

MEASURING LAND POTENTIALS IN SOUTH-WESTERN MIDNAPORE, WEST BENGAL

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ABSTRACT : It the present juncture of increasing population especially in the developing countries there is an urgent need to extend the exploitation of land resources to obtain maximum return as well as to ensure the productive capacity of land. This, however, can rapidly be attained by the proper assessment and improvement of the use of land. The objective of the present work is to collect a detailed information about the study area and to classify the concerned area on the basis of land potential characteristics.

INTRODUCTION

In assessing land potentials it is necessary to understand the meaning of land in its proper perspective as well as in a wider sense.

Land is the basic natural resource. It is the man's habitat and living space.

In an ecological sense, land can be considered as a renewable resource. Crops, for example, can be cultivated from the same land year after year if the quality of land is maintained in a proper/rational manner. Like water-power, wind and solar energy, land is also treated as a resource. On the other hand, the meaning of land in the sense of space is rather different. The land surface of the earth is of finite and limited extent. So, land as space in some respects resembles a non-renewable/stock/fund resource like coal or oil (Mather, 1986).

From the spatial viewpoint it may be mentioned that land is not exhausted. Land qualities (ecological land condition) indicate the direct relationship between the land (as an ecological complex) and the biological as well as

technological activities of landuse. These land qualities are very much relevant in determining the use of land in a prevailing natural conditions (Vink, 1975).

For the determination of land suitability for landuse as well as for land improvement, a systematic land evaluation is necessary. Land evaluation may be defined as the process of collating and interpreting basic inventories of soil, climate, vegetation and some other aspects of land in socio-economic terms. Land evaluation can assimilate the physical, biological and technological aspects. For socio-economic purposes, it is the utilisation of socio-economic parameters in evaluating physical data.

Land suitability is thus the fitness of a given tract of land for a definite use. It is better to mention in this context that there is a difference between land potentiality and land suitability. Land potentiality means the inherent land qualities whereas land suitability refers to fitness of land to particular uses. A potential

land, however, may not be suitable due to adverse environmental situation but a suitable land may have the potential (De, Ghosh & Jana, 1994).

OBJECTIVES OF THE PRESENT WORK

The land is considered as an important resource. As assessment and improvement of the use of land are essential to any significant increase in food supply in developing countries of the world, in the present changing economic situation there is an urgent need to extend and improve the exploitation of land resources to obtain the maximum return (i.e. crops, livestock, timber) as well as to ensure the productive capacity of the land. This however, can rapidly be attained with emphasis on the developmental planning and the implementation of plans after the initial classification of land on the basis of Geomorphological attributes which are directly related to their ecological set up.

The objective of the present work is to collect detailed information about the study area and to classify the areas under consideration based on land potential characteristics. Keeping these aspects in mind a case study has been made of S.W. Midnapore, w. Bengal.

STUDY AREA

The south western part of Midnapore district includes Gopiballavpur, Nayagram, Sankrail, Keshiary, Belda and Dantan police stations. Extending latitudinally from 21° 46' N to 22° 24' N and longitudinally from 86° 43' E to 87° 32' E it comprises an area of about 2191 sq. km. (Map No 1).

Geographically, the area lies within the transitional zone between the Western Chotonagpur plateau projection and the eastern Gangetic alluvial plain. The important characteristic formation is the laterite. The majority of the area (Gopiballavpur, Nayagam,

Sankrail, Keshiary) shows beds of gravels, grits, and sands of tertiary age. The surface appears to be pisolitic, gravelly and nodular. While Belda and Danta P.S. reflect their alluvial nature.

Topographically the relief here varies from moderate to gently undulating (N-W part) to almost plain (S-E part).

The north western boundary is more broken and picturesque in appearance. The general slope is from N-W to South and S-E.

