Percentage of total area
0^{o}-0^{o} 1′ 4.27"	1451.2	83.36
0^{o} 1′ 4.27"-0^{o} 2′ 8.53"	256	14.70
0^{o} 2′ 8.53"-0^{o} 3′ 12.83"	33.6	1.93

From the above analysis it is seen that the area is more or less plain land except in the north-western part where it is dissected by foot hills of Chhotanagpur plateau. Maximum and minimum height of the area is 120 m and 20 m respectively. Variation in

SOUTHERN PART OF BIRBHUM DISTRICT

SLOPE

0 64 KM



height is noticed in the north-western part only due to presence of hills. Other areas are more or less plain land and variation in height is also very less. As a result variation in slope is almost negligible except, little variation in the north-western region.

DRAINAGE:

Birbhum has 16 rivers or rivulets flowing over its territory some of which have been given in Table 2.3 and shown on map No. . The courses of these rivers, rivulets and "nalas", are influenced by the undulating topography of Birbhum. The Pagla nadi and its tributary Suri nadi in Muraroi police-station flows from north-west to north. Further north the Bansloi nadi also flows north-west to north. This direction of slope is marked contrast to the west to south-eastward flowing streams of Birbhum district. The Gamri Pagla interfluve is the divide from where this change of slope occurs. It is thus evident from the meandering bed of Pagla, that the slope is very gentle. These north-east flowing streams give off numerous spill channels as soon as these enter Murshidabad district and have formed several swamps within Birbhum.

BIRBHUM DISTRICT

DRAINAGE

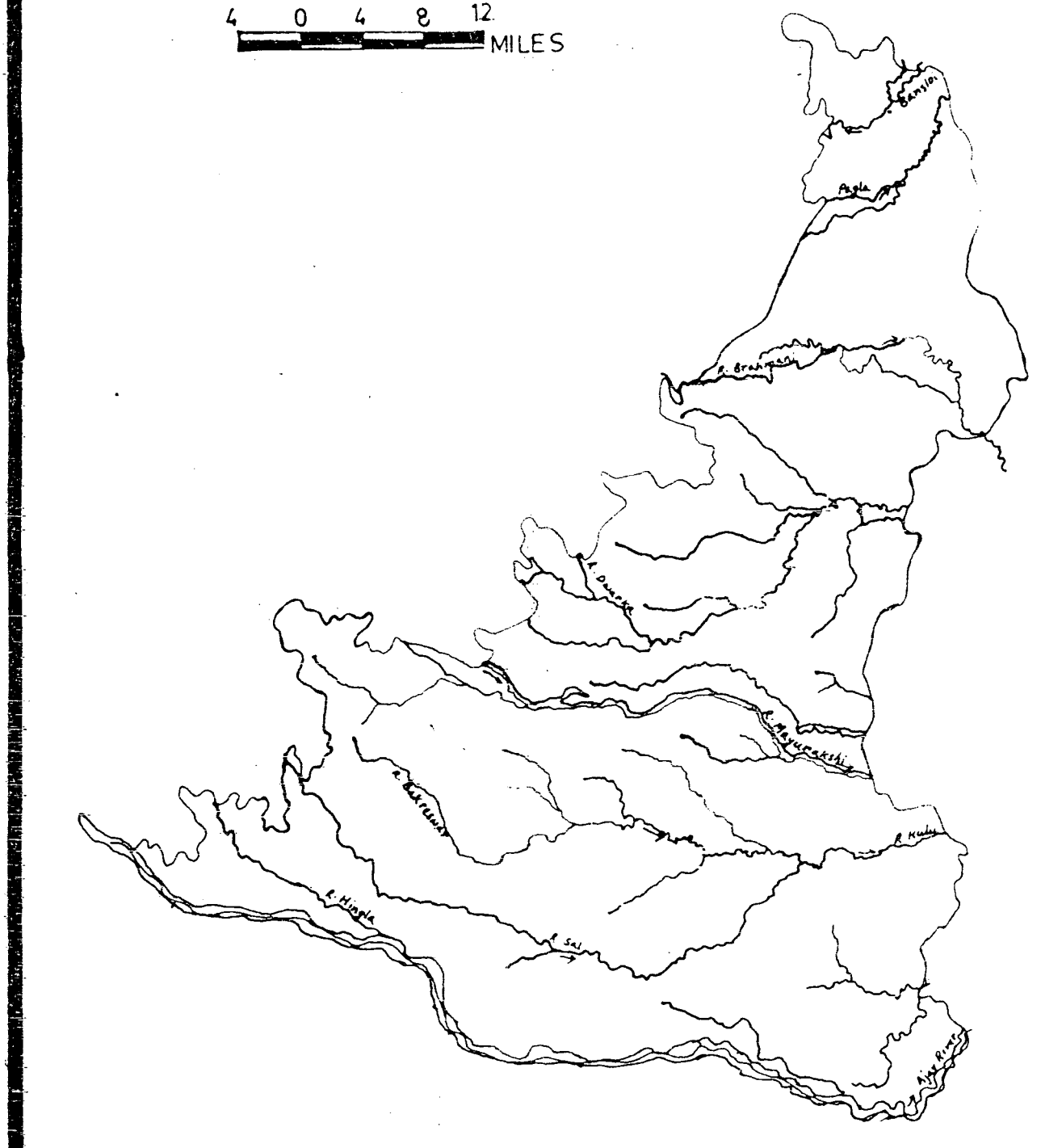


Table 2·3

MAJOR RIVERS AND RIVULATES

Name of River or Rivulates	Origin	Direction of flow	Condition
1. Ajoy	Chottanagpur hills of Bihar	S.W. to S.E.	Streams are narrowed in summer and widenting in rainy season
2. Mayurakshi	Santhal Parganes	West to east	Perennial only in its down stream course
3. Hingla	Santhal Parganes	Flowing into Ajoy from the North of Ajoy	Fed by a series of small streams
4. Bahreswar	South of Rajnagar 10 miles west of Suri	Zigzag course eastward	Fed by numerous streams
5. Kapai		North to norht west to east to southeast	Dry in summer
6. Brahmani	Santhal Parganes	West to east	Same type as Mayurakshi
7. Tripta	Santhal Parganes	West to east	Perennial east of 87° 43′ E
8. Gauri Nala	within the District	Towards east	Perennial, flows in meandering channel.
9. Bansloi	Plateau of west	West to north east	Partly perennial and sand choked after a eastly course.
10. Dwaraka	Ramnagar hills of Chottanagpur	West to south east	Non-perennial strengthened by many tributaries.
11. Bamini		West to south east	Non-perennial tributary to Dwaraka
12. Gharmorh	Ramnagar hills	West to east	Flows into Dwaraka at 87° 48′E and 24° 73′ N

The general slope of Rampurhat police-station is from west to east dominated by the east flowing left bank tributaries of the Dwaraka. The slope of Mayureswar police-station is northerly from about 24^{o} N latitude and south of it is easterly. These two different slope directions begin from the Mahammad Bazar police-station where the Dwaraka takes a north-easterly bend and the Mayurakshi throws-off a distributary, the Manikanika. The interfluve between these two streams is only 3 to 4 miles broad at points and is dominated by the 40 m. contour line.

To the south the Ajoy dominates the landscape with sandy beds which are miles wide at places. The Ajoy enters the district at a height of about 91 m and leaves at 22 m above the mean sea level. The river coincides with the limit of the forest belt which stretches across Burdwan. To the north lies cultivated lands, and to the south the dry river bed, embankments and a dense Sal jungle.

The rolling upland topography in between Mayurkshi and Ajoy is known for its splendour and picturusque variety. The general gradient is from north-west to south-east. However, the Sal river whose down stream is known as Kopai flows from north-north-west to east-

south-east and after crossing the 70 m. contour line, flows from west and north-west to last and south-east. The Bakreswar and the Chandrabhaga nalas follow similar course after crossing the 60 m contour line. The Mayurakshi has a perennial channel till it descends below the 60 m contour line. It becomes dry again between 23° 45′ N latitude and 87° 55′ E longitude. The Kopai meanders in a semi-circle from west and north-west to east and south-east and finally to north-east from 23° 41′ N and 87° 37′ 30" E. From this point the right bank tributaries of the Kopai display sever scars of gully erosion. This has resulted in bad land topography of places in the north of Binuria, Sriniketau, Surrul, Santiniketan and Makrampur. The bad land topography in this part does not extend below the 40 m contour and the banks of the Kopai itself are free form the ravages of gully erosion.

The district is well-drained by a number of rivers and plateau streams running in nearly all the case from west to east with a slight south-easterly inclination in the Suri sub-division and a north-easterly trend in the eastern part of Rampurhat subdivision. The Mayurakshi and Ajoy rivers are larger in size. The latter marks the southern boundary, and the Mayurakshi runs through Birbhum in the direction of west to east. Both the river valleys are of considerable size. Their width varies from two hundred metres to half a mile.

Their beds are broad expanses of sand with narrow streams trickling down in meanders. During dry season with the onset of rainy season the water channel grows much broader and deeper. After a heavy downpour in a few hours, these occasionally overflow their bank downstream and inundate the surrounding areas. In the western part of the district, the rivers, being fenced in by high ridges or well-marked undulations of stiff laterite keep fairly well within their permanent channels. Meandering of the rivers are found further eastward, where the country is level and the soil friable.

The southern part of the district is mainly dominated by braided channels while forming meanders. This characteristic of channel is controlled by its own depositional load. It is marked by the streams that split into a number of intermind channel bars. A considerable increase in sediment yield of the river can increase braiding. The rivers then tend to braid more and differs significantly with the earlier meandering characteristics. Braided characteristics are found in the whole central and eastern part of Mayurakshi and Ajoy rivers. Meandering nature is found in most of the main rivers like Mayurakshi, Ajoy, Kopai, Bakreswar, Koiya. When they are passing through the central and eastern portion, which are mostly flat plain region. Dendritic pattern is seen in same cases

when streams are coming from north-western hills.

Drainage density reflects the character of underlying lithology, climate and vegetal cover. The drainage density has been calculated on the basis of the Harton's method which can be applied by dividing the total length of the streams by the unit area. It can be expressed in mathematical form as follows:

$$D.D. = \frac{\Sigma L}{A}$$

where, D.D. = Drainage Density

L = Total stream length

A = Unit area

TABLE 2.4

DRAINAGE DENSITY

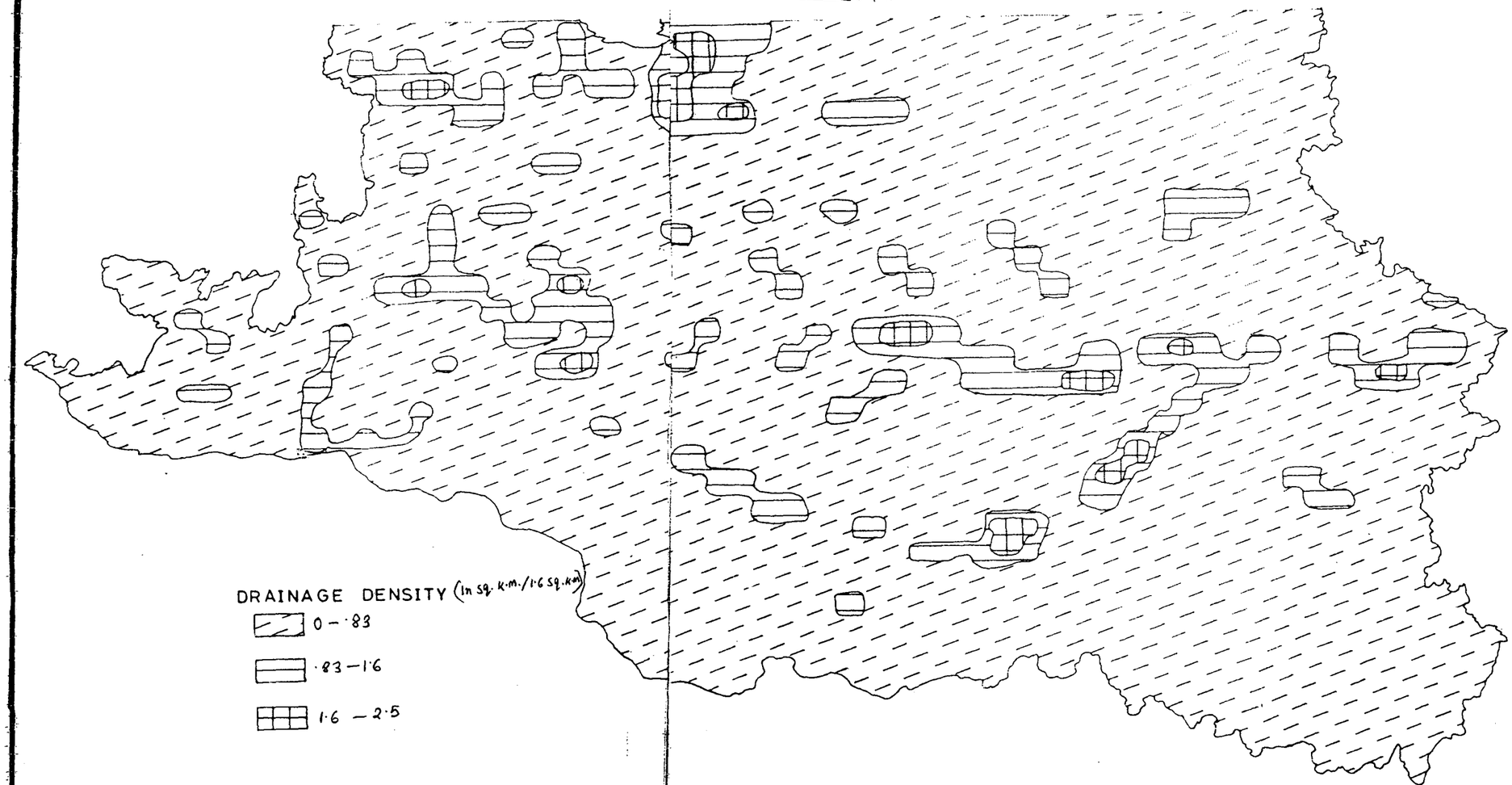
Range of Drainage Density in km per 1.6 km	Area in sq. km.	Percentage of total area
0-0.83	1545.6	88.78
0.83-1.6	156.8	9.00
1.60-2.5	38.4	2.20

The Drainage density in the southern part of Birbhum district varies from 0 to 2.14 km. per 1.6 sq. km. The above table shows that most of the areas are covered by a drainage density ranging from 0 to 0.83 km. per 1.6 sq. km. it can also be observed that 1545.6

SOUTHERN PART OF BIRBHUM DISTRICT

DRAINAGE DENSITY

0 6·4 KM



DRAINAGE DENSITY (In sq. k.m./1·6 sq. km)

0 – ·83

·83 – 1·6

1·6 – 2·5

GATEWAY

sq. km. of area has a drainage density of this range. Drainage density of 1.6 to 2.5 km. per 1.6 km covers only 38.4 sq. km. and 156.8 sq. km. has a range of 0.83 to 1.6 km per 1.6 sq. km.

The map No. shows that the north-western portion has some patches with drainage density of more than 0.83 km. per 1.6 sq. km. This can be mainly attributed to the presence of a hilly terrain in the north western part of the desert. And it is seen that along the course of the Kopai and Bakreswar rivers the drainage density is little higher.

To understand the general trend of drainage basins in the study area, a sample of drainage basin has been taken, which is the basin area of Bakreswar river- it starts from the south of Rajnagar and 16 km away from Suri. It crosses central part of the south Birbhum and then in its eastern part joins Kopai and that becomes Koiya river.

The first step in this analysis is the identification of stream order, following Strahler's method. According to him the first order drainage streams are those which have no tributaries. The second order streams are those which have as tributaries only first order channels, where two second order segment or channel join the third order channel segment is found.

