Land capability Classification of Purba Medinipur district, W.B.: A Geographical Case study

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Abstract

Land capability classification is a process of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without weakening over a long period of time. It is a scientific appraisal of physical characters of the land, inherent soil quality and management practices. This paper is an attempt to assess the land capability classification and relationship between agro-economic developments of Purba Medinipur district, West Bengal. Present study has been applying for measured the land capability classification of the Purba Medinipur district by method on the basis of V.R. Singh (1970). There are represent of positive factors as rainfall, soil fertility and irrigation facility and represent of negative factors as ruggedness number, soil erosion, water logging, forest density, drought, higher degree of slope and flood. With the help of Lorenz Curve, it has been found that Purba Medinipur district contains large area and low land capability in comparison with the coastal plains of West Bengal. The results of this research are going to provide reference for land capability region and management in this area.

Keyword: Land capability, Agro-economic developments, Lorenz Curve, Ruggedness number, water logging.

Introduction

Land capability classification is an implement for interpretative grouping and grading of soils according to their potentialities and limitations. Land capability is the natural environmental ability of the land to preserve a range of land uses and management practices in the long term without degradation to soil, land, air and water resources[3]. Land capability not only depends upon the geomorphic parameters, soil fertility etc, but also upon technological inputs and management practices. Land capability is measurement basis on the biological characteristics of the land, the level to which this will limit a particular type of land use, and the present technology that is accessible for the management of the land. It provides in sequence on the broad agricultural land uses most physically appropriate to an area, that is, the uses with the best match between the physical rations of the use and the physical qualities of the land, and the potential hazards and limitations associated with specific uses over a site. It can provide guidance on the inputs and management necessities associated with different intensities of agricultural land use. Using land beyond its capability may have serious consequences for the land and soil resources of the State as well as broader environmental impacts on water, air and biodiversity. Impacts can include loss of valuable soils on agricultural land, soil acidification, structure decline, soil carbon decline and wind erosion leading to poor air quality. All these are general indications of land degradation. The risk of land degradation and the need to deal with land within its capability has been recognized at the federal level[4-6] and at the State level by the

NSW Natural Resources Commission. Land management within capability is listed as one of 13 key natural resource management targets for NSW[7], by 2015, there will be an increase in the area of land being managed within its capability. Land capability in one hand helps to find out efficiency of land for particular uses and on the other it helps to prevent improper use of land which leads erosion hazards and decline of land quality. Land capability classification enables the farmers to use the appropriately for sustainable production under required management measures.

Study area: The district of Purba Medinipur is a typical representative of an area having various types of resource but suffering from underdevelopment. The following account of the resources of the district provides an ample evidence of backwardness in resource richness. The undivided Medinipur has been divided into paschim Mednipur and became a district under Purba Medinipur division on 2002. The funnel-shaped district, with its eastern part penetrating into Bay of Bengal lies between lat 21° 36' 35"N to 22° 02' 23"N and long 87° 22' 48"E to 88° 01' 12"E. The district is well connected by Kolkata, Bhuneshwar, Ranchi, Bankura, Burdwan by a network of roads and railway. It is also only about 75 km away from Hoogly estuary.

Physiographically district lies in the plain area having slope towards east. The eastern part of district is bounded by Bay of Bengal, Howrah district in the North West Medinipur in the west, and south 24 Parganas in the east. Spreading over an area

of 4093.94 km^2, it consists of 3028 Mauza, 223 Gram panchayat, 25 CD Blocks, 4 Subdivision and inhabitated by 5095875, the district has density of 1186 person per km^2 .

Material and Methods

Land Capability Classification necessary for the planning of agricultural development. Land use capability classification[8] has been developed with an objective to discuss the site, soil and climate on farming. Sharma[9] defined the land capability classification as "a field investigation of soil properties, slope, degree of soil erosion and changing land use patterns which form the basis for future planning of soil and water conservation".