The Subarnarekha (golden-streaked) is the principal river of the area under study. It flows through a broad floodplain with a zig-zag direction in a slightly intrenched course. The banks are generally high and well-defined. The cross profile of the valley is asymmetrical with a steeper slope towards the south west. The course of Dulung (a tributary of the Subarnarekha) is prolonged downstream parallel with the main river. In rainy season the river overflows its left bank about six kilometers and thereby causes flood alluviation. Near Dantan the river flows through a comparatively narrow channel. This causes extensive overflow along the eastern bank of the river during flood. In summer season the river dwindles into a narrow and shallow stream (Chakraborty, 1961).

As a whole the area has a modified tropical monsoon climate. It is transitional between the types of the Chotonagpur plateau and lower Gangetic plain. High temperature and seasonal rainfall with cyclonic disturbances are the notable features. The mean temperature varies from 12.5° c to 14° c (from north west to south east) in January, whereas from 37.5 c to 38.5 c (from south east to north west) in May.

Rainfall is erratic and irregular in nature. Average annual rainfall varies between 1400 mm. and 1600 mm. Consequently, flood occurs

when the precipitation is high in a short period and drought occurs due to scanty rainfall over a longer period.

Laterisation is the predominant process of soil formation in major parts of the area. Lateritic and red soil which developed on laterite and granite-gneissic parent material have occupied the major part of the area. Likewise alluvial soil develops on alluvium in some parts. The development of these soils is the results of climate and parent material (Bandopadhyay, 1974).

The major part of the area possesses a flora closely approximate to that of Chotonagpur. Some parts contain jungles of small sal, kusum, piasal, Bamboo, Mango etc.

DATA BASE AND METHODOLOGY

In the present context both primary and secondary data have been used. More emphasis has been given on the study of pedogeomorphic limitations of terrain in the light of land complex approach for the categorisation of land order. This evaluation is necessary for the future land planning purposes.

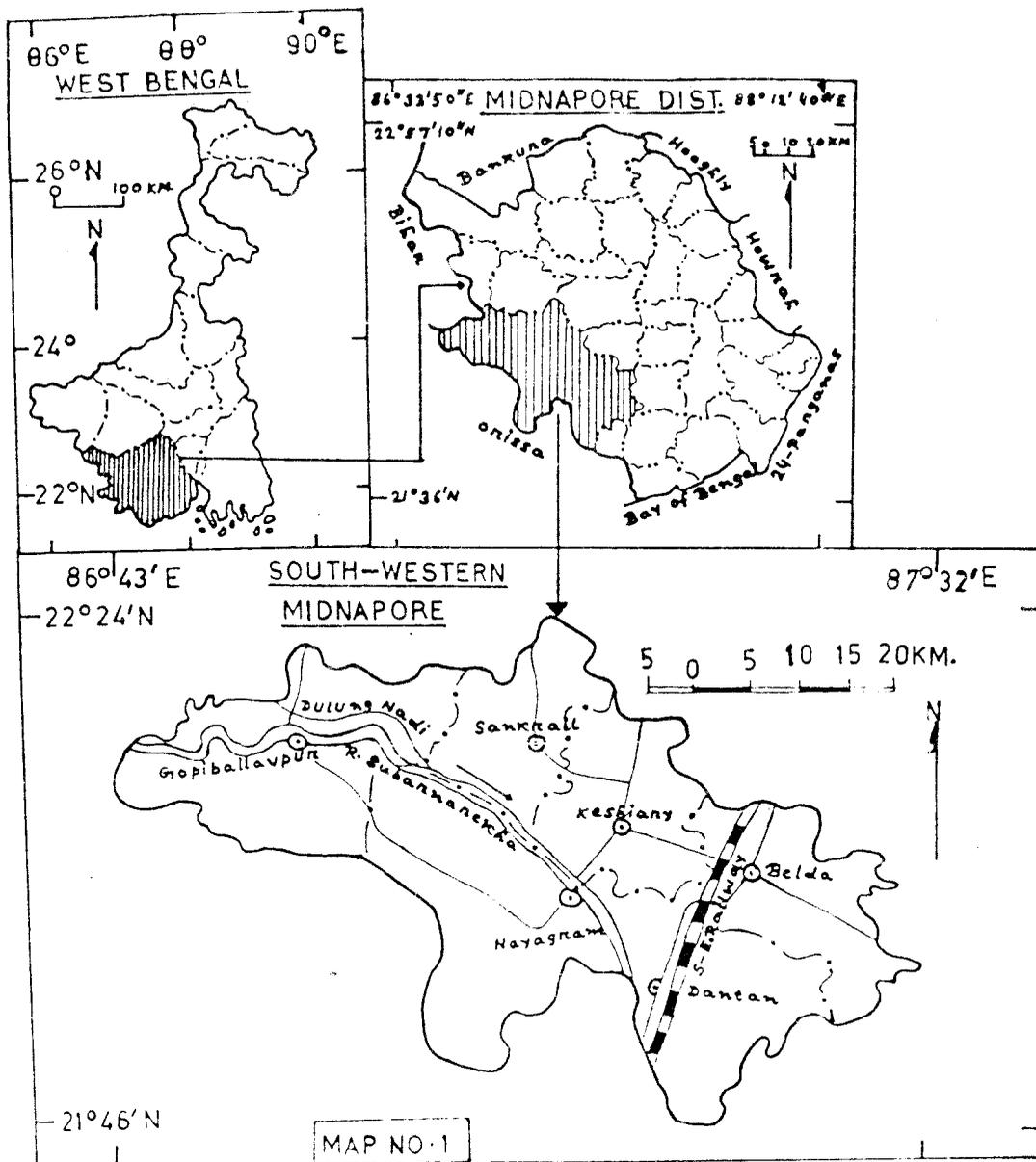
The systematic methodologies followed here include :

