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CLASSIFICATION AND ANALYSIS OF LAND FOR ASSESSING LANDSCAPE ECOLOGY: A CASE STUDY ON BANKURA DISTRICT, WEST BENGAL, INDIA

Amborish Das

Abstract

UN Conference on Environment Development 1992 laid emphasis on environmental indicators for sustainable development. Land management is very much essential for sustainable development because of Functions of Land such as- 1. Production Function, 2.Space function for socio-economic and infrastructural development, 3. Human settlement space function, 4. Biotic environmental function. 5. Climate regulative function 6. Hydrologic function 7. Waste and pollution control function 8. Storage function 9. Archive or heritage function. In the present study I have tried to categories the land for assessing the quality of land in Bankura District. To develop appropriate mapping and land quality assessment GIS-based techniques are used. Adopting the land-classification method, the study used different types of secondary data and maps such as District statistical handbook of Bankura, soil survey report-491 by NBSS and LUP (Regional Centre Kolkata), soil depth map, ground water map, soil particle map, soil type map topo map, administrative map and from official website of Bankura District, Landsat-8 data etc.

Keywords : *Soil, water resource, land classification, land management.*

Short Profile

Amborish Das is a working Research Scholar at Department of Geography in Visva Bharati, Santiniketan, Birbhum, WB.

INTRODUCTION

Lands tune song, more preciously the song of life. Land is primary resource that influences every sphere of life. So that management of this land-resource is very much essential. Agenda 21 has defined Land as a physical entity in terms of its topography and spatial nature thus including natural resources like the soil, minerals, water and biota existing on the land. These components provide a variety of services essential to the maintenance of life-support systems and the productive capacity of the environment.

Land can be divided into different categories according to a set of factors. It is controlled by climatic factors, soil characteristics, slope of land, and degree of erosion, water supply, drainage and similar environmental conditions. In past, several attempts have made in different countries to classify land from different viewpoints by employing various methods. Stamp (1968) was regarded as a pioneer in the field of land classification. In his book, "The Land of Britain : Its Use and Misuse" he has classified land into six categories, namely Forest and woodland, Arable land, Meadow land and Permanent grass, Heath and moorland, Gardens, Orchards, nurseries and unproductive land like land under buildings, mines and wastelands. The land capability classification is related to characteristics of land such as slope,

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erosion, stoniness, alkalinity, salinity, presence of high water table, land use, soil texture, soil moisture and the fertility of the soils (Ali Mohammad,1978). Soil characteristics and properties are the outcome of the interplay of pedogenic factors and processes prevailing in the area.

Anthropogenic activities also play important role in this connection. Improper land use practices can adversely affect many natural processes that lead to soil erosion, land degradation, habitat destruction, and water pollution. In particular, studies have shown that the proportion of different land uses within an area is directly related to variability in riverine water quality (e.g. Hunsaker and Levine, 1995; DelRegno and Atkinson, 1988). Soil loss, soil salinity, water degradation and flooding are also often associated with inappropriate agricultural, industrial and urban land use practices. Now a day, the relatively new field of landscape ecology has added a new dimension to land management. There is a growing recognition of the importance of the "landscape perspective"– the need to consider larger spatial and temporal scales than have traditionally been considered in policies and guidelines for managing state lands (Haines- Young et al., 1993). Results from landscape ecological studies suggest that a broad-scale perspective incorporating spatial relationships is a necessary part of land-use planning (Turner, 1989).

Study Area: Bankura is located in the western part of the State of West Bengal. It is a part of Bardhaman Division of the State and included in the area known as "Rarh" in Bengal. It ranks 4th according to Population and literacy rate of 2001 Census in the State. The District Bankura is bounded by latitude $22^0$38' -$23^0$38'N and longitude $86^0$36' E to $87^0$47' E. River Demodar flows along the northern boundary of the district. The adjacent districts are Bardhaman in the north, Purulia in the west, Paschim Medinapure in the south and Hooghly in the south-east. The Survey of India (SOI) toposheets covering the districts are 73I, 73J, 73M and 73N.