There are several methods commonly used for the rating the land capability classification such as Marbut's[10] method is based of statistical information on yield history of the particular piece of land, Morgan's[11] explain the degree of adaptation of land types of various crop, Bennett's[12] method establish on the site and physical land factors. V.R. Singh's[13] method the land capability classes should be determined with the help of physical and economic factors i.e., physiography, soil fertility. Other method are also land capability classification of the Bureau of Reclamation; L. D. Stamp's land classification in Britain; land classification of U.S.S.R.; Land capability classification by A.I.S.L.S.O., I.C.A.R. etc.
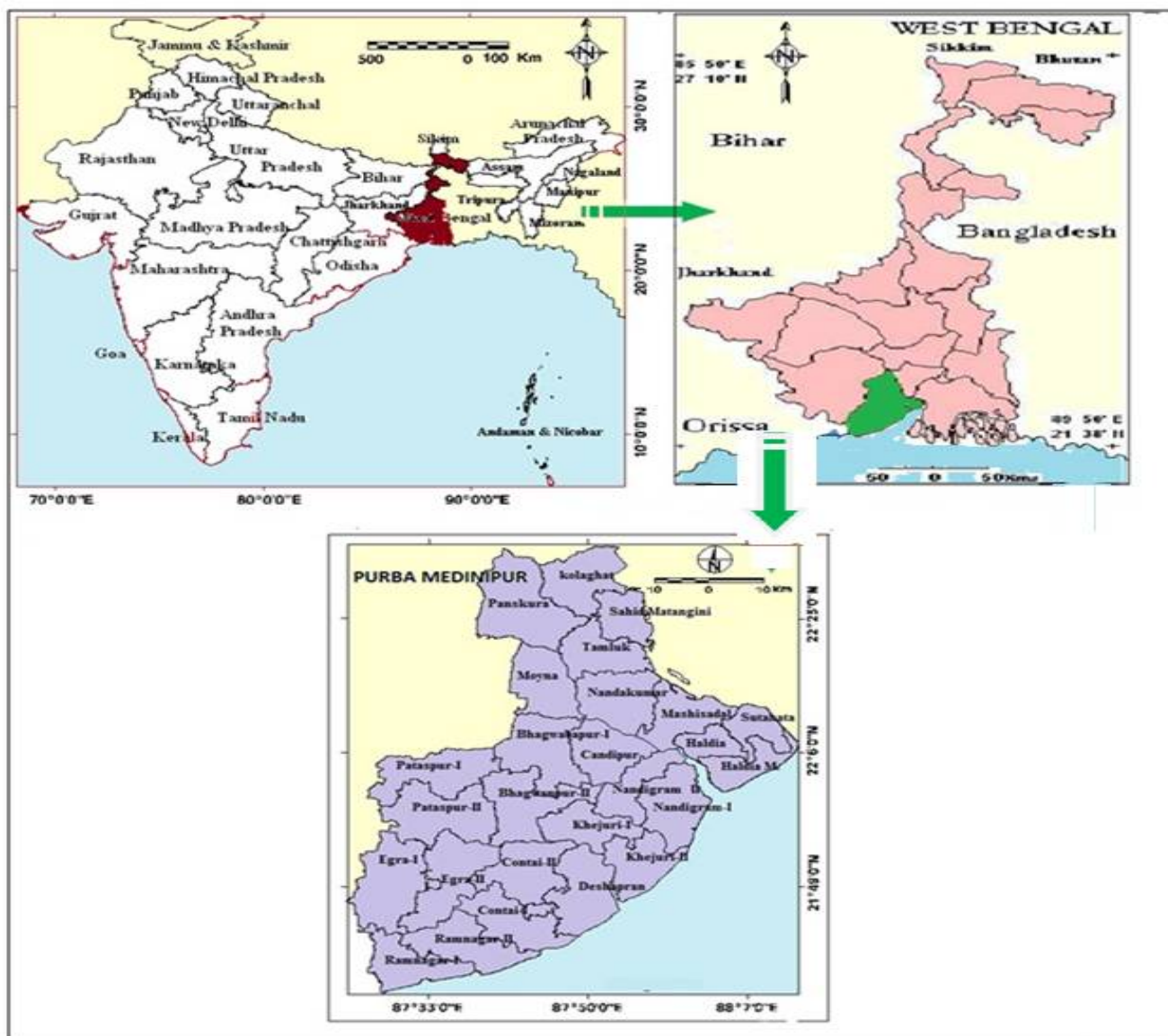