Similarly when two third order channel join, they give rise to a fourth order channel and so on. Thus, the trunk stream, through which all discharges of water and sediment pass, is the stream segment of highest order. Here the highest order of stream is four.

Horton's law of stream number states that the number of stream segments of each order form an inverse geometric series with the order number.

TABLE 2.5

ORDER NUMBER, LENGTH OF STREAM AND BIFURCATION RATIO

Stream order	I	II	III	IV
Stream number	135	42	9	1
Stream length (in km)	113	99	74	66.5
Bifarcation ratio	3.2	4.6	9	

The above table shows that the number of stream segments decrease with an increase in order which follows Horton's law of stream number. The table further reveals that the total length of stream segment is highest in case of first order stream, it gradually decrease as the order increases and is lowest in case of the highest order streams. This is quite contrary

to Horton's law of stream length which suggests increase in length with rise in order. It is mainly because streams of lower order cover a long distances as the region is situated largely on plain.

Horton considered the bifurcation ratio as an index of relief and dissection. It has been experienced by number of studies that the bifurcation ratio tend to have values between 2 to 5 but generally with a with usual value of around 3. Bifurcation is the ratio of total number of streams of one order to that of the next higher order. The ratio is generally influenced by variations in the physiographic, lithologic, and climatic conditions prevailing in individual basins. Thus basins with similar rock group composition and tectonic history, uniform climatic conditions and similar stage of development are characterised by more or less similar values of bifurcation ratio. Table 2.5 shows that in the sample basin the ratio is 3.2 to 9. Here the maximum is very high, which is much above the normal values.

Most of the rivers of the district have a eastward direction of flow because there the slope is from west to east except in the extreme north where two rivers are flowing through the east to west direction. Most of the drainage of Birbhum district, are seasonal in nature, a very few of them are perennial which flows from Chhotanagpur plateau. Flow of the main rivers of

the region become less while passing through the eastern plain and here they develop meandering courses with braided characteristics of channel. Drainage density is not very high - it varies from 0 to 2.5 km per 1.6 sq. km. Less than 1 km per 1.6 sq. km. Drainage density of less than 1 km. per sq. km is found in almost all the places of the southern part of Birbhum district. More than this range is found in very small patches in western portion. This is because western part of the district is chacterised by foot hills of Chhotanagpur plateau from where many stream lines are descending down. It can be seen from one sample drainage basin that stream length is less in higher order streams whereas it is more in lower order streams. The possible reason could be as the region is mainly a plain land, the lower order streams are covering larger distance to reach the main channel and as the number of streams in lower order is high so total length accounts to be higher. Here values of Bifurcation ratio varies from 3.2 to 9. One part of the region is characterised by foot hills and the other parts are by plain land. These variation in topography leads to the variation in bifurcation ratio as well. The places where topographic and climatic conditions are similar these values do not tend to vary much. Therefore as the topographic conditions are totally

different from one part of the district to another. The variation in bifurcation is also very distinct.

CLIMATE:

The climate of the district is characterised by an oppressive hot summer, high humidity and well distributed rainfall - during the monsoon. The cold weather from about middle of November to the end of February is followed by summer from March to May. The south-west monsoon lasts from June to September-October.

Here the temperature begins to rise rapidly from about the beginning of March. It is seen from the Table No. that May is the hottest month with the maximum temperature rising upto 39.7° C. The heat is summer is oppressive. The highest temperature during the period of April to the early part of June at times as high as 45° C to 46° C. There is a welcome relief from the heat, though temporarily, with the outburst of thunder showers in this season. With the advance of the south-west monsoon into the district early in in the month of June, the day temperature drops appreciably. With the withdrawal of monsoon by about the first week of October- the temperature begins to drop. The drop particularly in night temperature is more rapid from about the mid of the November.

January is the coldest month with the mean maximum temperature of 25.05° C and the mean minimum of 11.94° C. In association with passing western disturbances spells of colder weather is experienced in the winter season. The minimum temperature may then occasionally lower down to about 6° or 7° C.

Table No. 2.6
Meteorological Data from 1968-87

Month	Mean maximum temperature (C)	Mean minimum temperature (C)	Rain fall m.m	Mean Relative humidity (%)
January	25.05	11.94	11.29	72.95
February	28.04	14.01	17.49	61.45
March	34.00	19.70	25.70	55.24
April	36.86	23.88	47.76	60.95
May	39.70	25.02	101.08	72.42
June	34.40	25.68	246.22	79.43
July	32.75	25.85	315.54	84.16
August	32.04	25.07	397.21	87.31
September	32.14	25.20	227.57	84.57
October	31.48	22.45	110.83	74.99
November	29.10	17.31	14.51	72.13
December	26.02	12.47	8.9	69.98

Source : Sriniketan Meteorological Observatory.

The rainfall during the monsoon months that is from, June to september contributes for about 78

percent of the annual rainfall. From the Table No. it can be seen that during the month of June and september average rainfall is more than 220 m.m. Whereas in the month of July and August, it is 315.64 m.m and 397.21 m.m respectively. Average rainfall of winter months is very less it is less, sometimes even than 20 m.m. The rainfall in the district in general decreases from the direction of north-west towards the south-west. The variation in the rainfall from year to year is not much. On an average, there are 69 rainy days in a year in the district. This number varies from 61 at Mayureswar to 78 at Suri. Special weather phenomena of the district are storms and depressions from the Bay of Bengal in May and in the post-monsoon season. These often reach the district and its neighbourhood that cause widespread heavy rain accompanied with high wind speed. Depressions in monsoon season and heavy rains also affect the district. During the hot season thunderstorm occur mostly in the afternoon. Associated with them are heavy rains, occasional hails and severe squalls. these thunderstorms called "northwester" are locally known as "kalbaisakhi" and the squalls associated with them usually come from the north-west. A sharp drop in temperature is experienced during these storms. Rain during the monsoon season is also often associated with thunder. Fogs occur occasionally during the winter.

The air is highly humid throughout the south-west monsoon season. Thereafter the relative humidity decreases progressively. The driest part of the year is the summer months, with average relative humidity of about 45 percent in the mornings and about 20 to 25 percent in the afternoon. Later relative humidity increases with the progress of the season.

Skies are moderately clouded in may and heavily clouded to overcast in the south-west monsoon season. Cloudiness decreases in october and the skies are clear or slightly clouded during the rest of the year.

Winds are generally light or moderate with a slight increase in force during the summer and monsoon seasons. Winds blow mostly from the directions between the south and east in may and in the cold season. In march and april these blow mostly from south and north-west direction.

From the above discussion, it is clear that Birbhum district is characterised by a hot summer. Highest temperature is experienced in the month of May and usually during March to September it experiences high temperature. One of the main climatic phenomenon of the district is monsoon rainfall. South-west monsoon wind brings storms and with this storm temperature decreases rapidly in the district. Humidity of air also depends on monsoon rainfall, which

is high during south-west monsoon season and low in the pre-monsoon summer months.

SOIL:

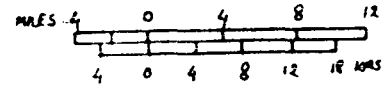
Mainly there five types of soils are found in the district. These are laterite, red soils, gondwana alluvium, vindhyan alluvium and gangetic alluvium.

Laterite nodule extensively cover the Soil of the district. Due to undulating physiography, soil erosion is very high. It is found in almost everywhere in Dubrajpur, Suri, Mahammad Bazar, Bolpur and Sainthia police-stations, south-eastern part of Rajnagar police-station, middle part of Mayureswar and Rampurhat and eastern part of Nalhati and Muraroi police-stations.

From the Map No. it is seen that red soil covers a few portion of Nalhati, eastern part of Rampurhat and middle of Mayureswar police-stations. This soil has similarity with lateritic soil and generally it is present near the lateritic soil.

Gondwana alluvium occurs mainly in the western part of the district. The area comprising this soil include Mahammad Bazar, Rampurhat, northern part of Murraroi and western part of Mayureswar police-stations.

BIRBHBUM DISTRICT
SOIL TYPES



TYPES OF SOIL

- LATERITIC SOIL
- RED SOIL
- GONDWANA ALLUVIUM
- VINDHYAN ALLUVIUM
- GANGETIC ALLUVIUM

Soil deposited by rivers like Mayurakshi, Ajoy etc. is called as Vindhyan alluvium. Since the catchement areas of all these rivers lie in Rajmahal hills and Chhottanagpur plateau, it has some physiographic similarity or continuity with the Vindhyan Range.

Gangetic alluvium has been deposited by the tributaries of Ganga river. Eastern and southern part of Muraroi police-station is covered by this soil.

VEGETATION :

The vegetation of Birbhum district belongs to the tropical dry deciduous type with a few representatives of the evergreens occurring in some pockets. As stated earlier the district can be broadly divided into two zones comprising the undulated high lands along the western part of the district and the plains in the eastern part. Thus division also coincides with vegetation zones. Although the soil erosion is acute in the western lateritic area, several relief patches of Chhotanagpur plateau forests are still to be found in Rajnagar, Mahammad Bazar, Metampur and Suri police-stations. The vegetation of this region shows semi-arid nature and is similar to eastern Bihar. Species like Accacia Bridilia, Buchanauia, Calotropis, Caesalpinta, Capparis, Cassia, Feronia, Tathrapa and other plants of the laterite are common. Grooves and trees are rather scarce in the south-western parts of

the district. The common plants sown around the habitations in valleys and the towns are babla, bel, ata, kanthal, neem, bansh, papaya, sandal etc. There are no extensive tracts of grassland in the district. Species of Euloliopies binata, Paspalum scrobiculatum etc. are common on pasture grounds and on waste land surrounding the forests.

An analysis of flora of the district reveals certain interesting phytogeographical relationships. A large number of plants got introduced in the district its adjoining areas and are not found elsewhere in the state of West Bengal. Certain species like Acampe precmorsa, Jatorpha etc. extend into the district from the peninsular India. Some Himalayan species like Hypericum japonicum, Atylosia volubilaes also succeeded in spreading in Birbhum through North Bengal and Bihar.

The Birbhum district also produce several important plants of economic value. Some common ones which are exploited for indigenous drugs and form articles of trade are Vasaka, Kalmegh, isharmul, Barun and satamul etc. The majority of the medicinal plants occur in the forests. There is quite a variety of timbers in Birbhum, used for agricultural and household work. Most predominant among them are babool, sirish, kadam, sisoo, simul, sal etc. The arm, jam, kanthal tal form the popular fruit trees of Birbhum.

The forests of Birbhum district occupy an area of 137 sq. kms. which is only 3 percent of the total land. The forests are usually distributed in scattered patches in between the stretches of barren waste lands or fallow fields along the western fringe of the district. They are located in Nalhati, Rampurhat, Mahammad Bazar, Suri, Rajnagar, Khayrasol, Dubrajpur, Illambazar and Balpur police-stations. The forests may be classified as lateritic forests, which include sal forests of about 116 sq. kms. and miscellaneous forest of about 21 sq. kms. The top canopy in the forest area is represented predominantly by sal. It forms extensive reserve in all forests. The usual associates of sal are khair, khudi jam, pial, palas etc. The undergrowths of the forests and their outskirts, usually contain species of jati, kurchi, rangan, pind khejur, kul, dhai etc.

So, natural vegetation of Birbhum district is tropical dry deciduous type. In summer the trees become almost leafless, however in monsoon period they present a luxuriant appearance. Timbers and medicinal plants are available in the district and main forest vegetation is sal.

Environment consists of physical and biological factors, elements of both the factors are interrelated and they influence each other. In the present chapter

the nature of individual environmental factor of Birbhum district has been discussed.

Morphometric analysis of the southern part of Birbhum district shows that in the south-western part of the district the topography is undulating in nature, hire variation in relief and slope values are much, whereas in the other parts variation is very less because of the nature of topography which is almost a plain land. Most of the rivers of the district are non-perennial in nature. A few perennial rivers namely Ajoy, Mayurakshi, Brahmani are flowing through the district which are originating from Chhotanagpur plateau. Most of the rivers in the district flows from west towards east except in the extreme north where Pagla and Bansloi nadi flows from north-west towards north. Analysis of drainage density of the southern part of Birbhum district shows that central and eastern parts are characterised by low drainage density whereas it is high in north-western hilly region. It is evident from the analysis of one sample drainage basin (basin area of Badreswar river) that in this area stream number and total stream length decrease with the increase in stream order. As this region is situated in plain land so streams of lower order are covering a long distance thus the stream length of lower order becoming more so this characteristic of drainage is found here due to the plain nature of topography. In

the sample basin area bifurcation ratio varies between 2.5 to 9, which shows that the composition of rocks and tectonic and climatic conditions are not similar in the basin area. Climate of the district is characterised by an oppressive hot summer, high humidity and well distributed rainfall during the monsoon season. November to February are the coldest months when rainfall is minimum. March to May are hottest months, rainfall is low in this season. June to september are the time for onset of south-west monsoon when maximum rainfall occurs. Five types of soils are mainly found in the district. They are Laterite, Red soils, Gondwana alluvium, Vindhyan alluvium and Gangetic alluvium. Laterite soil covers maximum portion of the district, next to laterite soil comes Vindhyan alluvium and least area is covered by Gangetic alluvium. Red soil Gondwana alluvium are occurred in some patches. Types of vegetation present in Birbhum district are tropical dry deciduous with a few representatives of the evergreens. With two broad divisions in the topography of the district two vegetation zones are found. One is in the western hilly region which is mainly characterised by semi-arid type of vegetation and second group is found in the eastern plain region with tropical dry deciduous types. Some scattered patches of forests are mainly found in the western part of the district and major forest vegetation is sal.

It is inferred that with the change in the topography, the distribution of drainage and vegetation is also varying in the district. Vegetation is dependent on the climate and soil type of the region, whereas soil is dependent on the geological and climatic conditions. Thus, every environmental factors influence each other which ultimately affect the land-use of the district. An attempt has been made in the succeeding chapter to discuss the pattern of land use of Birbhum district which varies geographically due to variation in distribution of major environmental factors.

CHAPTER III

LAND USE AND OCCURRENCE OF WASTELAND AND ITS FACTORS OF GENESIS

Land use mean surface utilisation of all developed and vacant land on a specific point, given time and space[1]. The primary uses of land are for crops, forest, pasture, mining, transportation, garden, residential, recreational, industrial, commercial and uncultivable waste, barren and factory land etc. To meet the needs of human being, man has to look towards land. Man need land for his food requirement for this conservation of good agricultural land for production and at the same time the development of poorer land for production of food and cash crops in needed. Again land is needed to satisfy man's need for transportation, settlement, recreation. Beside these many different kind of uses of land are there. Again rural and urban areas have land under different uses. In rural areas much of the land is used for agricultural purposes and other use have less land. On other hand, in urban areas much of the land remains under residential, commercial, industrial and other uses. Since one use of land excludes another, it is necessary to assess fully the potentialities of every

1. Jainendra Kumar; Land use Analysis- A case study of Naland District, Bihar; Inter-India Publications, D-17 Raja Garden Extn. N.D.; 1986.

type of land in respect of all possible uses. The patterns of land utilization are the result of a continuous interplay of physical elements like topography, climate and soils and human efforts guided by socio-economic conditions. A highly eroded and rugged terrain leads to a large portions of land being classed as barren and uncultivable. Land in alluvial tracts is generally fertile and suitable for cultivation. This with the variation in the nature of land it's utilization variation in the nature of land its utilization also varies.

Land use in Birbhum district: Agriculture is the chief occupation of the inhabitants of Birbhum district. Both physiography and soil conditions delimit the area under cultivation. for example comparatively higher relief and dissected terrain make agriculture less significant in the western and south-eastern parts of the district. Also undulations caused by alternating nature of valleys and interfluves in its central part somewhat restrict the area under cultivation.