- i) The study of available maps, literature (published and unpublished) and other information relevant to the study area.
- ii) The study of topographical sheets on different scales and police station maps (2 cm. = 1.27 km).
- iii) Preparation of base map and planning for field study.
- iv) The Landsat MSS data (April 27, 1978) as well as aerial photographs (1:60,000) relevant to the study area are analysed. This is supplemented by field work (ground check).

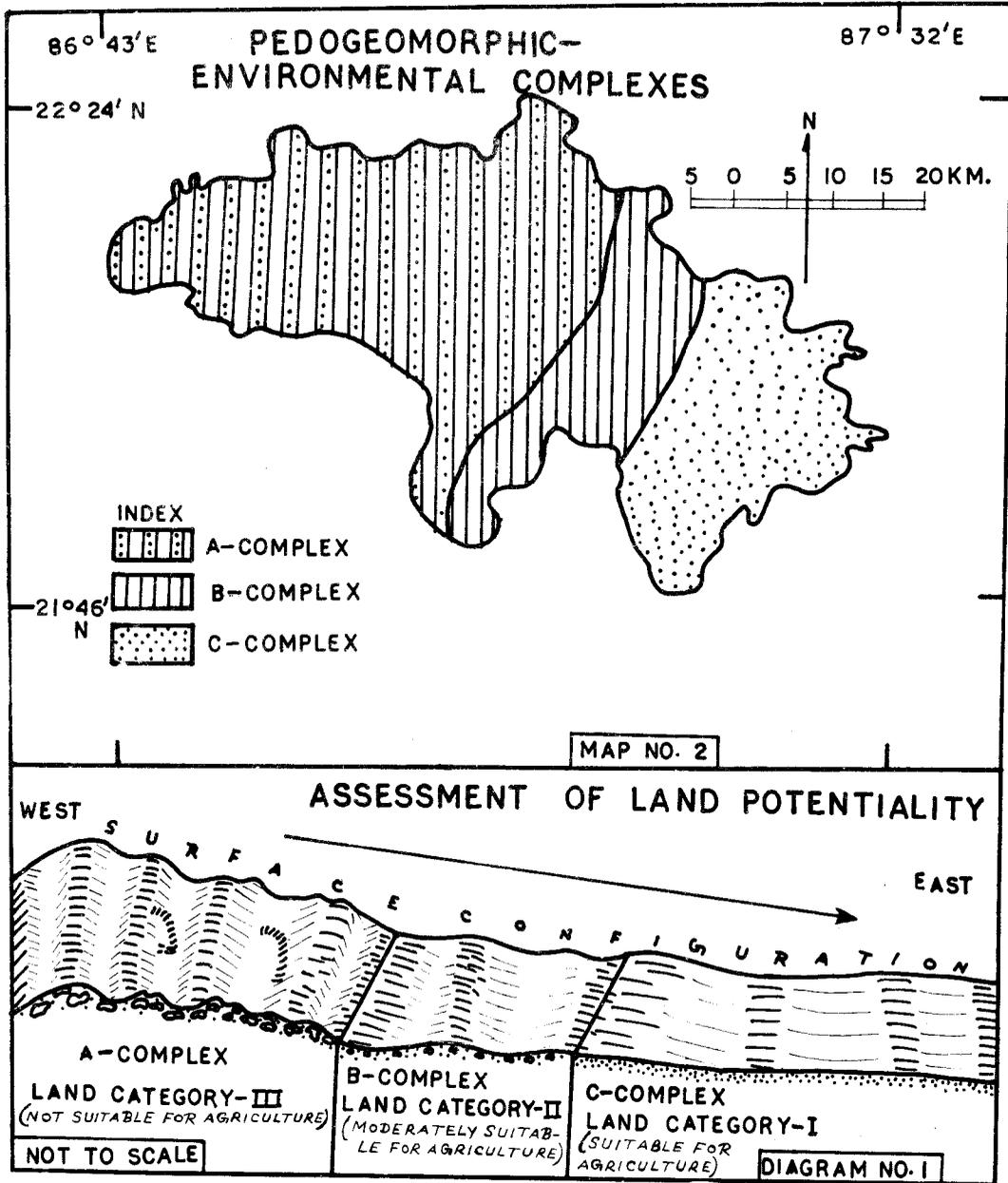
- v) The data relevant to pedogeomorphic attributes are collected from available sources including field work.
- vi) Data related to land utilisation, irrigation, crop production etc. are collected (from primary and secondary sources).
- vii) Analysis of the collected soil samples in the laboratory.
- viii) Assessment of the land potentiality based on the pedogeomorphic attributes as well as other considerations.
- ix) Finally, the lands of S.W. Midnapore West Bengal are classified into different categories (based on potentiality) for future developmental planning.

LAND COMPLEX APPROACH

Land complex may be defined as an area or group of areas, throughout which there is a recurring pattern of topography, soils, vegetation etc. Land complexes may range in size from only a few sq. km. upto some hundred of km². The topography and soils are dependent on the nature of the underlying rocks (Geology), the erosional and depositional processes which have given rise to the present day landscape (i.e. geomorphology and climate under which these processes have operated). Thus, the concept of "land complex" may be used for the scientific classification of terrain based on topography, soils, vegetation correlated with geology, geomorphology and climate. In practice, whether the boundaries are being drawn in the field or from imagery/aerial photographs, the simplest criterion for distinguishing one land complex from the other is the surface relief. Secondly, the interpretation of geology, soils, depositional and erosional processes come most readily through land form analysis. That is why geomorphology is the key element in land complex mapping



Map No.1



Map No. 2 & Diagram Map

or in any type of intergrated environmental survey especially at the rapid reconnaissance level.