Figure-1
Location map of Study area

Present study has been applying for measured the land capability classification of the Purba Medinipur district by method on the basis of V.R. Singh[13]. In this method is below:

$$\text{Land Capability Index (LCI)} = \frac{\left(\sum_{i=1}^{n} \frac{R_1 + S_2 + I_3 + \cdots\cdots\cdots\cdots Qn}{\sum PFV} \times 100\right)}{\left(\sum_{i=1}^{n} \frac{Rn_1 + Se_2 + W_3 + \cdots\cdots\cdots\cdots Qn}{\sum NFV} \times 100\right)}$$

Where, LIC = Land capability index, PFV = Positive factors values, NFV = Negative factors values, R, S, I = Rainfall, soil fertility and Irrigation facility represent as positive factors, R_n, S_e, W, F, D, H and T = Ruggedness number, soil erosion, water logging, forest density, drought, higher degree of slope and flood represent as negative factors of land capability.

Discussion and Results

Land capability classifications are indicated by the some physical and socio-economic parameters. The Purba Medinipur district of West Bengal has the highly agricultural fertility soil on over the entire district. As with all interpretive groupings the capability classification begins with the individual soil-mapping units i.e. soil structure, soil texture, soil pH, soil organic matter etc, which are building stones of the system (table-1). Present study the land capability classification are measurement by the micro level field study, there are data collection from the twenty five blocks on the basis of random sampling method. This survey data are tabulated on the basis of V.R. Singh method and calculate the gross Positive factors values, gross of Negative factors values and finally calculate the land capability index. There are represent the relationship between the Land Capability with Net Sown area by the scatter diagram. The preparation of Lorenz Curve the cumulative percentage of land capability on X axis and cumulative percentage of net area sown area on Y axis of different block has been used. There are analysis the help of Lorenz Curve, it has been found that Purba Medinipur district contains large area and low land capability in comparison with the coastal plains of West Bengal.

There is land capability classification measurement by the some positive factors i.e. rainfall, soil fertility and irrigation facility and negative factors like ruggedness number, soil erosion, water logging, forest density, drought, higher degree of slope and flood.
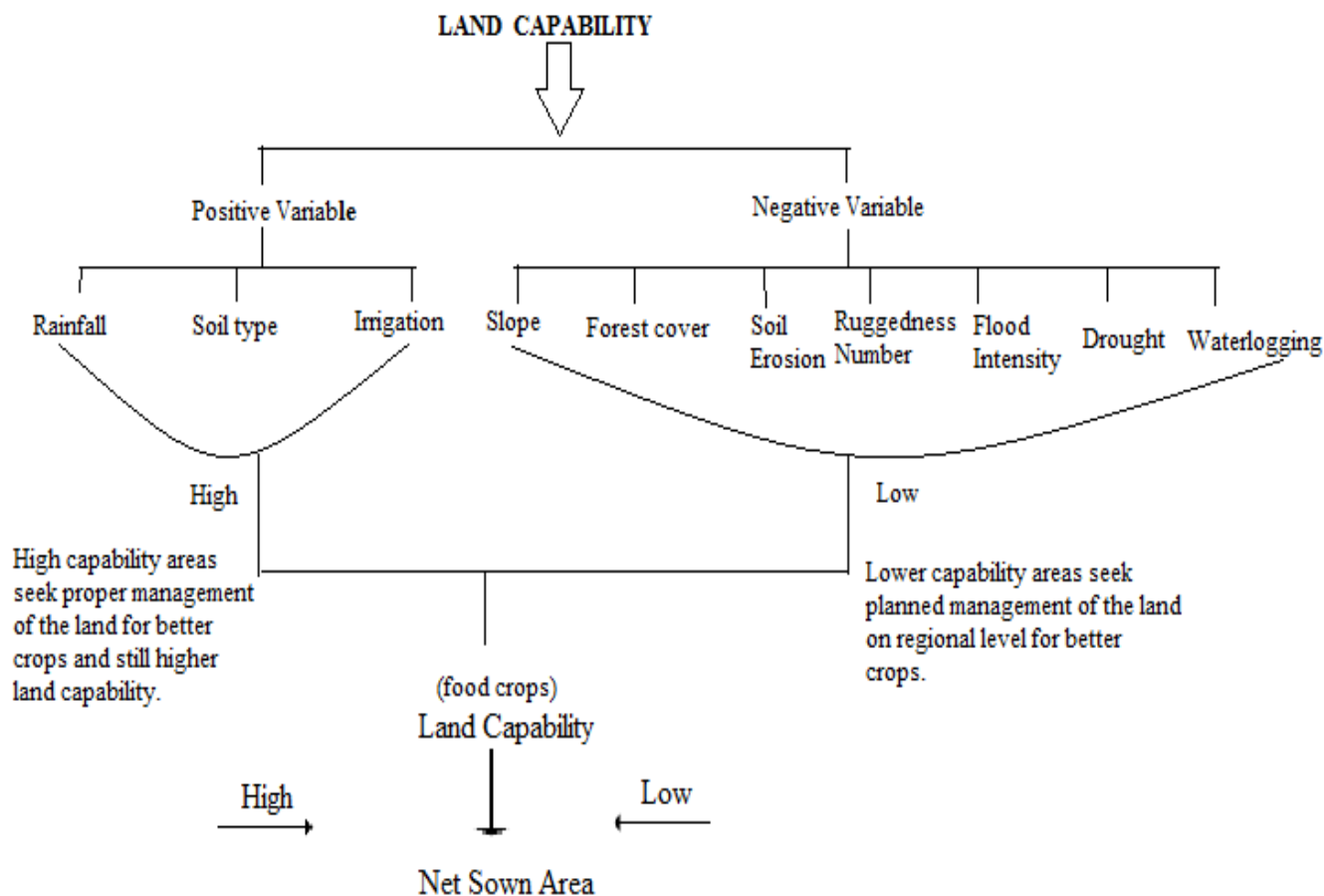