Table No. 2.7 shows that area under forest is very less in almost all the police stations. It is highest in Rajnagar police station where it covers more than 10 percent of total area. Police-stations Mayureswar, Labhpur and Nanoor do not have any forested area. Mahammad Bazar and Dubrajpur police-stations have forest cover of 6.1 and 7.05 percent of the total area

respectively. Areas under forest is very less in remaining police-stations because these have flat terrain, therefore, land has been reclaimed for cultivation. Cultivated land is very less in case of Rajnagar police-station due its undulating topography - thus, this police-station comprises maximum area under forest cover. It can be observed that all the police-stations have more than 70 percent of land under plough except Rajnagar where it is 58.12 percent. Mayureswar has highest proportion of area under cultivation i.e. 93.73 percent, on the other hand amount of total uncultivated area is also very less here. It is largely because this police-station is situated in a plain area and red soil is present which is good for crop production. Some portions of this region have Vindhyan alluvium which is also productive. Besides, this region is drained by two rivers of the district, these are Dwaraka and Mayurakshi. Thus all these environmental factors make the land productive. It may be noted that Rajnagar police-station have highest area classified as culturable waste which amounts to 20.4 percent of total area, again the reason is undulation topography which limits the area under cultivation. Mahammad Bazar and Khoyrasol police-stations have culturable wasteland to the time of 6.79 and 9.45 percent respectively. Remaining police-stations have less area under this category and police-station Muraroi have least that is 0.21 percent of total land

Table No 3.1

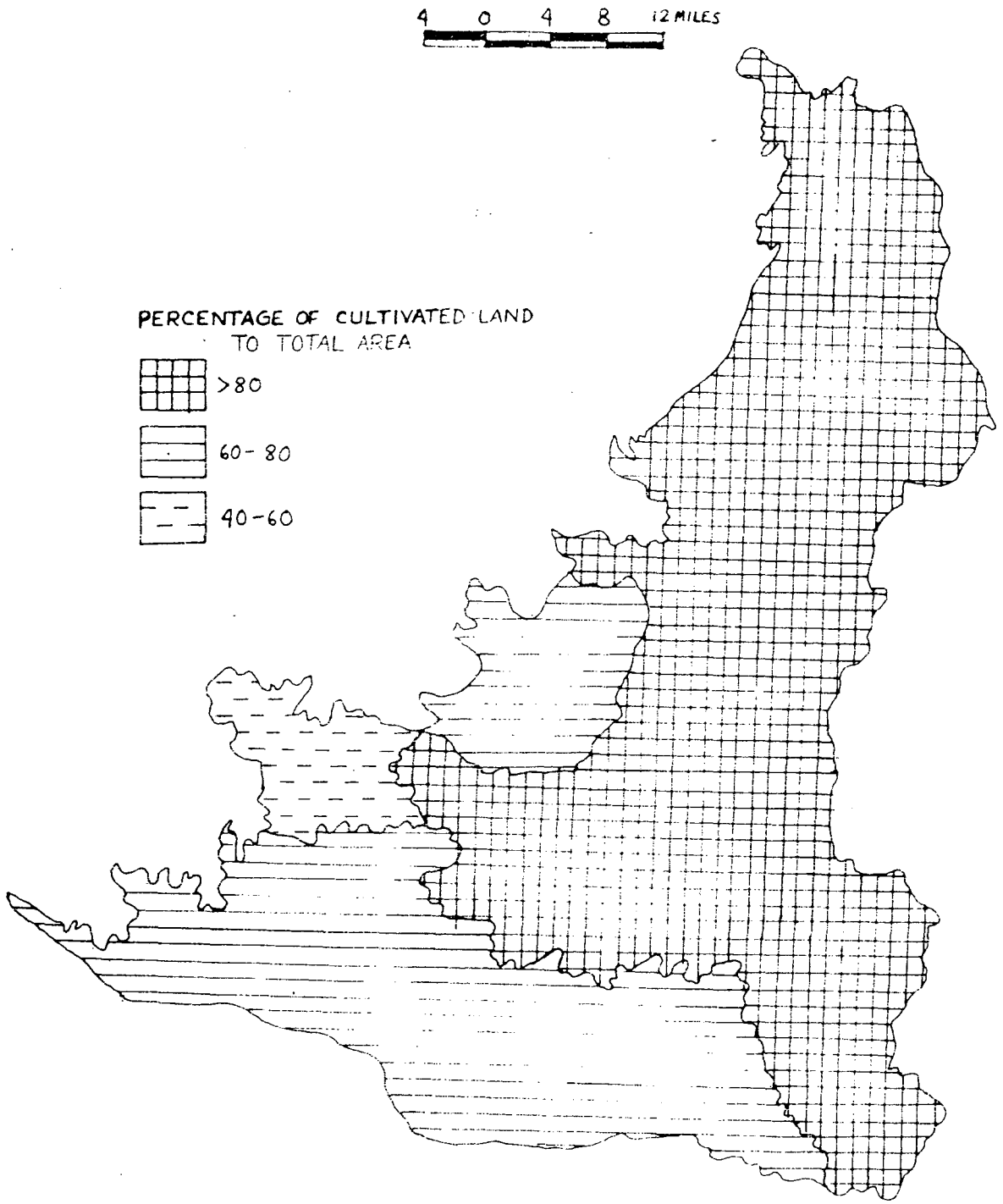
Land-use in Birbhum District (in percent)
1981

Name of the Police-stations	Forest (A)	Cultivated land (B)	Cultivable waste (C)	Other Uncultivated land (D)	Total cultivated land (C+D)
Murarai	0.09	88.70	0.21	11.21	11.42
Nalhati	0.36	89.70	2.32	7.45	9.77
Rampurhat	0.84	89.33	0.90	8.90	9.80
Mayureswar	---	93.33	0.39	5.80	6.19
Mahammad Bazar	6.10	75.33	6.79	1.17	7.96
Rajnagar	10.51	58.12	20.40	9.80	30.20
Khayrasol	3.74	76.45	9.45	10.33	19.98
Dubrajpur	7.05	72.82	2.88	17.22	20.10
Suri	1.24	86.84	3.27	8.59	11.86
Illambazar	4.35	76.57	0.23	18.83	19.06
Sainthia	1.15	91.95	1.07	6.67	7.74
Bolpur	1.08	74.08	1.14	23.6	24.74
Labhpur	----	87.70	1.60	10.50	12.10
Nanoar	----	92.6	0.3	6.90	7.2

Source: Census of India. District census Hand Book; Village and Town Directory; Birbhum District Part XIII B, 1981.

because here area under cultivation is very high as this region mainly has gangetic alluvium and gondwana alluvium which are good for cultivation. Area under other uncultivated land is highest in Balpur police-

BIRBHUM DISTRICT
DISTRIBUTION OF CULTIVATED LAND

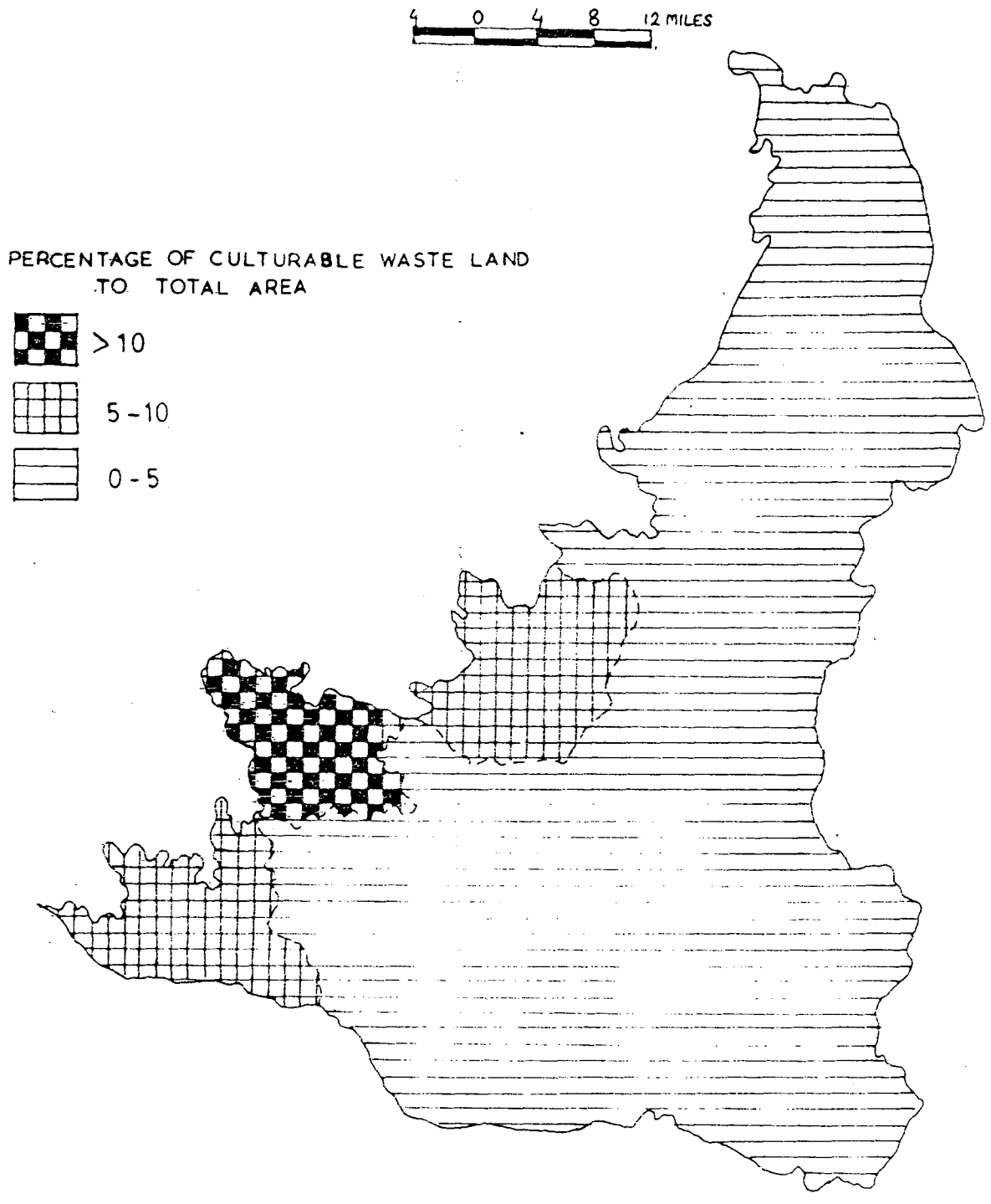


station (23.6 percent) because of the presence of al big town many portions of land has been used for settlement and other administrative purposes. Illan bazar and Dubrajpur police-stations have other uncultivated land of 18.83 and 17.22 percent whereas other police-stations have less than 15 percent area under this category. It can be observed that total uncultivated land is highest in Rajnagar police-station that is 30.2 percent of total area. Main reason of it is rugged physiography which limit the area under cultivation. Balpur police-station has next highest area under uncultivated land, here mainly because of land trut to use other than cultivation. Other police-stations has uncultivated land less than 20 percent.

The above discussion shows that because of unfavourable physiographic condition police-station Rajnagar has least area under cultivation. On the other hand police-station Mayureswar has highest area under cultivation where fertile soil make the land suitable for cultivation. In case of distribution culturable wasteland also the same trend is observed. As same police-stations have more land under urban settlement so distribution of total uncultivated land vary according to the distribution of culturable wasteland and other uncultivated land. Thus, because of varying nature of physiography, soil, climate etc.

BIRBHUM DISTRICT

DISTRIBUTION OF CULTURABLE WASTE LAND



land use of each police station varies from each other considerably.

Though because of varying physiography, soil, and other conditions area under cultivation in Birbhum district is limited, still 8 lakh acres or 68.18 percent of the total land is under plough. Principal crops grown in Birbhum district are paddy, wheat, mustard, potato etc. It is evident from the table 2.8 that aman paddy is grown on largest area accounting for 63.31 percent of total cropped area. It is because this crop need high temperature and humidity which are climatic characteristics of the district. mainly it is a rain-fed kharif crop and maximum rain occurs during kharif season. After aman paddy next crop is wheat which occupy 13 percent of total cropped area. Though wheat is a crop of mid-latitude grassland but it has a wide geographical distribution due to its adaptability to varied physical environments and in Birbhum district it is raised during rabi season when the temperature and rainfall both are low. Other crops of the district occupy very less area. And least area is covered by potato, gram, sesamum, sugercane and others which cover less than 2 percent of total cropped area individually. Total gross cropped area of the district is 11.53 lakh acres and here multiple cropping is practiced.

Table No. 3.2

Cropping pattern of Birbhum District

Crops	Area (in 100,000 acres)	Percentage of Area
Aush Paddy	0.50	4.3
Aman Paddy	7.30	63.31
Boro Paddy	1.50	3.6
Wheat	0.50	13.0
Mustard	0.20	4.3
Potato	0.17	1.73
Gram	0.15	1.47
Pulses	0.42	1.3
Fodder	0.42	3.6
Sesamum	0.09	0.78
Sugarcane	0.10	0.86
Others	0.20	1.73
Total	11.53	100.00

Source : Statistical Abstract of West Bengal_

Among the total uncultivated land, some lands are used for transportation, settlement, communication, recreation etc. Purposes but some are kept unutilised or as wastelands. There are mainly four types of wasteland in Birbhum district. These are- 1. upland waste, 2. lateritic waste, 3. stony waste, 4.

anthropogenic waste[2]. Considering the existing conditions of the landscape another wasteland type may be included in the list that is riverine waste.

The upland waste, usually occupy higher parts of the interfluves in almost all the police-stations of the district. This type is characterised by soil covered with pebbles and boulders and in certain area like in Balpur police-station it is known as "Banjar" forming mounds.

Lateritic wasteland or kankrili land covers large areas in the western and south-western parts of Birbhum district. Large patches of this type of wasteland found in Bolpur, Dubrajpur, Illambazar, Sainthia, Mayureswar and Suri police-stations. Although climato-genetic processes are largely responsible for the development of lateritic soils or wastes, removal of vegetal cover by man for either fuel or timber or fodder or extension of cultivation and subsequent accentuation of denudational processes have made these land unproductive. Besides, the soil has predominance of iron and alumina oxide which form hard concretions called morums. The lateritic wastes are underlain by a bed of clay in Ballabhpur area but these are underlain by gneisses near Dubrajpur.

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2. V.C. Jha; Wasteland Types and their Utilization; The Deccan Geographer; Vol. No. XXV; 1987.

Stony wastes occur in the western parts of Muraroi, Nalhati, Rampurhat, Rajnagar and Khoyrasol police-station. Exposure of granitic gneiss, sandstone and shale have produced a special type of terrain at places characterised by hillocks and scattered blocks of rocks which are not suitable for cultivation. Extraction of rocks in the western part of police-station Rajnagar has accelerated man-induced erosion resulting in the transfer of even course particles eastwards onto the cultivated fields, thus lowering their fertility.

Some wastelands have been developed by mis-use or over-exploitation of land by man. That is due to overgrazing and deforestaion resulting in serious loss of soil. Some degradation of land is also coming up due to traditional and unscientific method of cultivation. Thus in almost every police-station some wastelands are found which are anthropogenic in character.

Apart from this large areas in riverine belt along the banks of Mayurakshi, Ajoy, Sal, Dwaraka, Pagla, Brahmani suffer by water erosion resulting formation of gullies and with the progress of time these lands have been turned into wasteland.