Bankura district has been described as the "connecting link between the plains of Bengal on the east and Chota Nagpur plateau on the west." The areas to the east and north-east are low lying alluvial plains, similar to predominating rice lands of Bengal. To the west the surface gradually rises, giving way to undulating country, interspersed with rocky hillocks. Much of the country is covered with jungles.

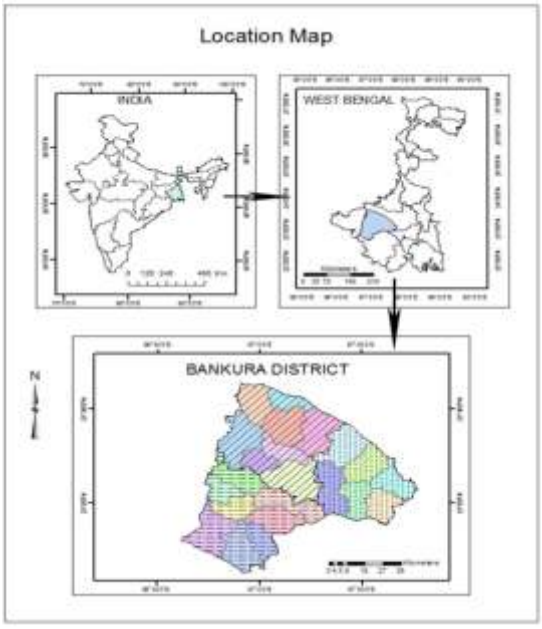

Fig:1 Location Map of study area

Aim and Objectives:

The objectives of this study are as follows:
1) To prepare a soil fertility map of Bankura District using soil texa as a mapping unit and
2) To determine land capability classes and soil productivity potentials in Bankura District.

Materials and Methods:

This entire work is mainly based on secondary data i.e., collected from District statistical Handbook Bankura District (2008), District Census Handbook of Bankura District

(2001), West Bengal State Water Investigation Directorate (SWID), District Gazetteer of Bankura District and ,soil survey report-491 by NBSS and LUP (Regional Centre Kolkata), soil depth map, ground water map, soil particle map, soil type map, administrative map and from official website of Bankura District, slope map(NATMO), many others literatures and research papers. All the maps have been georeferenced by the author. Land classification mapping has been prepared using ArcGIS 10 software. Raster to vector conversion has been carried out through digitization from the map of Bankura (soil depth map, slope map, ground water map, soil particle map, soil type map, climate map) in ArcMap. After digitization ranking of all the layer categories have been done. Finally land classes map have been prepared after carried out through union of all the layers then error correction combine ranking procedure in arcGIS environment.

Results and discussion:

There are several factors that determine the quality of land such as soil type, soil depth, particle size of soil, slope of land, rain fall & temperature, ground water potentiality etc. In this study I have selected flowing factors, then finally prepared land classification map that actually showing land capability in Bankura.

Soil Type: Soil constitutes one of the vital parts of natural resource. There are different types soil can be found and the production capacity of those also varies. Bankura District experience 6 types of soil namely younger alluvial soil, older alluvial soil, red sandy soil, red and yellow soil, red gravelly soil and lateritic soil.