Figure-2
Factors affecting of land capability

Table-1
Land Capability Index of Purba Medinipr district

Block	Positive Index Value ($\sum PFV$)	Negative Index Value ($\sum NFV$)	Land Capability Index (LIC)	Percentage of Net sown area to total area
Tamluk	75	45	1.66	2.51
Sahid Matangini	75	50	1.50	2.24
Panskura-I	75	45	1.66	5.84
Kolaghat	75	45	1.66	3.92
Moyna	60	45	1.33	4.03
Nandakumar	60	50	1.20	4.36
Chandipur	60	45	1.33	3.62
Mahishadal	60	45	1.33	3.25
Nandigram-I	50	45	1.11	4.528
Nandigram-II	50	50	1.00	2.86
Sutahata	50	45	1.11	2.00
Haldia	50	45	1.11	1.78
Potashpur-I	45	50	0.90	4.69
Potashpur-II	45	50	0.90	5.14
Bhagawanpur-I	55	50	1.10	5.04
Egra-I	55	65	0.84	5.90
Egra-II	55	65	0.84	5.14
Khejuri-I	50	65	0.76	3.43
Khejuri-II	50	60	0.83	3.81
Bhagawanpur-II	50	65	0.76	5.13
Ramnagar-I	55	35	1.57	3.25
Ramnagar-II	55	40	1.37	3.91
Contai-I	55	35	1.57	4.15
Deshapran	55	40	1.37	4.71
Contai-III	55	35	1.57	4.62