Thus mainly five types of wasteland are found in the district. With the increase in population of the

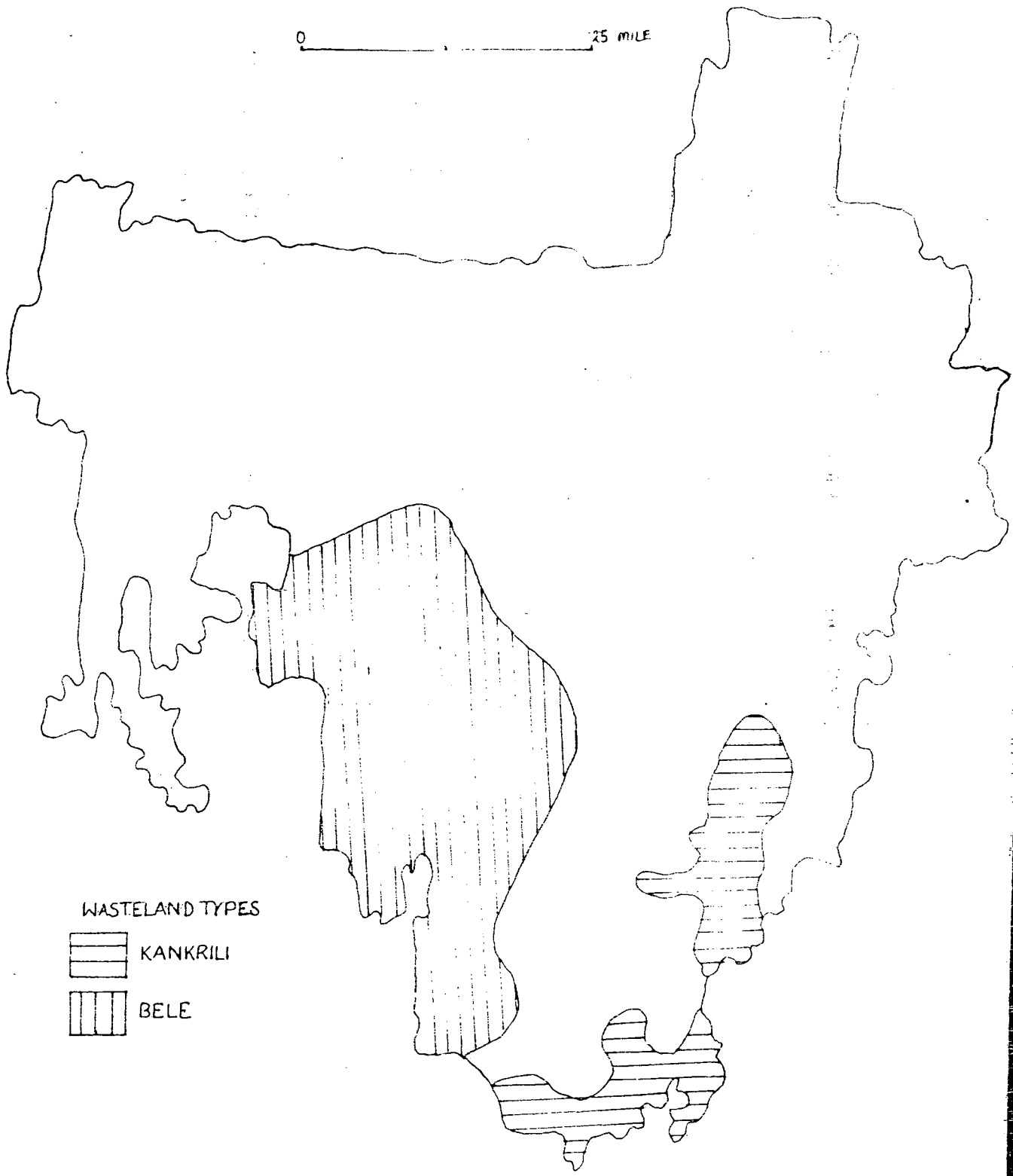
district demand for food-grain, demand of land for settlement and other purposes are also increasing. With this increasing demand of land, need of using wasteland is also increasing. So as this district have culturable wasteland so this kind of land can be brought under use if little attention and some extra input has been paid for it. Besides there are wastelands which are not suitable for cultivation for these wastelands suitable uses can be suggested after knowing their causes of formation.

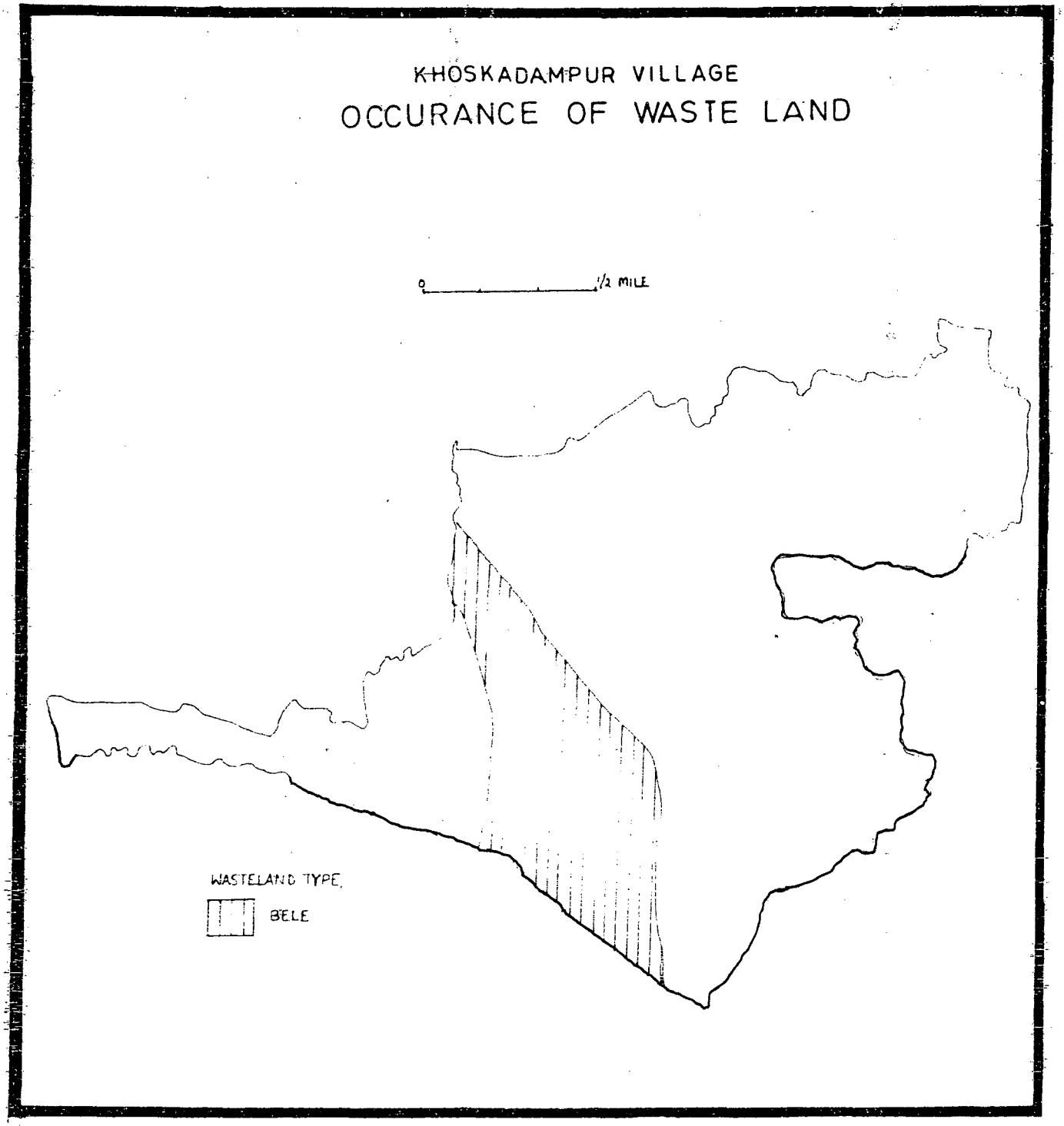
To know the factors of genesis and assess the extent of wasteland in Birbhum district a micro-level study is needed. So, six villages have been chosen for this purpose. As the study is based on secondary data and as detail information about all the villages are not available in secondary level so this study could not choose villages according to its highest percentage of wasteland. For few villages detail information are available and among them those villages having more amount of wasteland has been taken for the present study. Name of the villages are - Baidyanathpur, Khoskadampur, Ballabhpur, Sahajapur, Muluk and Hatserandi.

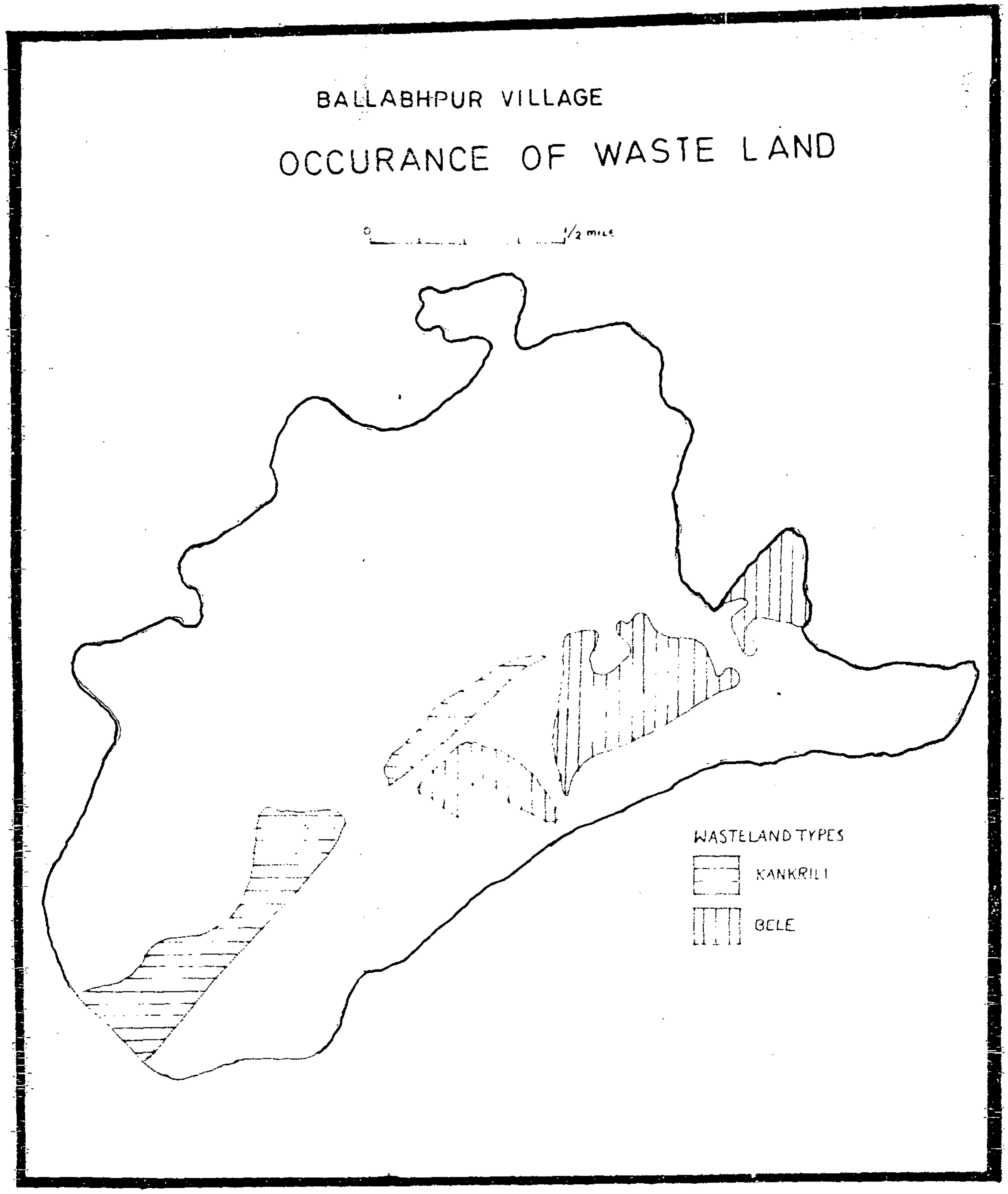
Occurrence of wasteland in villages: Within these six villages two types of wasteland are found. These are kankrili and bele. Kankrili land are those lands where concretion takes place and kankar are visible on earth