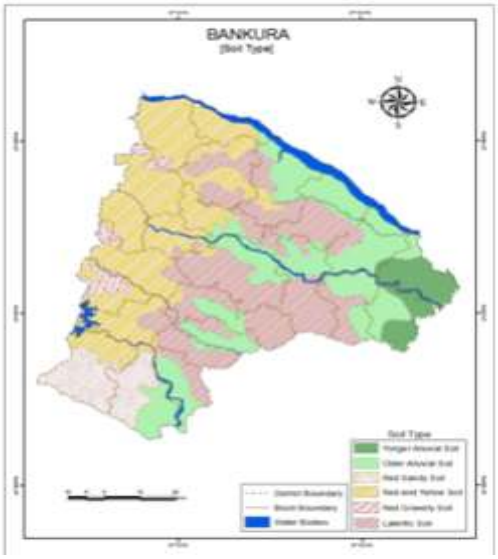

Fig: 2 Soil Type map of Bankura

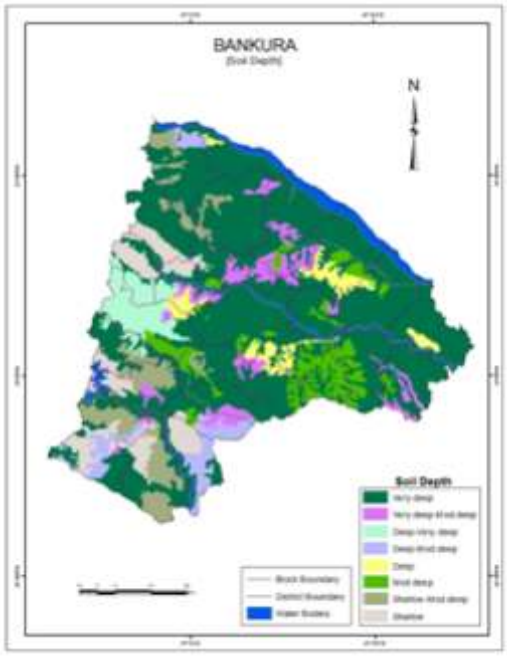

Fig:3 Soil Depth map

Soil Depth: Depth of soil is also another important factor affecting productivity of land. In case of Bankura from the perspective of soil depth there are 8 category can be drown as shown in fig-3.

Soil Particle Size: Soil particle size refers the grain size of soil that determines the water holding capacity which has great impact on agricultural productivity of land.On the basis of soil particle size Bankura's soil are divided into 9 catagories that can be seen in fig-4.

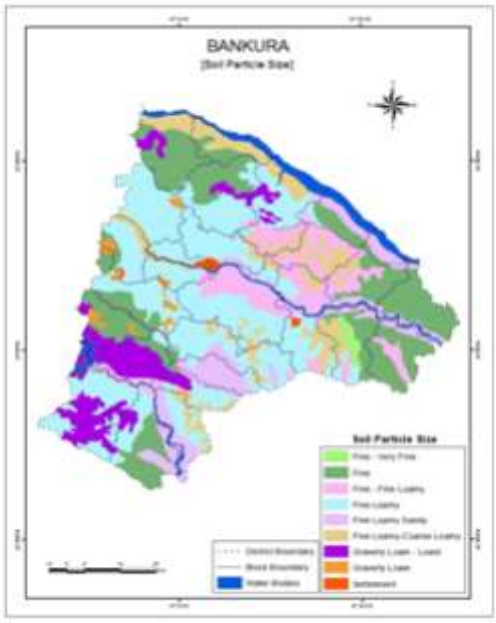

Fig:4 Soil Particle Size Map

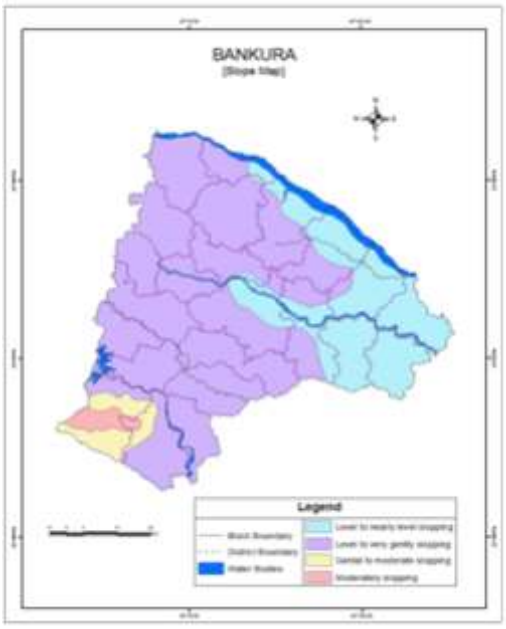

Fig:5 Slope Map

Slope: Land slope influences the efficiency of land, here (Bankura) land slope are classified into 4 groups (see Fig: 5).