Sources: Authors survey
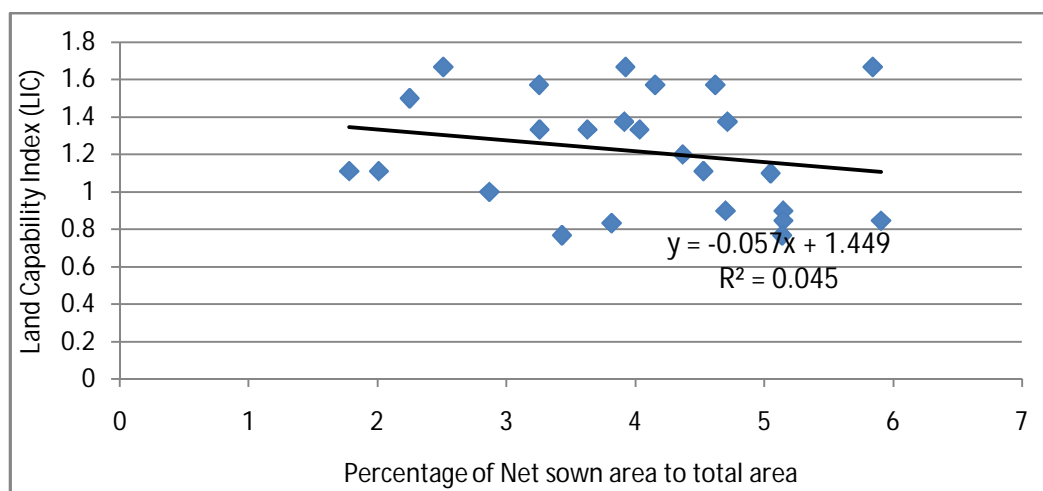

$y = -0.057x + 1.449$
$R^2 = 0.045$

Figure-3
Relationship between Land Capability with Net Sown area

In the evident from table-1 and figure-2 that relationship between land capabilities index in relation to net sown area. A product moment coefficient of correlation has been estimated which comes to r=0.045. This along significant the relationship of the capability index and the net sown area available in the region. For these two components of land use the regression value comes to y=0.057× + 1.449. In this way, it can be said that the intensity of net sown area is the real indicator of the potentialities of land capability in a region.

Aft rewards Lorenz Curve has been used to measured the dispersion of land use capability index in different block of Purba Medinipur district, west Bengal. This graphical method has merit to illustrate the line of equal distribution of land capability in relation to the actual dispersion. For the preparation of Lorenz Curve the cumulative percentage of land capability on x axis and cumulative percentage of net area sown area of different block has been used.

With the help of Lorenz Curve, it has been found that Purba Medinipur district contains large area and low land capability in comparison with the coastal plains of West Bengal.

Land capability region of Purba Medinipur district: In the evident from table-2 a map of land capability region in Purba Medinipur district has been prepared. The categories of coloring has been chosen on the basis of the 'Semi Inter Quartile Range' principle of statistics, which has been divided a set of data into four sub-group.in this way, the district of Purba Medinipur has been divided into four categories of land capability regions.

Table-2
Cumulative percentage of Land capability and net sown area in Purba Medinipur district

| Block	Cumulative Percentage (X)	Percentage of land Capability index	Cumulative percentage of land capability index
Tamluk	3.43	5.471349	2.525238
Sahid Matangini	8.56	4.924213	5.050476
Panskura-I	12.37	5.471349	7.786149
Kolaghat	18.27	5.471349	10.56391
Moyna	23.41	4.377077	13.34167
Nandakumar	28.1	3.93937	16.2962
Chandipur	33.24	4.377077	19.25073
Mahishadal	36.1	4.377077	22.53354
Nandigram-I	41.14	3.647565	26.14463
Nandigram-II	45.66	3.282809	29.79219
Sutahata	47.66	3.647565	33.43976
Haldia	49.44	3.647565	37.08732
Potashpur-I	53.8	2.954528	41.02669
Potashpur-II	57.83	2.954528	45.40377
Bhagawanpur-I	61.45	3.61109	49.78085
Egra-I	64.7	2.777762	54.15792
Egra-II	68.61	2.777762	58.67179
Khejuri-I	73.32	2.525238	63.18565
Khejuri-II	75.56	2.735673	68.10986
Bhagawanpur-II	78.81	2.525238	73.26856
Ramnagar-I	82.96	5.158701	78.42726
Ramnagar-II	87.58	4.513862	83.58596
Contai-I	90.09	5.158701	89.05731
Deshapran	96.08	4.513862	94.52866
Contai-III	100	5.158701	100
Source: Compiled by the Author			
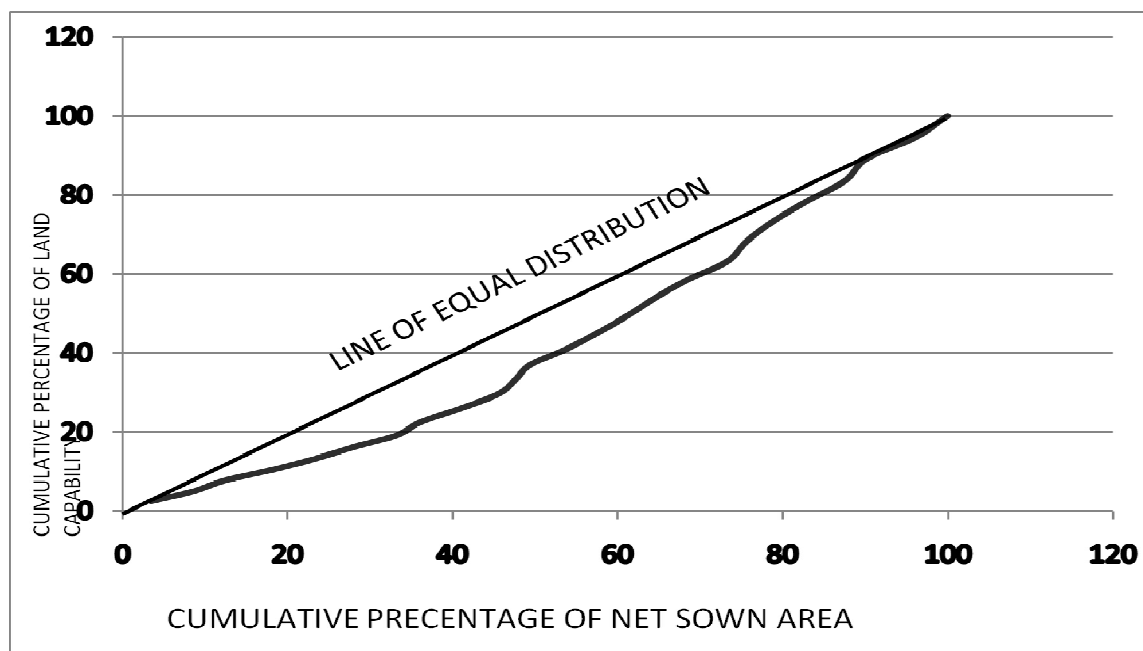
Figure-4
Dispersion of land capability on Lorenz curve