BAIDYONATHPUR VILLAGE

OCCURANCE OF WASTE LAND

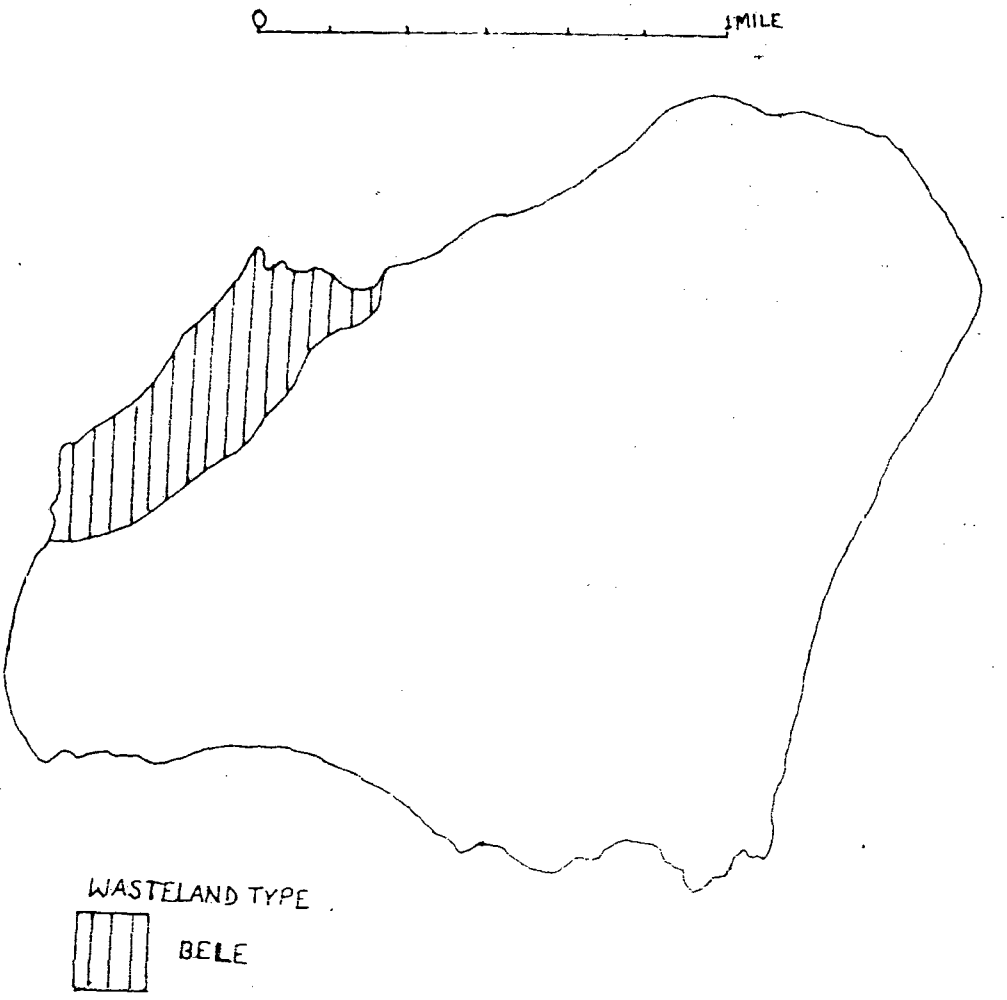


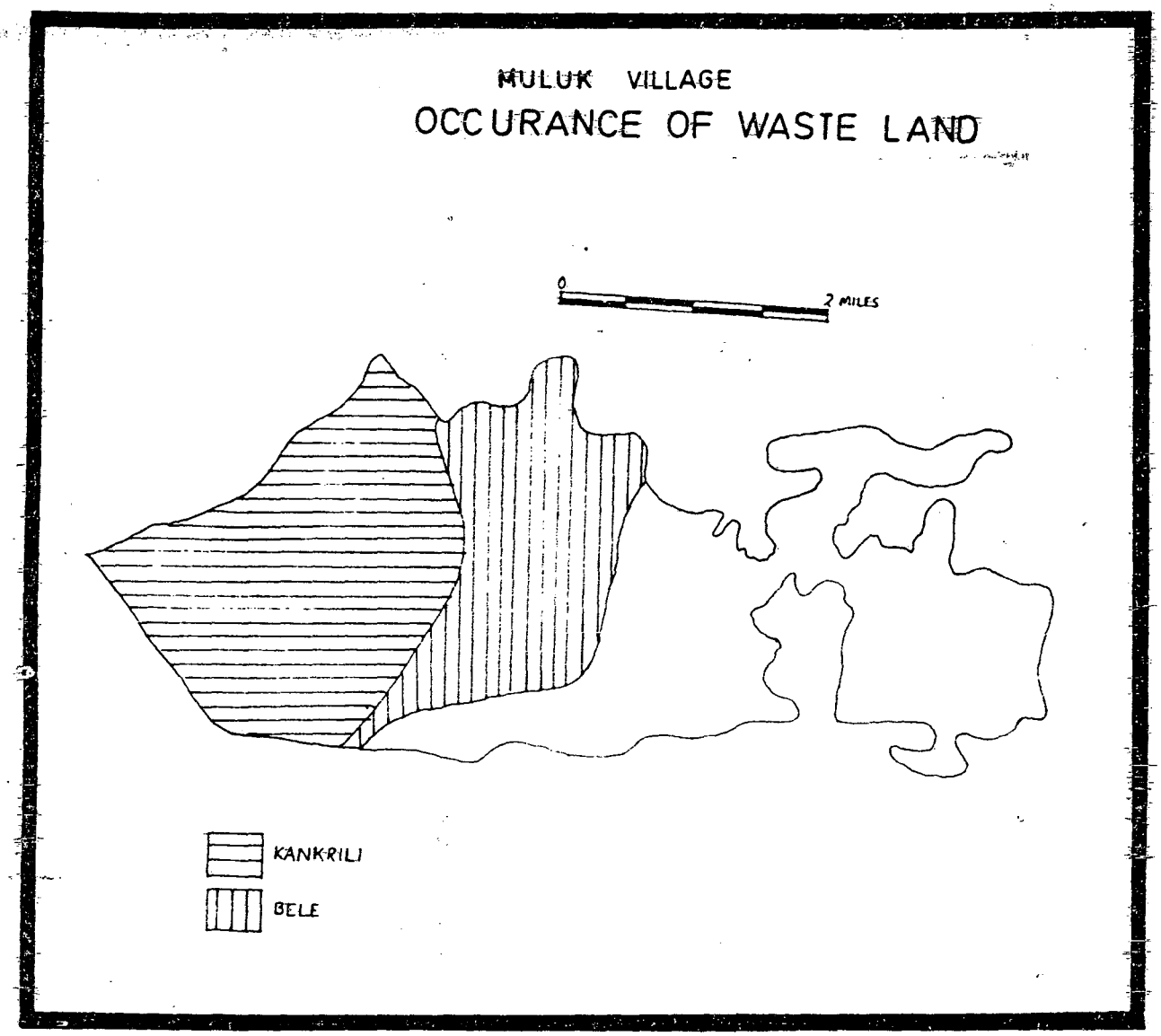

KHOSKADAMPUR VILLAGE
OCCURANCE OF WASTE LAND
0
1/2 MILE
WASTELAND TYPE
BELE

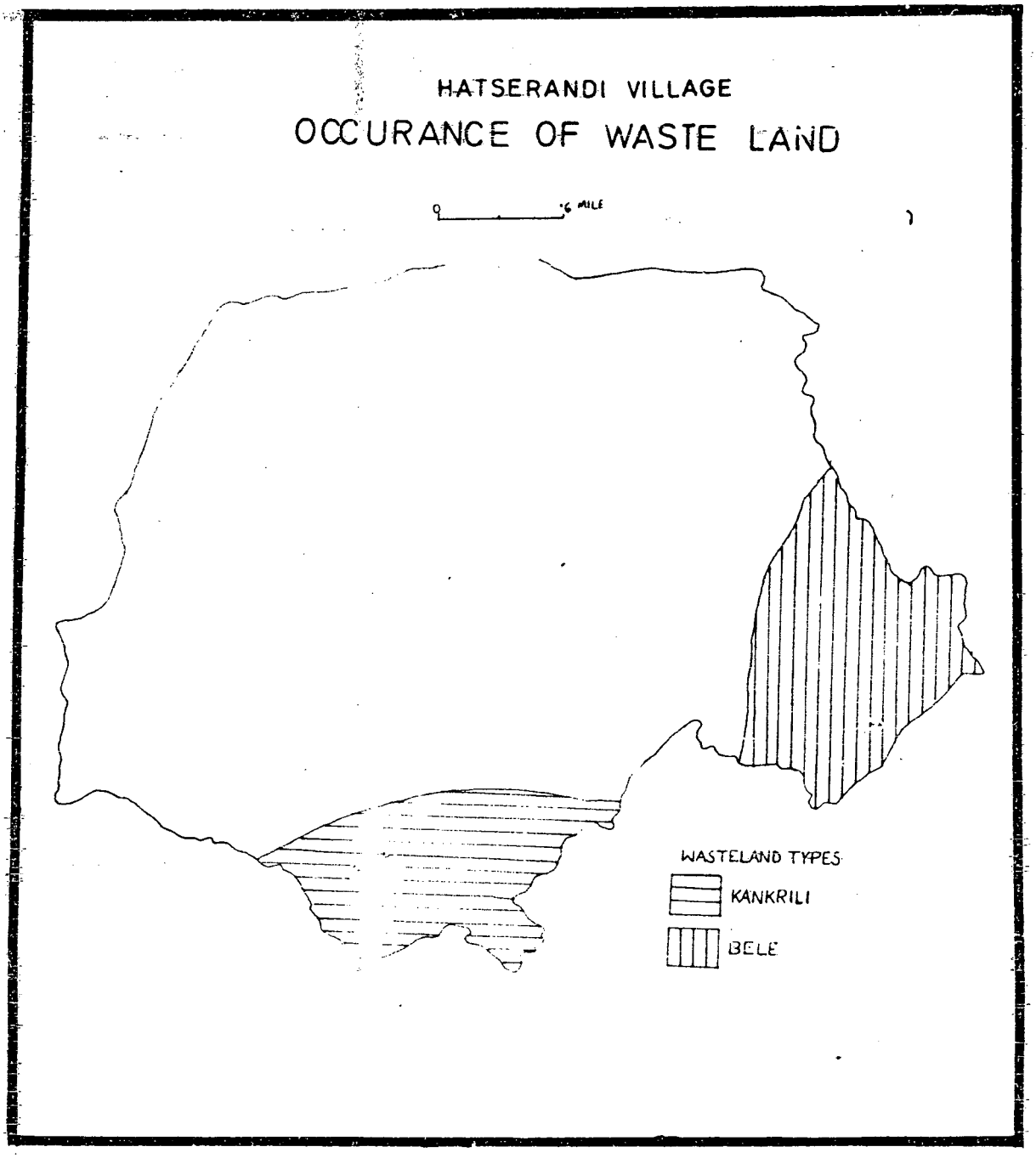

BALLABHPUR VILLAGE
OCCURANCE OF WASTE LAND
0
1/2 mile
WASTELAND TYPES
KANKRILI
BELE

SAHAJAPUR VILLAGE

OCCURANCE OF WASTE LAND




MULUK VILLAGE
OCCURANCE OF WASTE LAND
0
2 MILES
KANKRILI
BELE


HATSERANDI VILLAGE
OCCURANCE OF WASTE LAND
0
1/2 MILE
WASTELAND TYPES
KANKRILI
BELE

surface and sometimes at a certain depth. In many areas the kankars are exposed on the surface mainly because of the removal of the top soil due to erosion. Bele lands are those lands which are mainly sandy in nature. In this soil amount of sand is 80 to 90 percent other components of this soil are clay and silt amount of which varies from 5 to 10 percent.

From maps showing occurrence of wasteland in sample villages, it is seen that the village Baidyanathpur have two types of wasteland kankar and bele. Kankar type land occurs in two patches in the south and south-eastern part of the village which accounts for 2.15 percent and 2.65 percent of the total area of the village respectively. In the south-eastern part a big patch of bele type land is seen which covers 15.85 percent area. Village Khoskadampur have area under bele type wasteland which accounts for 11.65 percent of total area of the village and it is located in the central-western part of the village. Village Sahajapur also has only bele type of wasteland which covers 7.82 percent of total area and situate in the north-western corner of the village. Village Muluk has land under kankrili and bele type of wasteland, kankrili land occurs in the eastern part of the village and covers 39.06 percent area. Bele type land is seen in central-western part of the village which covers 24.20 percent of total area. Village Hatserandi have

kankrili land in the southern portion which covers 9.09 percent area and bele is seen in east which covers 14.9 percent of the total area.

Factors of genesis: As stated earlier, genesis of wasteland in a region is the result of various natural and human factors. Natural factors are manifested by certain morphometric, climatic, hydrologic and pedogenic parameters including slope, ruggedness number, drainage density, rainfall, water table and thickness of the top soil. The human factors influencing wasteland include certain aspects of land concentration, incorrect agricultural practices, over grazing, over irrigation etc.

The above parameters generally influence the genesis of wasteland in various ways in Birbhum district. Among morphometric parameters slope has some influence on the formation of kankrili land. Because for kankar formation leaching of materials like silica takes place and materials like sesquioxide of iron and alumina remain in the soil as permanent residual materials. If slope of an area is more then in that place ingress of surface water is not possible and if this is absent leaching can not take place. For the formation of kankar, sloppy terrain is not suitable. Climatic parameter like rainfall can be helpful in getting an idea about the level of water table. Hydrologic parameters such as drainage density provide

some possible trends. In some cases there is much overland flow in the form of drainage either natural or artificial due to which fertility of soil get eroded and farmers have to leave the land fallow or uncultivated. Sometimes high drainage density give rise to higher dissection of the land whereby the top soil of the strata do not remain in equilibrium which makes the land uncultivable. It is possible sometimes that high degree of natural overland flow in the district may leads to more erosion due to which little abraded kankar calcium nodules may be deposited down from higher to lower areas through this kankrili land may increase. Water table also has relationship with different types of wasteland. For example it is possible in some areas that very low water table results in lowering soil moisture through percolation, consequently crop producing capacity of soil gets reduced. Areas with high water-table have enough moisture in the soil and in the rainy season it may results in logging condition forcing farmers to leave it uncultivated. Proportion of wasteland can be high in those villages where water table is very low. Pedogenic that is type of the soil and thickness of top soil cover also has some relationship with the occurrence of wasteland. Type of the soil is a very important factor, production capacity of a soil mainly depends on its type, and in Birbhum district soil type varies considerably. In case of thickness of the top

soil, it is possible that sometimes leaching takes place in area having thin soil cover.

Among anthropogenic factors, land concentration has some influence. In some cases of large sized land holding, the farmers are least bothered to improve the fertility status because on the one hand they are getting less output and on the other hand they have other better land for agricultural use. So they apply much input to the good quality of land only where they are sure of getting good profits. That is the reason why some lands are left uncultivated. Situation of canal may cause some land to be kept as uncultivated. Sometimes the excess water through small drains, canal and over irrigated water from the field accumulate into nearby low lying areas which makes the land unsuitable for cultivation. Again sometimes canal are situated very far from the field. In such case if field do not get irrigated when need, the field may become dry and in that way the place may turn into wasteland.

It is seen from this chapter that though physiography delimit the area under cultivation but land-use of this district is mainly dominated by cultivated land. Among total area 68.18 percent is under cultivation in the district and here main crop grown is paddy. Because of varying environmental condition the district is characterised by different kinds of wastelands which cover some portion of land in

almost every police-station. Most of these wastelands have been developed by some unfavourable environmental conditions and in some cases its formation gets support from mismanagement of land by human beings. So an attempt has been made in the next chapter to know the influence of possible indicators in the formation of wasteland in Birbhum district.

CHAPTER IV

FACTORS OF WASTELAND - A CORRELATION AND SOME REMEDIAL MEASURES

As seen in the earlier chapter, factors of genesis of wasteland in Birbhum district are both natural and anthropogenic. Among the natural factors most important are - soil type, thickness of the soil cover, rainfall and slope. Soil is important because in Birbhum district, it varies considerably from one place to another. Formation of wasteland depends mainly on the nature of soil, fertility and many other factors. if a soil is very loose and infertile then it cannot be used for cultivation for any other beneficial use. Thickness of the soil cover is important specially in Birbhum district because leaching plays important role in the formation of "Kankrili" land. It has been seen earlier that leaching takes place in areas having thin soil cover. Monsoon rainfall is a major climatic phenomenon of the district. It plays an important role in changing water table which results in the formation of wasteland. Besides, rainfall accelerate the leaching process. The slope of the land is not very steep in Birbhum district as it is situated almost in a plain land except the central western part of the district. But gentle slope also adds to the formation of "Kankrili" land as this type of wasteland

are found in Birbhum district so slope as a factor of genesis of wasteland is important.

Among anthropogenic parameters important factors in the context of Birbhum district are distribution of land holdings, position of canal and exploitation of forest for timbers. it is seen that rich farmers generally have good quality land. Poor farmer have poor quality of land and to use this land they need to provide more inputs. Sometimes it is out of their reach. So they are at time forced to keep the land unused and it after few years becomes wasteland. Land is not equally distributed in Birbhum district. It can be an important factor of the genesis of wasteland. To cultivate land, canal water is very much needed in the district because as it gets maximum rainfall only in the monsoon period so for the rest of the year storage of water is needed.

Above mentioned factors are important in Birbhum district for the genesis of wasteland. To know the genesis of wasteland a detail micro level study has been attempted. Six villages have been chosen for this purpose. Occurrence of wasteland in these villages have already been discussed in the previous chapter. A discussion about the factors responsible for the genesis of wasteland in those villages have been carried out in succeeding part.

As discussed in earlier chapter, name of the six villages are - Baidyanathpur, Khoskadampur, Sahajapur, Ballabhpur, Muluk and Hatserandi. Physical background of these villages are to some extent similar, still there are some variations. Villages Baidyanathpur, Ballabhpur and Khoskadampur are situated in the south of Kopai river, Baidyanathpur is 2.56 km away from Kopai river and this river passes through the northern border of village Ballabhpur. Village Muluk is situated between Kopai and Ajoy rivers. The maximum height of village Baidyanathpur is 48 mt. on the south and minimum is 35 mt on the north. The village land slopes from south to north. In case of the village Khoskadampur the land is undulating in nature with slope from the south to north-east, middle part of the village has lower elevation. Maximum height is in south 52 mt. and minimum is in north-east 40 mt. Slope of the village Ballabhpur is south-west to north-east and its maximum height is 60 mt. in the south-western corner and minimum is 45 mt. in north-eastern part. Topography of the Muluk village is more or less plain. It is relatively steeper in south and south-eastern side. Maximum height is 46 mt. in the north and minimum is 35 mt in the east. Hatserandi village is situated more or less on plain land. here unlike the other villages slope varies from north-west to south-east. Maximum height is 34 mt. in north-west and minimum is 25 mt. in south west.