Rainfall: Rainfall is an important dominative climatic factor influence productivity of land. In Bankura higher rainfall receive in south-eastern part i.e. more than 1600mm/year in average. Medium rainfall occur in the south-eastern and eastern part (1400-1600 mm/year) of the dist. And rest of the part receive rainfall below 1400mm annually. (Fig:6)

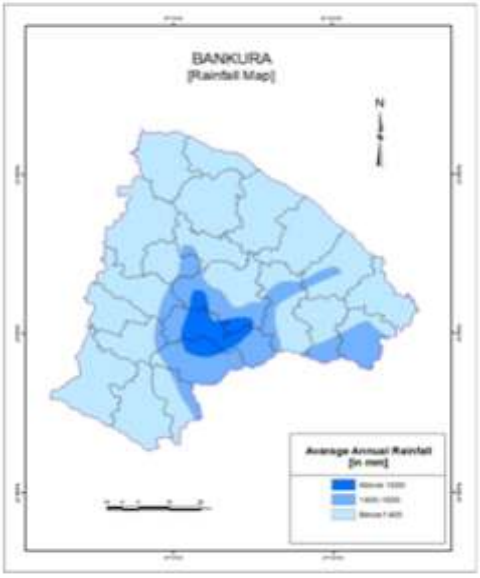

Fig:6 Rainfall Map

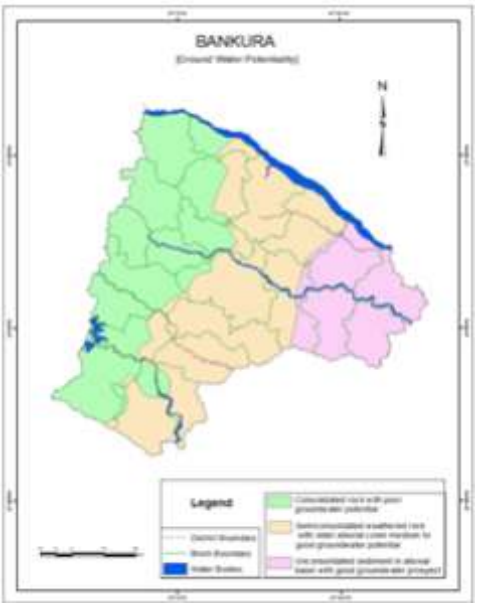

Fig:7 Ground water potentiality map

Ground water potentiality:

Ground water play significant role in agricultural practice, from this view point it has considered in land classification in Bankura district. Ground water potentiality is in the eastern part while the western part experiences poor ground water potentiality and middle part

is with medium potentiality (Fig-7).

Land Classification:

Based on physical characteristics like soil type, soil depth, soil particle size, slope, rainfall, and ground water potentiality the land capability of the Bankura District has been evaluated and classified into seven classes of land (Fig 8, Table 1).

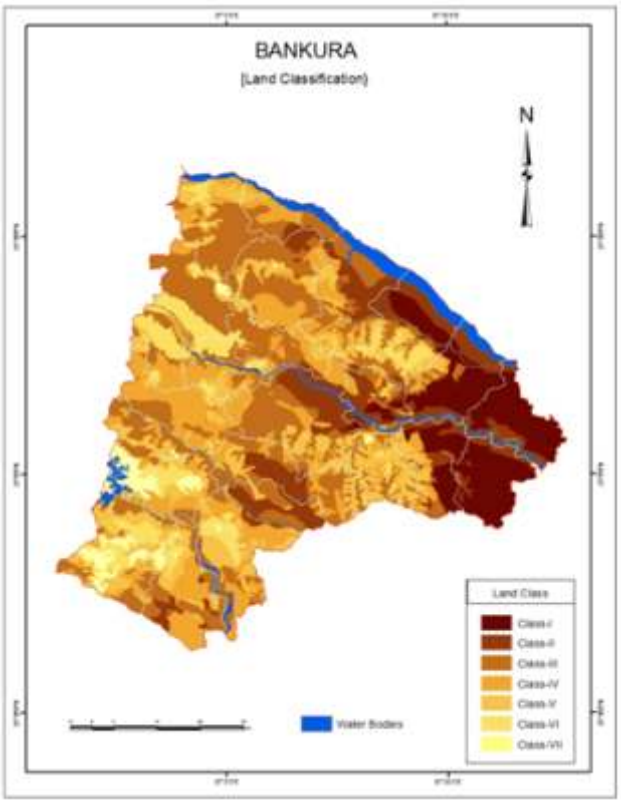

Fig: 8 Land Classification Map of Bankura

Class-I: The class 1 lands consist of rich and fertile soil with excellent ground water resources. The slope is level to nearly level, water retensive capacity is high. It is very mach suitable for agricultural practice. This type of land can be found in Kotalpur, Patrasayar, Indus, Joypur,some part of Sonamukhi, Bishnupur block.