Thus, land complex is an area which appears for all practical purposes to provide throughout its extent similar local conditions as to geology, physiography, climate and soil. It consists of landform assemblages with its associated pattern of soil and vegetation and it can be subdivided into distinctive land units of which they are composed. The concept of land complex visualizes that each part of the land surface is the end products of an evolution governed by the parent geological material, geomorphological processes, past and present climate and times. In other words, the geomorphological history working on parent material governs the land surface. The landsurface has thus been shaped to its existing land units, each developing in the process of its own hydrological features, soil mantle, vegetation community, animal population and range of micro-environments. It is further emphasized that the land units maintain their character as a recurring topographical units together with characteristics of soil, vegetation etc. Thus each unit gradually evolves its own morphological character through time.

The concept of land complex and land unit or in other words geomorphology, the science of earth form, and its application can have important bearings. As the nature of the ground surface is an important indicator of the character and distribution of rocks, soils, vegetation, drainage and the geomorphological processes operating through time, the application of geomorphological knowledge and the concept of land complex can satisfactorily be applied in assessing the land potency (De. 1984).

IDENTIFICATION OF DIFFERENT PEDOGEO MORPHIC - ENVIRONMENTAL REGIONS

Based on the spectrum of land complex approach, the land of S-W Midnapore is divided into three pedogeomorphoc Environmental complexes (Map No. 2).

- 1) A-Complex
- 2) B-Complex
- 3) C-Complex

Broadly speaking, the study area as a whole is the combination of plateau fringe and alluvial tract from the pedogeomorphoc environmental viewpoint. Topographically the relief fluctuates from moderately undulating to almost plain. The general slope of the area is from NW to South and SE. The macro topographic variations here affect the soil development. The pedogeomorphoc environment of each complex is highlighted as follows :-

1. A- Complex

This is the transitional zone between the Bihar plateau in the West and the undulating upland of Midnapore in the east. Major parts of Gopiballavpur, Sankrail, Nayagram and Keshiary police stations are included here. Sharp relief with undulating topography and lateritic soil are the common features of the area. The region has an average altitude of 150 ft. - 500 ft. It is characterised by severe erosion. Soils are thin, low in humus content and low in water holding capacity. Leaching is predominant in the area. The isolated uplands which are nothing but the low residual hillocks are formed of hard rocks like granites, gneisses or quartzites. The slope of the land surface is from North West to south and south-east. Erosional features with intricate gullies are common in the undulating areas. The

drainage is sluggish and is characterized by sharply cut banks. The area is not normally subject to flooding. Extensive agricultural practice is not possible due to the presence of hard Fe & Al concretions on the surface. Because of the presence of hard basement complex, unfavourable agricultural soil and drier climate, the area may be developed industrially with suitable environmental protection measures.

2. B - Complex

This complex lies between the A - Complex in the west and the C - Complex in the east. This includes parts of Dantan, Belda, Nayagram and Keshiary police stations. Altitude here lies between 25 ft. and 125 ft. The area reflects moderate relief with gently undulating topography. The soil depth, hummus content, and water holding capacity is much better here than the former complex. The soil is mainly developed on older as well as on newer alluvium. Leaching is present in the area to some extent. Slope of the area is towards south and south-east. Erosional features are also common in the area. Here depositional features are confined in the channels mainly. The area is flooded occasionally.

Chemical properties of the soil vary from place to place depending on the topographic situation. Iron oxide content is low and aluminium oxide is higher than the lateritic soil zone. Agriculture is mainly practiced here. Large scale agricultural practice is possible with the help of more irrigation and other inputs.

3. C - Complex

This covers major parts of Dantan and Belda police stations. This is a monotonously

flat terrain with low relief and gentle slope. This region is characterised by depositional surfaces, interlacing drainage forms and is liable to floods. The average relief varies from 20 to 50 m. This environmental complex is very rich in potentiality because the area is overlain by new fertile alluvial soil. It is a purely agricultural tract where rice, rabi crops and vegetables are grown. Here floods occur which create physical, social and other environmental hazards. The fertility of soil is enhanced due to flooding of the landscape. As the soil cover is thicker, irrigation facilities and soil fertility are higher than that of the lateritic and red soils, the agricultural practices are more developed in this tract. Aman, Aus, Rabi, Pulses and potatoes are the cultivated crops.