Climate: In case of climate it is seen that monsoon type of climate is found in all the villages. The climate is hot and dry here. Oppressive hot summer, high humidity and well distributed rainfall during the monsoon season are some of the characteristic features of the climate of these villages. Here winter starts about the middle of the November and it remains upto February. The summer season lasts from March to May, June -September is the north-west monsoon season. October and first week of November constitute the post monsoon season. At the beginning of the rainy season the climate is humid and oppressive. Rainfall data of the villages has been grouped as season-wise : 1. Pre-kharif (March to May), 2. Kharif (June to October) and 3. Rabi (November to February). Data of rainfall for the villages Baidyanathpur, Khoskadampur and Ballabhpur are same as these are situated close to each other.

Table No. 4.1

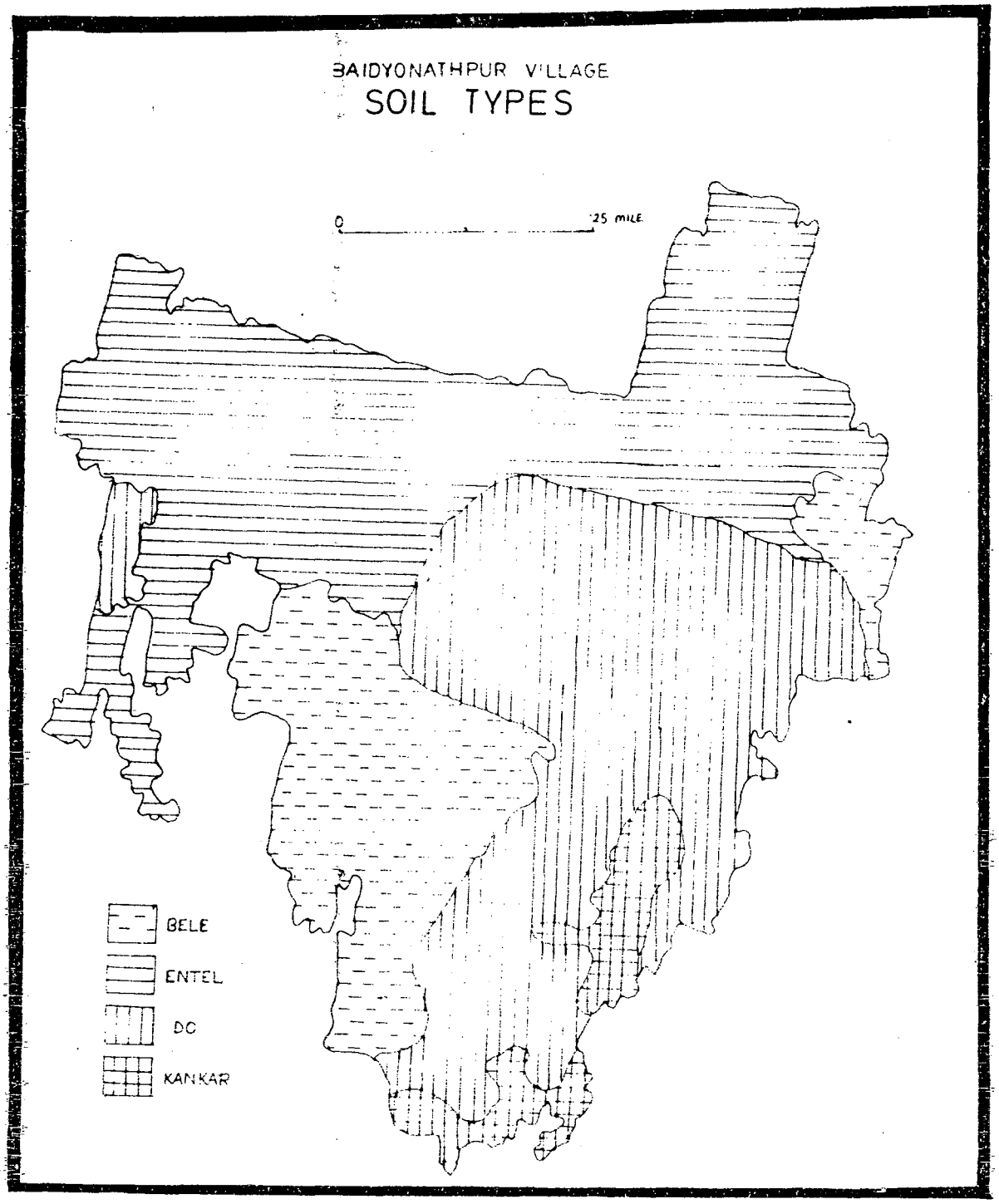
DISTRIBUTION OF RAINFALL (in m.m.)

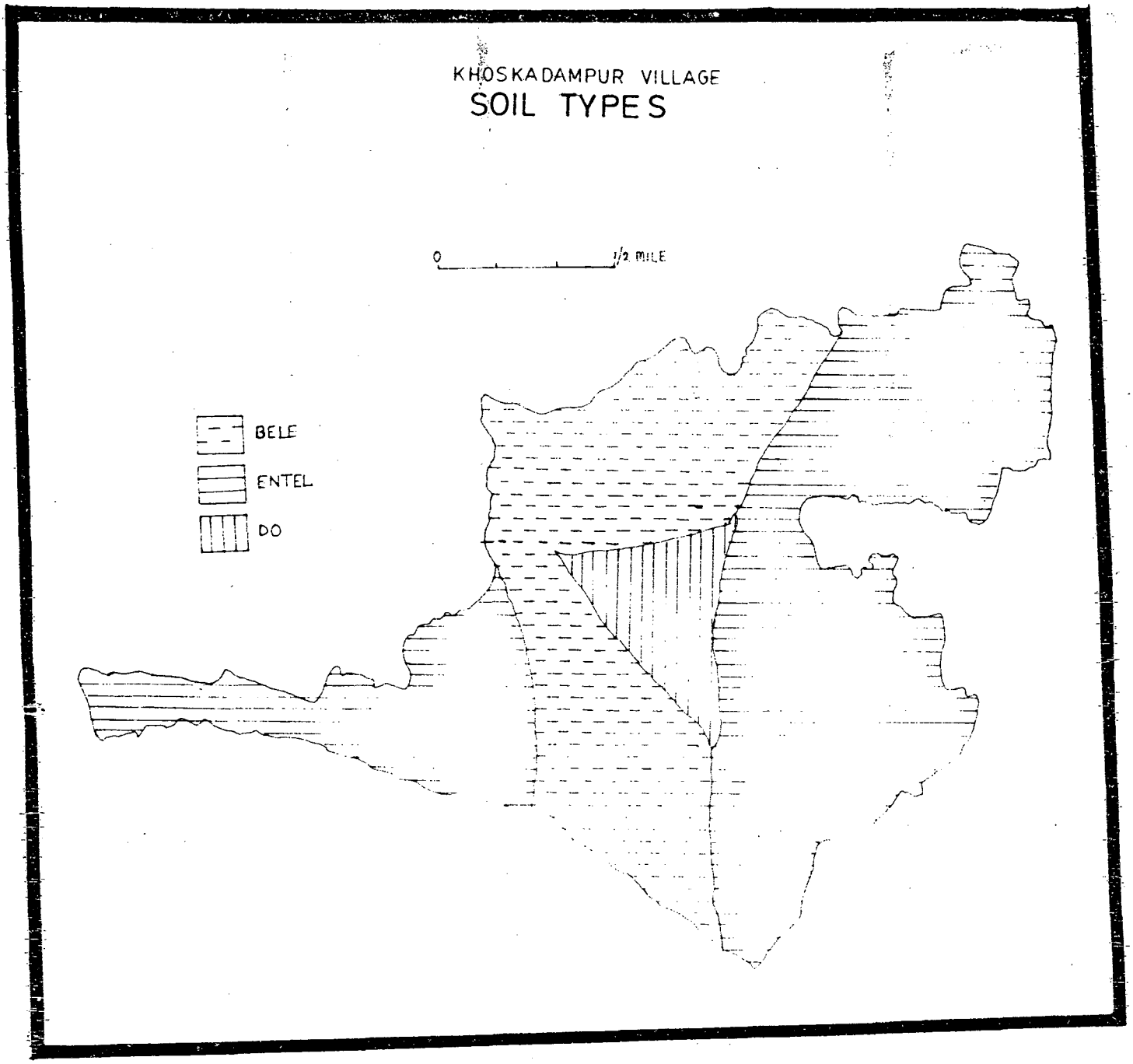
Name of the Village	Baidyanathpur, Khoskadampur and Ballabhpur			Shajapur			Muluk			Hatserandi		
Year/ Season	Pre Kharif	Kharif	Rabi	Pre Kharif	Kharif	Rabi	Pre Kharif	Kharif	Rabi	Pre Kharif	Kharif	Rabi
1978	163.3	1868.1	36.6	163.3	1026.9	41.3	154.6	1875.1	24.01	122.4	1868.1	118.3
1979	23.7	1026.1	59.9	23.7	2554.0	63.2	28.7	1007.9	49.9	23.9	1026.9	40.9
1980	211.9	680.3	37.6	291.9	1038.4	96.0	241.9	275.4	37.6	291.9	275.4	63.2
1981	207.6	1037.7	133.7	206.6	589.2	37.8	247.4	1008.9	323.7	207.6	1098.4	96.0
1982	192.5	544.4	41.8	192.5	1171.2	64.5	85.34	329.4	53.5	102.0	345.5	52.0
1983	206.8	1218.1	42.3	206.6	961.0	88.2	86.8	1217.1	80.0	98.9	1137.5	78.8
1984	105.1	1980.4	40.1	105.0	184.0	42.3	90.89	1980.4	39.0	87.8	1560.3	41.5

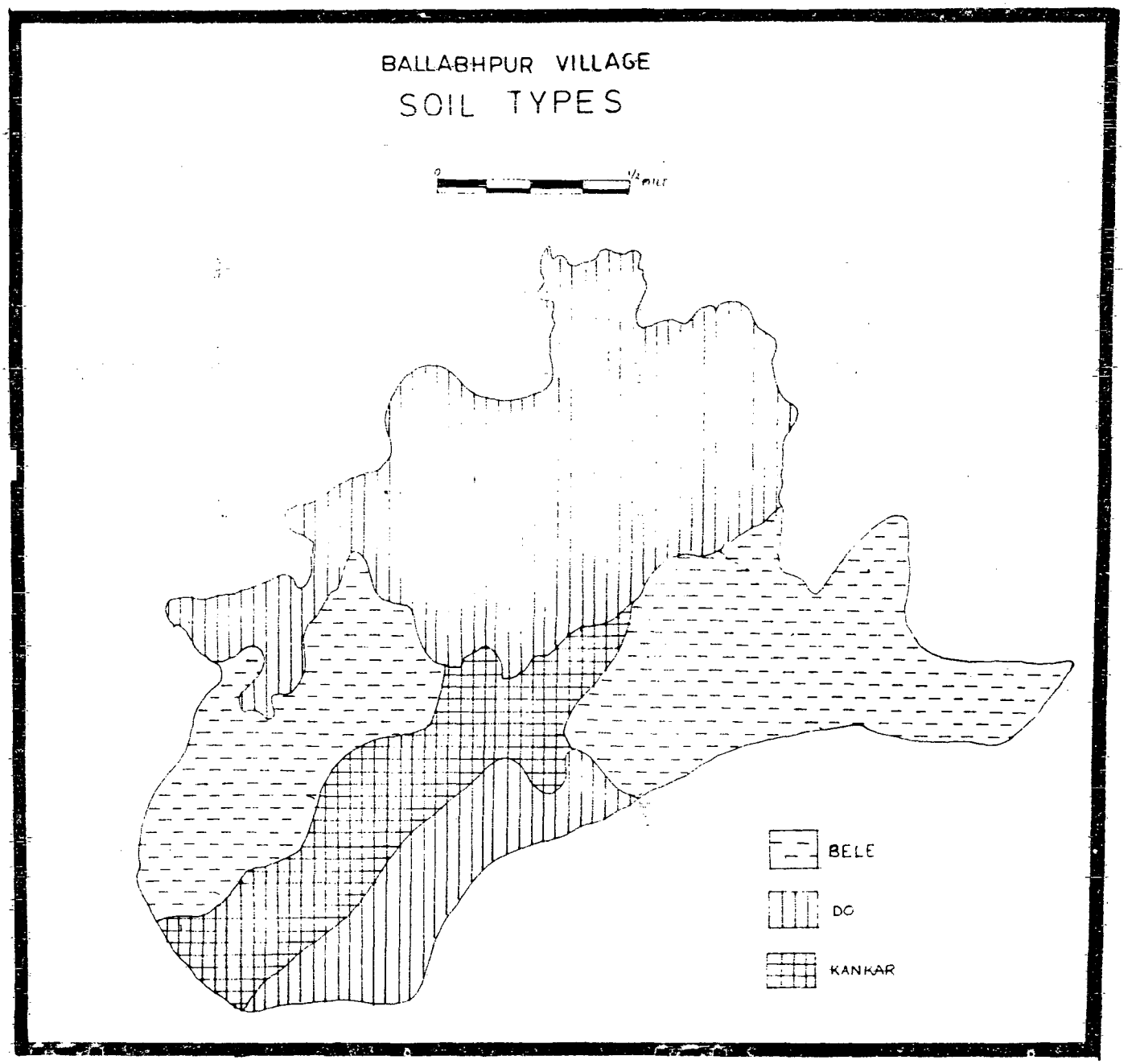
Source : Sriniketan Meteorological Station, Birbhum District, West Bengal.

From table No. 4.1 it is evident that maximum rainfall occurs during Kharif season. Minimum rainfall occurs in Rabi season and Pre-kharif season gets a moderate amount of rainfall. It has seen that highest kharif rainfall occurred in Sahajapur village in the year 1979 (2554.0 m.m.) whereas lowest was in the villages Muluk and Hatserandi that was 275.4 m.m in the year, 1980. In case of Rabi and Pre-kharif season, highest rainfall among the villages, was observed in Muluk and Hatserandi where it was 323.7 m.m and 291.9 m.m. respectively. Lowest of Rabi and Pre-kharif seasons was observed in Baidyanathpur, Khakadampur and Ballabhpur villages where these were 36.6 m.m. and 23.7 m.m. respectively. So it is evident from the above discussion that these villages do not have a similar distribution of rainfall throughout the year. Few months of a year get heavy rainfall whereas others are getting less. So it is possible that because of this uneven distribution of rainfall, those field which and water throughout the year for its utilisation, they are lying unutilised in the maximum portion of the year and thus amount of wasteland is increasing.