Table-3
Block wise regional distribution of land capability in Purba Medinipur district,

Grades	Value Extension of land capability	Categories of Blocks
High land capability area	>1.44	Panskura-I, Kolaghat Sahid Matangini, Tamluk, Ramnagar-I Contai-I Contai-III
Medium land capability area:	1.22-1.44	Moyna, Chandipur Mahishadal Ramnagar-II Deshapran
Low land capability area	1.00-1.22	Nandakumar, Nandigram-II Nandigram-I Sutahata Haldia Bhagawanpur-I
Very low land capability area	<1	Potashpur-I, Potashpur-II Khejuri-II Bhagawanpur-II Egra-I Egra-II Khejuri-I

Source: Compiled by the Author

Region of highest land capability index: The blocks having more than 1.44 land capability index (LCI) come under this categories of region. It comprises the block of Panskura-I, Kolaghat Sahid Matangini, Tamluk, Ramnagar-I Contai-I and Contai-III. In these blocks factors like rainfall and soil fertility for raising better crops supported by artificial irrigation facility keep the capability of the land highest and the positive factors predominate in comparison with the negative factors.

Region of medium land capability index: This categories land capability index range value is 1.22-1.44. It comprises the blocks of Moyna, Chandipur, Mahishadal, Ramnagar-II and Deshapran. Here the land capability is medium due to positive factors and negative factors have been equal effective to the measurement of land capability.

Region of moderate land capability index: All the blocks having partly rugged terrain and partly plain come under this group and land capability index value range from 1.00 to 1.22. this categories included the blocks are Nandakumar, Nandigram-II Nandigram-I Sutahata Haldia Bhagawanpur-I. In the above areas the limiting factors are rugged forested terrain, inferior qualitility of soil, etc. only hard labour and huge capital investment can raise their capability index, which requires fertilizer, and the protection from the hazarded of soil erosion.

Region of low land capability index: Under this categories have land capability index value range less than 1.00 which includes the blocks of Potashpur-I, Potashpur-II Khejuri-II Bhagawanpur-II Egra-I Egra-II and Khejuri-I. In these areas the negative factors are high affected and positive factors are low affected for the land capability determination and for this reason

these areas have lowest land capability index in Purba Medinipur district.