ASSESSMENT OF THE LAND POTENTIALITY

The potentiality of the three aforesaid pedogeomorphic Environmental complexes are assessed in tabular form (Table 1, 2, 3 and Diagram No. 1).

STRATEGIES FOR FUTURE DEVELOPMENT

The development of a region can be made on the basis of environmental understanding. Development strategies are subject to time space frame as well as to the accessibility of the concerned environment.

Analysing the sum total pedogeomorphic-environmental conditions in the light of land complex, the potentiality of the lands of south western Midnapore (A, B & C Complexes) are assessed and grouped as follows (Table 4).

TABLE 1. A- COMPLEX

Areal delimitation	Geological foundation	Topographic situation	Hydrological scene	Climatic phenomena	Soil character	Vegetal cover	Present utilisation
Covers major parts of Gopiballavour, Sankrail, Nayagram, and Keshiary.	Contains Archaean Gneisses & Granites, some basalts of Gondwana origin are also found.	Sharp relief with undulating topography. Relief varies from 150 ft. to 500 ft. slope ranges between 4 & 6 . slope is towards south & south east. The land surface is generally in nature, with isolated uplands, Leaching is predominant, erosional features with intricate gullies are common.	Seasonal rivers of the Chotanagpur intersect the region. The drainage is sluggish and is characterised by sharply poor in underground water condition, depth of water varies from 45' in summer to 10' in rainy months. In the rainy season soil erosion is getting momentum by the torrential nature of the flowing rivers.	Tropical monsoon climate, Monsoon rainfall in summer months. Temperature is higher but rain fall is lower than the other two complexes, average annual rainfall is about 150 cm. Temperature rises up to 45° c in summer and decreases to 8 c in winter.	Soils are mainly lateritic. Soils are thin, light, coarse textured and low holding capacity. Soil reaction ranges between 5.5 to 6.0. Iron concretions are present. Soil are dry and completely beached. They are low in humus, nutrients and fertility status.	Patches of dense Sal bush- common. Moreover Eucalyptus, Akashmani, Mahua, Kusum, piasal, Bamboo etc. are present.	Aman paddy as monocrop generally practiced in suitable locations. HY.V. paddy also cultivated but in negligible amount. In the river side, green vegetables are practiced. Some parts are covered with forests and a considerable portion is lying fallow.

TABLE 2. B - COMPLEX

Areal delimitation	Geological foundation	Topographic situation	Hydrological scene	Climatic phenomena	Soil character	Vegetal cover	Present utilisation
Covers parts of Dantan, Belda, Nauagram, and Keshiary police stations.	Beds of gravels, grits and sands of Tertiary age.	Moderate relief with gentle undulating topography. Relief this varies between 25 ft. and 125 ft. slope is towards south and south east and varies from 3° to 5°. Leaching is present to some extent. Here depositional features in the channel are found.	Subarnarekha is the main river passing through complex. Situation of underground water is better than the lateritic tract. Depth of water table varies between the summer and rainy seasons. Depth of water table is 30' in summer and 6' in winter.	Mainly Monsoon showers in summer months. Average annual rainfall varies between 150 cm and 200 cm. Air temperature rises upto 40° c (summer) and decreases to 10° c (winter).	Soil (Red Soil) is mainly developed on older as well as newer alluvium. Colour of the soil ranges between yellowish brown to brown and grey brown. Soil texture varies from sandy loam to clay loam and clay. Depth of soil is moderate. Dry moisture varies from 1% to 3%. soil pH ranges between 5.5 and 6.5. Iron oxide content is below 3% Aluminium oxide is higher than the lateritic soil and varies from 5 to 10%. Nitrogen content also slightly higher compared to lateritic soil and ranges from 0.05% to 0.1%, K ₂ O and P ₂ O ₅ are below 0.5% and 0.01% to 0.1% respectively. organic matter content is 0.1% to 1.0%, salt content is below 0.05%.	A considerable portion is forested. Mainly tropical deciduous type of species occur. Amongst the species, Mango, Siris, Sal, Neem, Bamboo etc. are common.	Agricultural practice is better as compared to the lateritic zone. Rice is the main crop here, vegetables are produced on substantial amount within the river valley. Generally monocrop is practiced. Double cropping is found patchy in the localities. Some parts are lying fallow.