Soil: Mainly four types of soil are found in all the villages. These are "entel", bele" "do" and "kankar". "Entel" soil is brownish in colour and it is poor in agricultural production though some paddy can be grown but it is generally not suitable for agriculture. The

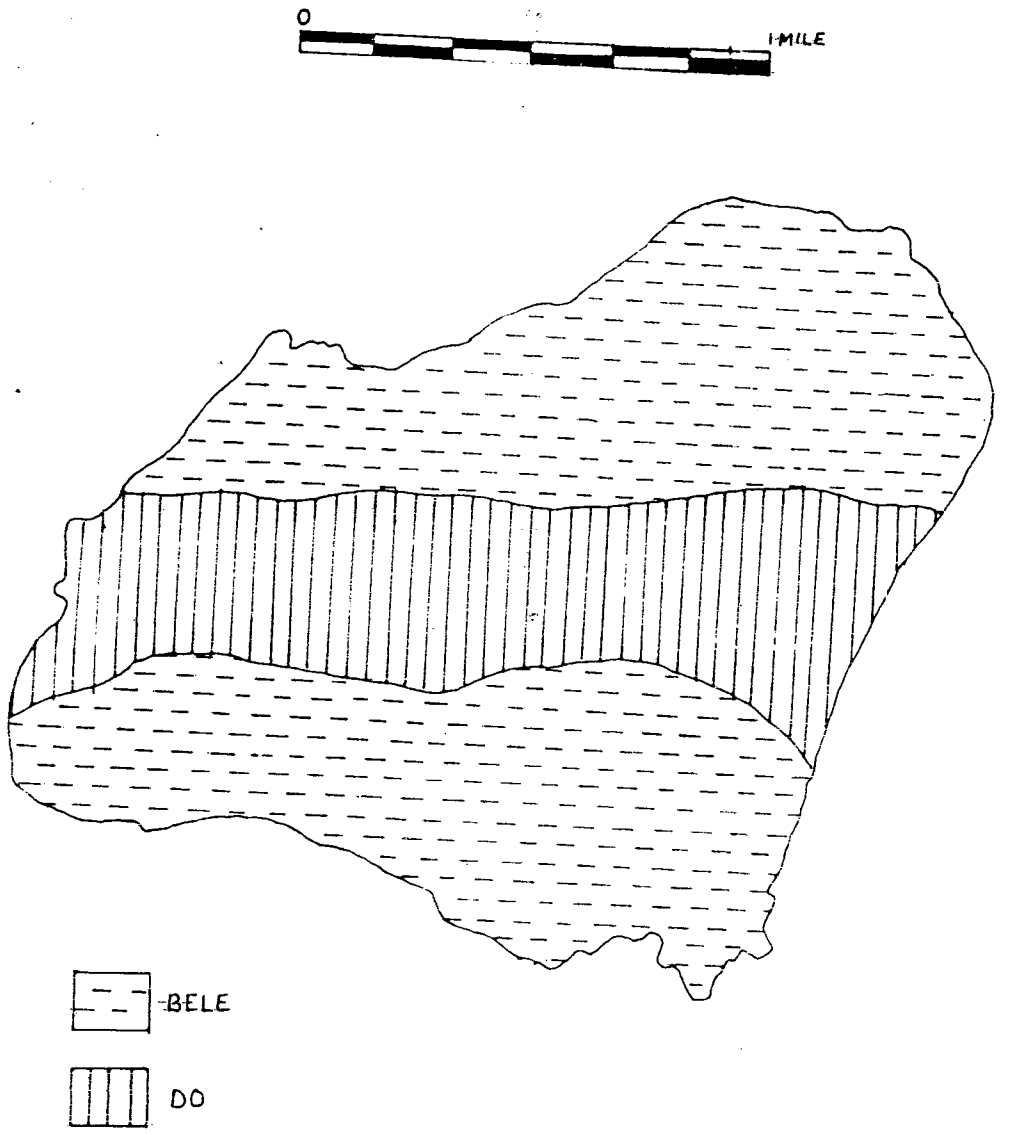

BAIDYONATHPUR VILLAGE
SOIL TYPES
0
·25 MILE
BELE
ENTEL
DC
KANKAR

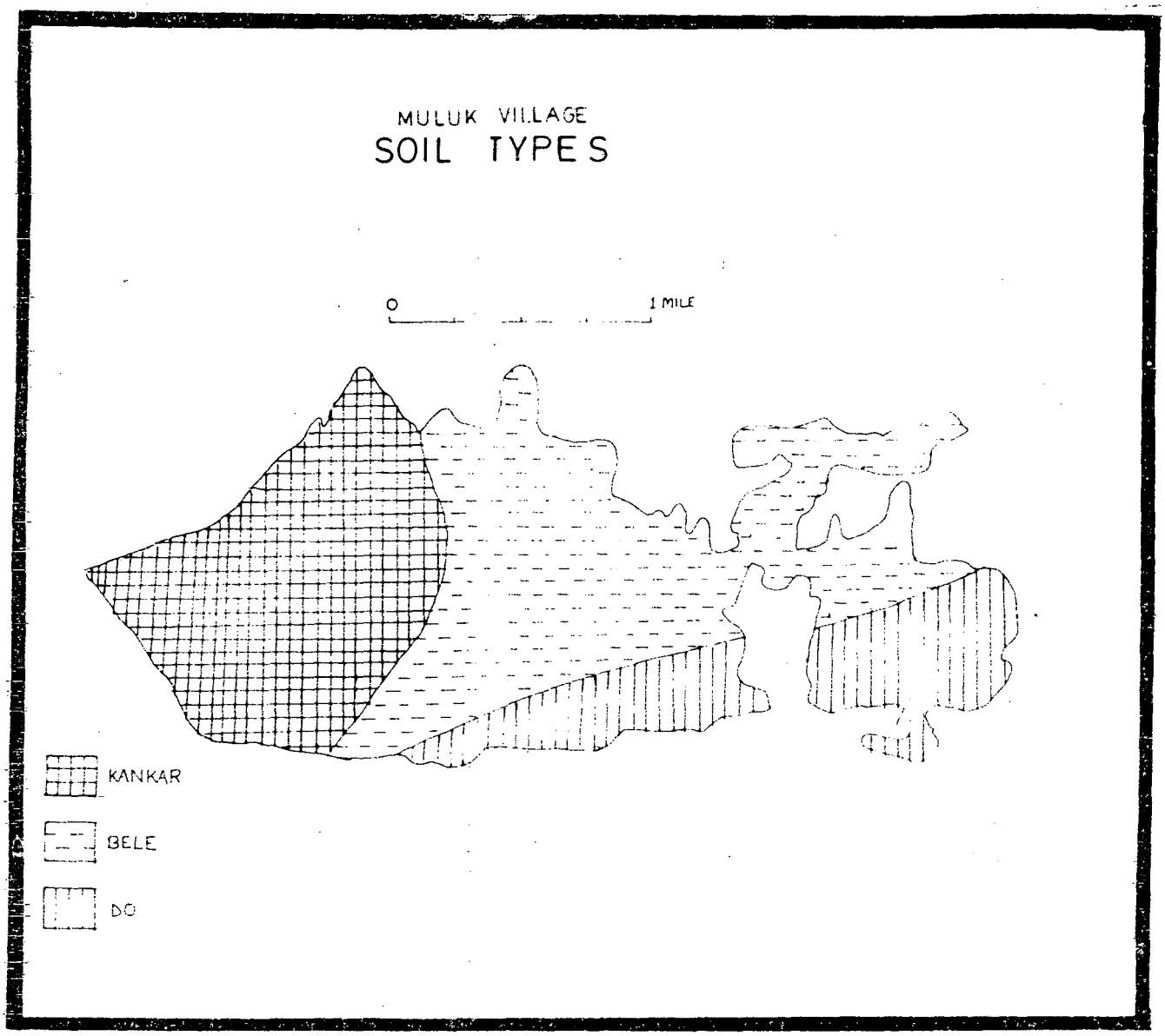

KHOSKADAMPUR VILLAGE
SOIL TYPES
0
1/2 MILE
BELE
ENTEL
DO

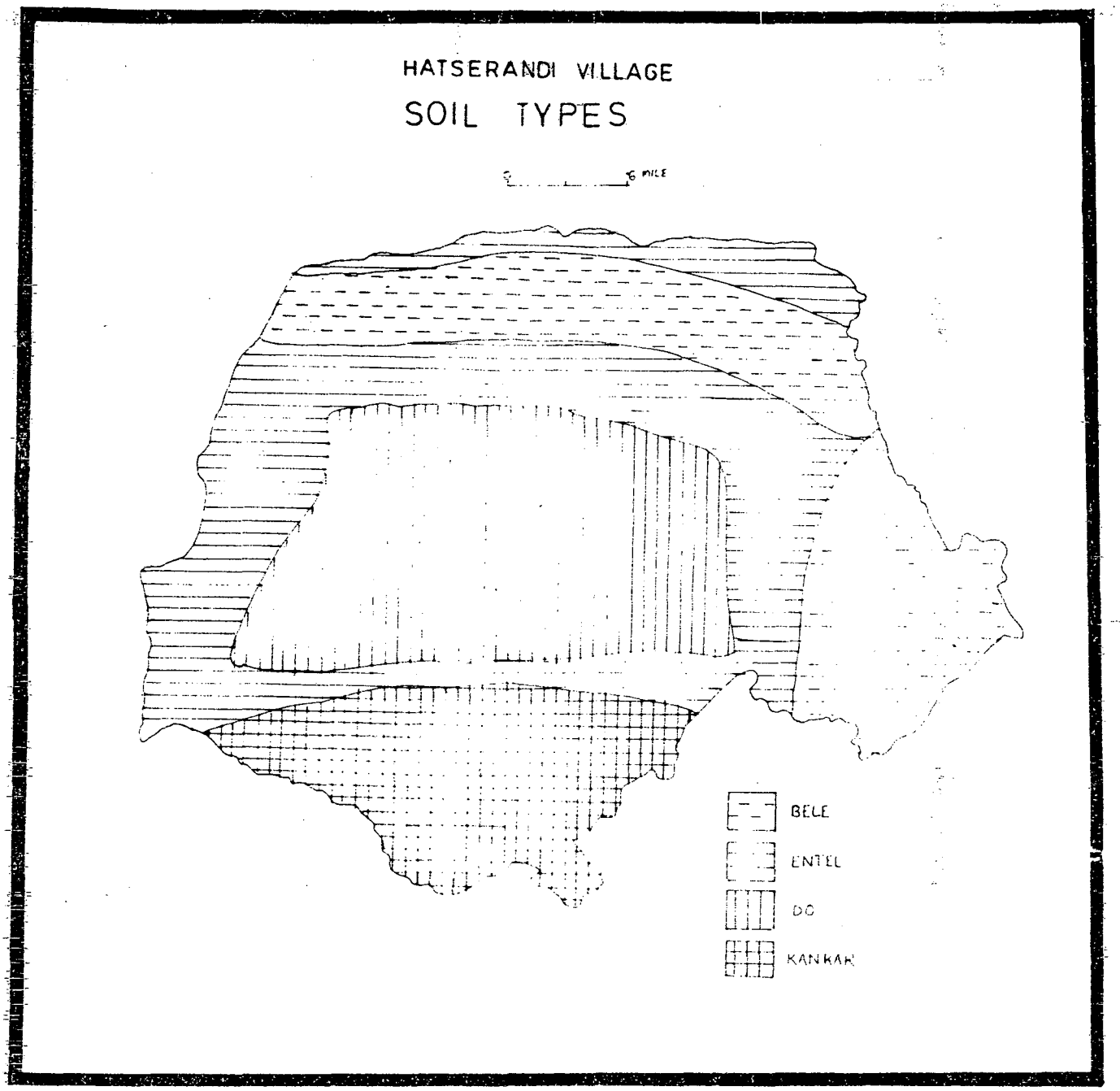

BALLABHPUR VILLAGE
SOIL TYPES
0
½ MILE
BELE
DO
KANKAR

SAHAJAPUR VILLAGE

SOIL TYPES




MULUK VILLAGE
SOIL TYPES
0
1 MILE
KANKAR
BELE
DO


HATSERANDI VILLAGE
SOIL TYPES
½ MILE
BELE
ENTEL
DO
KANKAR

soil is very sticky and the water storage capacity is high. "Bele" is friable and loose whitish soil, portion of sand is high in this soil. It is poor in fertility but can be used for growing paddy and some vegetables. It is not suitable for rabi cultivation. "Do" soil is blackish in colour and very rich in fertility, almost all crops can grow in this soil, one of the main constituent of this soil is clay. "Kankar" - it generally occupy highland areas of the district, these are reddish, friable lateritic soil. It is very poor type of soil, here crops like bajra, can grow and with the help of irrigation some rabi crops can be raised.

It is seen from the soil map of villages that village BAidyanathpur have mainly three types of soil these are "intel", "do" and "bele". A small portion of the village is covered by "kankar" soil. Khoskadampur village is also characterised by "intel", "do" and "bele" soils. Sahajapur village have mainly two types of soil "do" and "bele". Ballabhpur village is characterised by "do", "kankrili" and "bele" soil. Muluk village is also occupied by these same three kinds of soil. Village Hatserandi is characterised by four types of soil category - "bele", "intel", "do" and "kankrili". Occurrence of soil influence of wasteland in every village. Kankrili type of wastelands are found in those villages where "kankar" soil is present and "bele" wasteland is found in this particular type of

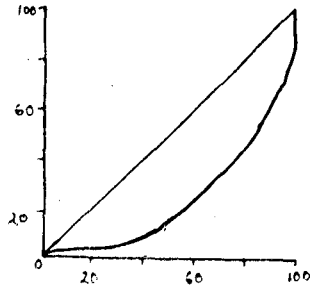
soil only. So it can be said that in the formation of wasteland in these villages soil plays an important role but with it some other responsible factors are also there for which these formations take place only in some patches.

Water resources: None of the village having river except the village Ballabhpur where Kopai river flows through the northern portion of the village. But there are seasonal drainage system in every village which flows temporarily by rain water. In two villages that is Baidyanathpur and hatserandi there are two "kandar" or "nalas" which are the main drainage system of these villages. Except the village Muluk canal is present in all other villages. Besides every village having tank and ponds. In case of the village Hatserandi here few tube wells are also present.

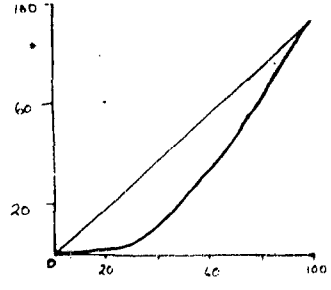
Land holding pattern: Ownership of land holding is one of the most important institutional factor which determines the economic condition of the villagers. In all the villages it is seen that distribution of land ownership show high inequality. In most of the villages best cultivable lands are in the had of rich persons and poor people have waste and unirrigated land. In some cases poor people work as labourer to the rich farmers and those who have small cultivable land they cannot properly utilise the land because of their poverty. This has also led to land going to the rich farmers. To

LORENZ CURVES SHOWING DISTRIBUTION OF LANDHOLDING PATTERN OF THE VILLAGES

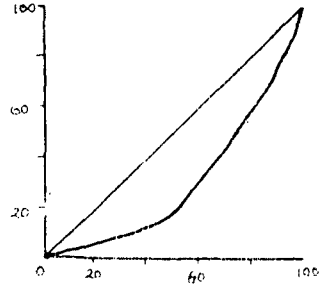
MULUK



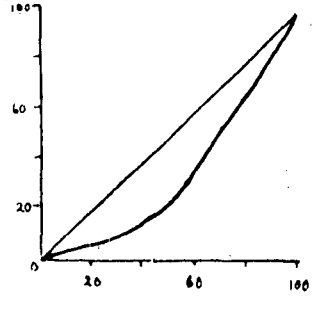
BAIDYANATHPUR



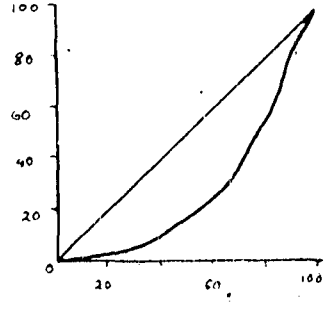
HATSERANDI



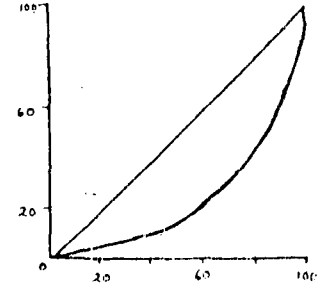
SAHAJAPUR



BALLABHPUR



KHOSKADAMPUR



see the extent of inequality in land holdings Lareng's curve of the six villages have been drawn. It shows that the maximum inequality is found in the village Khoskadampur whereas the minimum is in the village Baidyanathpur. In Ballabhpur and Muluk villages inequality in land holdings is again quite high but in the Hatserandi and Sahajapur villages it is comparatively low.