Conclusion

At the conclusion, it can be safely stated that the term 'Land capability' is contemplated here as the scientific evaluation of the physical factors in attractive the net sown area of Purba Medinipur district in West Bengal. The product moment coefficient of correlation is high for land capability and net sown area, which suggest that land should be properly managed for booting up the production from the land. Such measurement is also necessary for the farm planning on regional level to credit the regional imbalance of agricultural growth. The result obtained for particular land use, land capability required and copping pattern sets out a very interesting picture. In this way, on Lorenz Curve the dispersion of land capability is also shown which represents the division from the line of equal distribution. This study has also a advantage to help in agricultural planning and guiding for the better land use, in a exacting capability class zone.
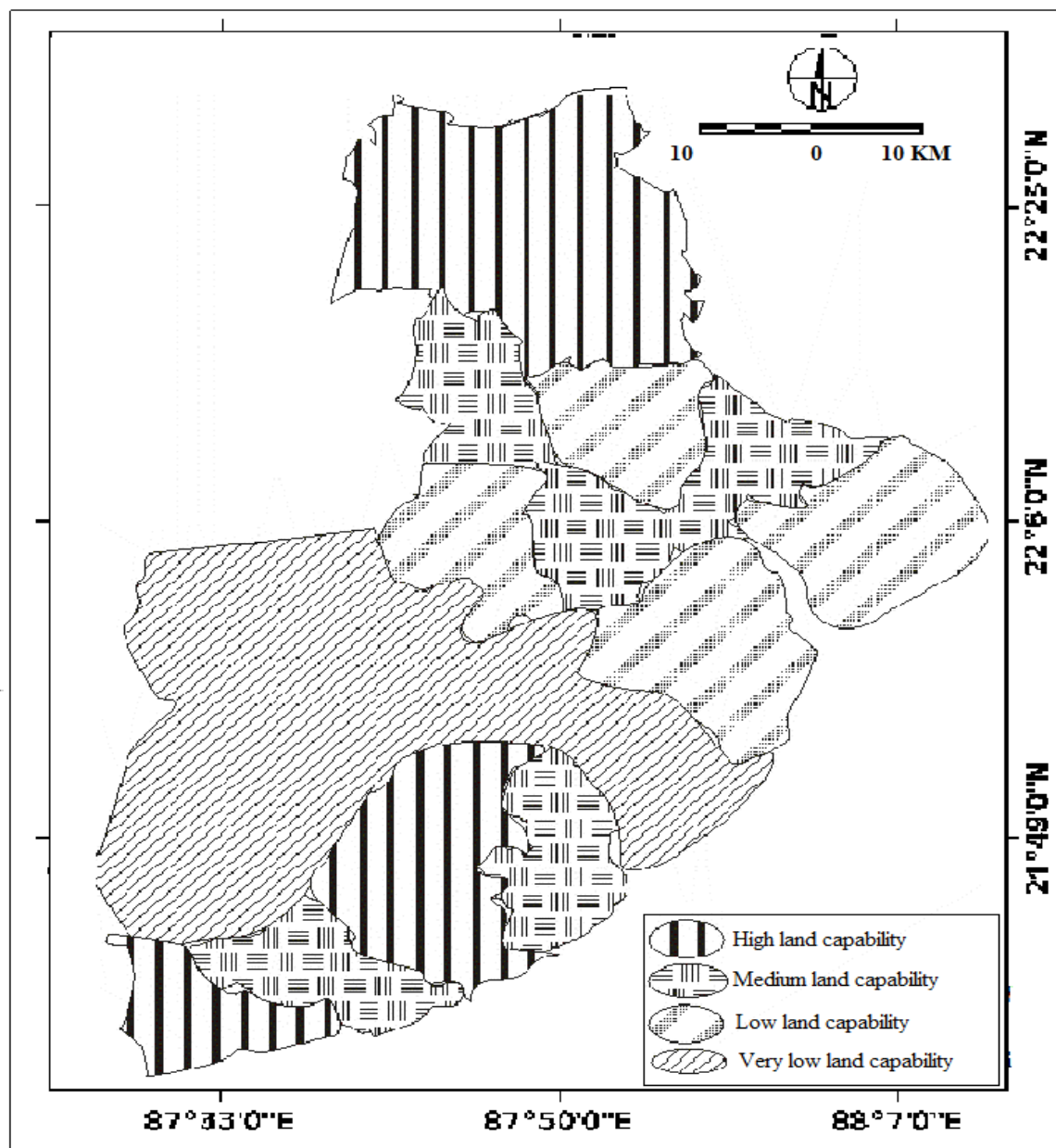

Figure-5
Land capability region of Purba Medinipur district

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