TABLE 3. C - COMPLEX

Areal delimitation	Geological foundation	Topographic situation	Hydrological scene	Climatic phenomena	Soil character	Vegetal cover	Present utilisation
Covers major parts of Dantan, and Belda police stations.	Mainly recent alluvium, some older alluvium are also present. General lithology is alluvial, sandy and gravelly.	Monotonously flat terrain with low relief and gentle slope. Relief varies from 20 m to 50 m, slope is very gentle (1° -5°). The land surface shows many depositional characteristics.	Subarnarekha is the only river. Besides a Khal whose source is the R. Subarnarekha is found near Dantan. Situation of underground water is better here; ground water level is 20' in summer and 5'-10' in rainy season.	Tropical monsoon climate. Substantive amount of monsoonal rainfall during summer months. Average rainfall is 150 cm to 200cm. Temperature rises upto 38°C in summer and decreases to 10°C in winter.	New alluvial soil. Soil is deep to very deep. Texture is clay loam to clay and in some places clay. Colour varies from brown to grey brown and olive brown. High water holding capacity and high in soil fertility. More sands near the river beds and more clay further away. soil reaction is slightly acidic (pH range is 5.8 to 6.8), organin matter is 0.5% - 1.0%, airdry moisture is higher than the former types.	Mainly tropical deciduous types of species are found within the cultivated fields. The species include Mango, Siris, Babla, Akashmani, Bamboo etc., fruits & vegetable gardens are common nearer the settlements. content	Fertile soil, more irrigation facilities with multiple and double cropping practices. purely agricultural tract; Aman, Aus, Boro paddy, Jute pluses and Potatoes are the main cultivated crops. Oilseeds and vegetables are also grown. Forest is almost absent in this complex.

Table 4.

Status of land in the study area			
S.No.	Land complexes	Land quality	Land category
1	A - Complex	Poor	III
2	B - Complex	Medium	II
3	C - Complex	Good	I

On the basis of above land categories, strategies for future development of each complex are being prescribed as below :-

1. A - Complex : Water is the main problem. For intensive and large scale agricultural practices, irrigation facilities have to be provided on urgent basis. As the A - Complex reflects sharp to moderate undulations, the land should not be used for agriculture only. The upper parts of the complex are to be utilised for dry farming and commercial forestry. Agriculture can be practiced in favourable locations only. Some parts of the complex may be utilised for selected industries especially forest base depending on the locally available forest resources.

2. B - Complex : Extensive agricultural practice is possible with the aid of irrigation facilities. Emphasis has to be laid on the double and multiple cropping. In this complex, some portions are not conducive for agriculture. In these parts forestry has to be encouraged as an alternative. In this complex, vegetables may be grown on commercial basis (other than crops) in the floodplain.

3. C- Complex : Proliferation of transport network, social forestry in wasteland, provision for the use of surface water in the form of canal and river lift irrigation, production of more energy from local unused potential resources, provision of soil testing facilities at micro-level, planning to set up agrobased industries, to bring more villages under rural electrification as well as to provide extensive credit facilities are the important measures to be taken for the optimum utilisation of lands and soils in the area for balanced regional development.

CONCLUSION

In the decade of population explosion, pressure on land is a matter of great concern. For want of ecological perception amongst the people, the land is not utilised on optimum scale. In such a circumstance, actual understanding, proper measurement of land potentiality and its required management practices are a major field of research for the geographers.

As the study area is an agrarian one and as there are no alternatives for economic development, measures are to be taken by the government to optimise the land utilisation to form a sound agrobased economy.

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