Choice of indicators: The nature of the factors responsible for the formation of wasteland in the selected villages has been studied. To know the influence of individual factor on wasteland, correlation coefficients have been computed taking wasteland and some environmental and anthropogenic factors as variables.

The indicators that has been chosen for present analysis are slope and mean annual rainfall as environmental parameters, land concentration and distance of the field from canal as anthropogenic parameter. Two types of wasteland available in the studied villages that is "Kankrili" and "bele" are the other variables.

Other parameters like drainage density could not be taken into account as most of the villages do not have river except one village that is Ballabhpur.

Informations on the behaviour of water table and thickness of the top soil was not available.

Methodology: In case of kankrili land six sample areas, having this type of wasteland has been taken from the sample villages. Sample area 1 is taken from the village Hatserandi, sample area 2 and 3 are from village Baidyanathpur. Sample area 4 is from village Muluk and sample area 5 and 6 are from village Ballabhpur. In case of "bele" land eight sample areas have been taken from the studied villages, sample area 1 has been taken from village hatserandi, sample area 2, 3, 4 and 5 has been taken from village Baidyanathpur, Khoskadampur, Sahajapur and Muluk respectively. Sample area 6, 7 and 8 has been taken from the village Ballabhpur. Percentage distribution of individual sample area to the total area of the respective villages has been computed. Slope analysis of each sample area has been calculated from village contour map this contour maps have been prepared by the geography department of Viswa-Bharati. To analyse slope Wentworth's formula has been used where

$$\text{slope} \Rightarrow \frac{\text{Number of contour cuttings per mile} \times \text{contour intervals}}{3361} = \tan\theta$$

In case of rainfall and land holding pattern values of mean annual rainfall and land concentration ratio of

each village has been taken. To know the land concentration Gini's coefficient has been computed using following formula

$$\text{Coefficient of variation} = \frac{\text{Standard Deviation} \times 100}{\text{mean}}$$

Distance of the canal from the sample areas has been measured. Thus type of wasteland has been taken as a variable (y) and other variables are slope (x1), mean annual rainfall (x2), land concentration ratio (x3) and distance of the field from the canal (x4).

Before computing correlation coefficient, variation in the distribution of individual factors in villages have been seen computing coefficient of variation, using the following formula

To know the relationship between dependent and independent variables Pearson's formula of correlation coefficient have been used, where

$$r = \frac{\Sigma xy - \frac{\Sigma x \cdot \Sigma y}{n}}{\sqrt{\Sigma x^2 - \frac{(\Sigma x)^2}{n}} \sqrt{\Sigma y^2 - \frac{(\Sigma y)^2}{n}}}$$

where r = correlation coefficient

x = Independent variable

y = Dependent variable

n = total number of observations.

Kankrili Land : Table No. 4.2

DISTRIBUTION OF VARIABLES

Sample Area No.	Area in Percent (Y)	Slope (X_1)	Mean Annual rain fall (in m.m.) (X_2)	Land concentration ratio (X_3)	Distance of The field From the Canal (in mile) (X_4)
1.	9.09	0° 1′ 22.8"	116.80	0.32	2.47
2.	2.65	0° 1′ 8.4"	130.75	0.33	0.42
3.	2.15	0° 3′ 25.2"	130.75	0.33	0.59
4.	39.06	0° 2′ 13.3"	130.75	0.46	----
5.	4.5	0° 3′ 32.4"	113.59	0.38	0.16
6.	1.28	0° 2′ 49.2"	113.59	0.38	0.06

Table No 4.2 shows that sample area 4 (village Muluk) has highest percentage of wasteland and lowest percentage is in sample area 6 (village Ballabhpur). Except in sample area 4 in all the sample villages the percentage of Kankrili land is less than ten percent. As far as slope is concerned it varies from 0.1′ 8.4" in sample area 2 to a highest is in sample area 5 (0.3′ 32.4"). In case of rainfall data as in each and every village, there is no rain gauge station so the rainfall data of the nearest village is taken into consideration. The mean annual rainfall varies from 113.59 m.m. to 130. 75 m.m. The lowest rainfall is received in sample area 6. Land concentration in general is high in all the

villages and it ranges from 0.46 in sample area 4 to 0.32 in sample area 1. Distance of the field from the canal is very high as 2.47 miles in sample area 1 to very low as 0.06 miles in sample area 6. In sample area 4 (Village Muluk) there is no canal. In every sample area except sample area no. 1 distance of the canal from the field is less than a mile.

Table No. 4.3

VARIATION IN DISTRIBUTION OF VARIABLES

Variables	Coefficient of variation
Y	149.24
X_1	42.5
X_2	7.24
X_3	14.4
X_4	133.7

where,

Y = Kankrili Land

X_1 = Slope

X_2 = Mean Annual Rainfall

X_3 = Land Concentration Ratio

X_4 = Distance of the field from the canal

Table no. 4.3 shows the coefficient of variation for the selected variables. Highest variation is noted for the distribution of Kankrili land and lowest is for

mean annual rainfall. Variation for land concentration is also very less. In case of slope it is moderate but distance of the field from the canal is showing high variation among the sample areas.

Table No. 4.4

CORRELATION BETWEEN KANKRILI LAND AND OTHER VARIABLES

Variables	Correlation Coefficient
$Y.X_1$	-0.176
$Y.X_2$	0.37
$Y.X_3$	0.86
$Y.X_4$	0.89

where, Y = Kankrili Land

X_1 = Slope

X_2 = Mean Annual Rainfall

X_3 = Land Concentration Ratio

X_4 = Distance of the Field from the Canal

The above results shows that in Kankrili land, the distance of the field from the canal plays a very important role. Slope is negatively correlated with the percentage distribution of this particular wasteland. It is important to mention that land concentration ratio is highly correlated with percentage distribution of wasteland which proves that the hypotheses is correct.

Genesis of Kankrili land: Though kankrili lands are generally found in all levels of elevation, low area highly suits the formation of this type of wasteland. Because in kankar formation leaching occurs and for that the terrain should have water holding capacity that is why minimum slope terrain play important role, because in sloppy terrain water goes off quickly. Sometimes it is seen that in low level areas origin of kankrili land is secondary, in that case debris of primary kankars gathered at lower elevations. As it is seen that there is almost no correlation between slope and kankrili land so it is possible that the origin of kankar in the study area is on the plateau tops of Chhotanagpur in the west. From the correlation values it is also seen that there is moderate degree of correlation between rainfall and kankrili land, According to d'Moore[1], water in some quantity is essential for kankrili land. As soon as this medium of transport is absent there will be no accumulation. So it can be said that even if the origin of kankar is secondary in nature but once it is there rainfall will accelerate its further development. It is seen that relationship of kankrili land with land concentration ratio is positive. It can be inferred from this that with the increase of land concentration the formation of kankrili type land also increases. Possible reason is higher the land concentration, large

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1. M.J. McFarlance, 1976; Laterite and Landscape; Academic Press; London.

portion of land will be owned by a few rich farmers. The large sized land holding farmers are least bothered to improve the fertility states of the soil because, on the one hand they are getting less output and, on the other, they have other better land for agricultural use. So they apply much input to good quality land only where they are sure of getting good profits. Thus due to the little attention paid to those lands there is an increase in the areal extent of these lands. The relationship between the distance of the field from the canal and kankrili land is highly positive. This shows that more the distance from the canal, more will be the area of wasteland. This is because to use kankrili land water is needed throughout the year, and as in this region distribution of rainfall is uneven in the year so to use this land irrigated water is needed. If the field is away from the canal fetching water will not be possible to use it, and it will remain only as wasteland.

Table No. 4.5

Bele land: DISTRIBUTION OF VARIABLES

Sample Area No.	Area in Percent (Y)	Slope (X_1)	Mean Annual rain fall (in m.m.) (X_2)	Land concentration ratio (X_3)	Distance of The field From the Canal (in mile) (X_4)
1.	14.90	0° 1′ 22.8"	116.80	0.32	0.99
2.	15.85	0° 2′ 42"	130.75	0.33	0.40
3.	11.65	0° 2′ 6"	130.75	0.48	0.83
4.	24.20	0° 1′ 12"	130.75	0.46	----
5.	7.82	0° 0′ 39.6"	69.59	0.31	0.40
6.	1.33	0° 1′ 22.8"	113.59	0.38	0.33
7.	4.26	0° 0′ 39.6"	113.59	0.38	0.33
8.	1.83	0° 2′ 49.2"	113.59	0.38	0.36

The above table shows the percentage of the area of Bele land and slope of those sample areas, how far these sample areas are situated from the canal, the amount of rainfall and canal concentration ration in the villages of individual sample area. From the above table it is observed that sample area 4 (Muluk village) have highest proportion (24.2%) of Bele wasteland and sample area 6 that is in village Ballabhpur have lowest percentage of this wasteland (1.33%). Proportion of

wasteland is high in sample areas 1,2 and 3,4 but in 5,6,7 and 8 it is less than 10 percent. As far as slope is concerned it varies from a lowest of 0^{o} 0′ 39.6" in sample area 5 and 7 to a highest in sample area 8 (0^{o} 2′ 49.2"). Rainfall variations are not much as raingauge stations are not available in each and every village so this data of nearest village has been taken into consideration. The mean annual rainfall varies from 130.75 m.m. to 69.59 m.m. the lowest is found in sample area 5 (village Sahajapur). Land concentration ratio varies from a highest of 0.48 to a lowest of 0.31. Highest is found in sample area 3 that is in village Khaskadampur and lowest is in sample area 5 that is village Sahjapur. Distance of the field from the canal varies from 0.99 mile in sample area 1 to a lowest of

Table No. 4.6

VARIATION IN DISTRIBUTION OF VARIABLES

Variables	Coefficient of variation
Y	76.64
X_1	50.0
X_2	17.45
X_3	16.57
X_4	52.30

where, Y = Bele Land

X_1 = Slope

X_2 = Mean Annual Rainfall

X_3 = Land Concentration Ratio

X_4 = Distance of the Field from the Canal

0.4 mile in sample area 5. Sample area 4 does not have this data as there is no canal is present in this village.

The above table shows the coefficient of variation for the selected variables. Highest variations are noted in the distribution of Bele type of wasteland and lowest is in the case of land concentration. In case of slope and distance of the field from the canal the variation among the sample areas are moderate.

Table No. 4.7

CORRELATION BETWEEN BELE LAND AND OTHER VARIABLES

Variables	Correlation Coefficient
$Y.X_1$	0.161
$Y.X_2$	0.432
$Y.X_3$	0.249
$Y.X_4$	0.652

where, Y = Bele Land

X_1 = Slope

X_2 = Mean Annual Rainfall

X_3 = Land Concentration Ratio

X_4 = Distance of the Field from the Canal

The above table shows that only distance of the field from the canal is moderately correlated with the percentage distribution of this Bele type of wasteland. Other variables like slope, land concentration ratio and mean annual rainfall show insignificant relationship with this particular type of wasteland.

Genesis of bele land: Bele lands are those lands where amount of sand in the soil is more than 80 percent. So components of soil are more important in the formation of this land. it is evident from the result of correlation that among the all variables Bele land is moderately correlated only with the distance of the field from the canal. So it can be said these indicators are not responsible for the formation of bele land. But as this land and distance of the field from the canal are moderately correlated so it can be said that if this wasteland gets more irrigated water, it can be used for beneficial purposes, so water is needed for its proper management.

Remedial measures : As Kankrili lands are not suitable for cultivations planting of trees for fuel and timber and orchards can be practiced. It is necessary to distribute the land in the villages evenly so that all the land come under one or other utilisation. Because

if everybody have almost same amount of land they will try to use the full amount. For Bele wasteland as it is seen that it is positively correlated with distance of the canal so it can be said that water is needed to practice agriculture in this land. This type of wasteland can also be converted into pastures.

The above discussion shows that the soil in the villages varies considerably. It is seen that highest rainfall occurs in pre-kharif season. Rabi is the least rainfall season. All the villages have canal irrigation except Muluk village, land concentration is high in this villages.

Taking slope, rainfall, land concentration and position of the canal as environmental and anthropogenic variables and two types of wasteland available in these villages as other variables, correlation shows that the formation of Kankrili land to some extent depends upon the rainfall of the region, uneven distribution of land holdings and long distance from the canal. It is seen that above mentioned variables do not show much relationship with the occurrence of Bele type of wasteland. But distance of the canal from the field of Bele land to some extent influence its formation. Possible utilisation that can be suggested for timbers or orchards as this land is not suitable for cultivation

and in case of Bele land it can be used for grazing purposes.

CHAPTER V

SUMMARY OF CONCLUSION

Study on wasteland is very important for a country like India because of high population pressure. In India, population grew by 24.8 percent during 1971-81 whereas the food grain growth was only by 19.8 percent. In order to meet increasing food grain demand, there is need to use unutilised land in our country. Land is needed not only for cultivation but also for settlement, forest and for many other purposes. Wasteland is a type of unused land which can be put to use for many purposes through proper management. In order to reclaim a wasteland information about its genesis is very essential. It is only then that remedial measures can be suggested.

Considering the importance of wasteland, an attempt has been made in the present study, to throw some light on the genesis and characteristics of waste land. The present study mainly focuses on Birbhum district of West Bengal. Six villages have been selected from the district for detail study of two types of waste land i.e. "Kankrili" and "Bele".

Genesis of waste land in a region is influenced by the environmental factors. Study of the environment of Birbhum district shows that undulating topography in

its western part leads to the valuations in slope and relief values whereas the other parts of the district have less variation because of plain nature of topography. Drainage density of the district is very less with almost no variation except in the north-western part where it is more due to the presence of foot hills of Chhotanagpur plateau. It is seen in the Bakereswar river basin area that stream number and stream length decreases with the increase in stream order, it is because due to the plain nature of topography lower order streams are more in length. Variations in bifurcation ratio are more in the basin area which shows that the climatic and tectonic conditions of the region play an important role. Climate of the district is characterised by hot summer, high humidity and well distributed rainfall throughout the monsoon season. Mainly five types of soil are found in the district. These are lateritic soil, red soil, gondwana alluvium, gangetic alluvium and vindhyan alluvium. The distribution of soils affect the land use of the region. Vegetation of the district can be divided into two groups according to the two broad divisions in topography. One is in western hilly region which is characterised by semi-arid type of vegetation and another is found in eastern plain land and is characterised by tropical dry deciduous types. Thus, each environmental elements of the district are inter linked and these influence each other which

ultimately influence the land use of the district.

In spite of physiographic limitations, the land use in the district is mainly dominated by agriculture. Nearly 68.18 percent of total area is under cultivation and main crop grown is paddy. Every police station in this district has some land recorded as wasteland. There is a need to bring this land under use due to high population pressure, demand of food grain, demand of land for settlements, forest and other uses. There is a need to know the factors of genesis of wasteland to bring wasteland under use. A micro level study is needed for this. Occurrence of wasteland has been studied in six sample villages which are characterised by two types of waste lands "Kankrili" and "Bele". Kankrili lands are those lands found on lateritic soil where concretion takes place and kankars are visible on the surface. "Bele" are those lands which are mainly sandy in nature.

Some possible factors have been chosen to know the genesis of these wastelands in Birbhum district. These are slope of the area, rainfall distribution the distance of each sample area of wasteland from the canal and distribution of land holding pattern of the villages. Correlations have been computed to assess the extent of influence of each factor and it is seen from the correlation values that land concentration is

highly positively correlated with the distribution of "kankrili" wasteland whereas rainfall and the distance of canal are moderately correlated with its distribution. These three factors play some role in the formation of "kankrili". It has been seen that "Bele" wasteland is only correlated with the distance of the canal. It can be implied that water is very much needed to reclaim "Bele" land and grazing can also be practiced on these wastelands. As again this the "Kankrili" land is not suitable for cultivation. Thus, it can be put to other uses like for settlements, industry or forest.

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