Class-II: The class II land consists of irrigated plains other than fluvial plains. The slope is Level to very gently slopping. The ground water potential is good. The recharge is high. The soil fertility is moderate to good. It is very mach suitable for agricultural practice. This type of land can be found in Onda, Simlapal, Sonamukhi, Barjora, Bishnupur, Gangajalghati, Mejia, Patrasayar, Indus, Kotolpur, Joypur, Taldanga, Raipur block.

Class-III: The Class-III lands composed of Very deep-Mod.deep soil with Level to very gently slopping. The ground water potential is moderate to good. The soil fertility is moderate to good. The intensity of rainfall is moderate. It is also suitable for agricultural practice. The concerning block are Saltor, Gangajalghati,Onda,Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, Bishnupur, , Patrasayar, Indus, Kotolpur, Joypur, Ranibandh, Hirabandh, Seranga, Raipur.

Class-IV:The class-IV land consists of Deep-Mod.deep, Shallow-Mod.deep soil, moderate fertility and Medium to poor. The block co-inside with this class are of Bankura-I, Indpor, Seranga, Raipur, Ranibandh, Ranibandh, Gangajalghati ,Onda, Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, Bishnupur, , Patrasayar, Joypur, Hirabandh.

Class-V: The class-V land consists of Deep-Mod.deep, Shallow-Mod.deep soil, moderately sloppinng and Medium to poor Ground Water Potentiality. The block are Saltor, Bishnupur, Khatra, Gangajalghati,Onda,Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, , Patrasayar, Indus, Kotolpur, Joypur, Ranibandh, Hirabandh, Seranga, Raipur.

Class-VI: The Class-VI consists of Gental to moderate slopping and Moderately slopping regions with Moderate to poor Ground Water Potentiality as well as Moderate to poor Soil Fertility. The block are Ranibandh, Chatna, Sonamukhi, Bishnupur, Joypur, Simlapal, Serenga, Raipur, Bankura-I & II, Gangajalghati, Mejia, Saltor, Taldanga, Khatra.

Class-VII: The class-VII land co-inside with block Khatra, Ranibandh, Hirbandh, Raipur, Serenga, Chatna etc having poor soil fertility.

Class	Soil Type	Soil Depth	Soil Particle Size	Land Slope	Rainfall	Ground Water Potentiality	Soil Fertility	Name of the Block
I	Yonger Alluvial Soil,Older Alluvial Soil	Very deep,Very deep-Mod.deep	Fine, Fine - Very Fine, Fine - Fine Loamy	Level to nearly level	1400-1600 mm, below 1400 mm	Excellent	High	Kotalpur, max. part of Patrasayar, Indus, Joypur,some part of Sonamukhi, Bishnupur
II	Max. Older Alluvial Soil,Lateritic Soil, Red and Yellow Soil,	Very deep-Mod.deep	Fine, Fine - Fine Loamy,Fine - Very Fine,Fine Loamy-Coarse Loamy	Max. Level to very gently slopping	Max. below 1400, above 1600 mm	Good , medium to good	Moderate to good	Onda, Simlapal, Sonamukhi, Barjora, Bishnupur, Gangajalghati, Mejia, Patrasayar, Indus, Kotolpur, Joypur, Taldanga, Raipur
III	Older Alluvial Soil,Lateritic Soil, Red and Yellow Soil, Red Sandy Soil	Very deep-Mod.deep	Fine, Fine - Fine Loamy, Fine Loamy Sandy	Level to very gently slopping	1400-1600 mm, below 1400 mm	Medium to good	Moderate to good	Max. part of Saltor, Gangajalghati,Onda,Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, Bishnupur, , Patrasayar, Indus, Kotolpur, Joypur, Ranibandh, Hirabandh, Seranga, Raipur
IV	Max. Lateritic Soil, Red and Yellow Soi	Deep-Mod.deep, Shallow-Mod.deep	Fine, Fine - Fine Loamy, Fine Loamy Sandy, Fine Loamy-Coarse Loamy	Level to very gently slopping, Moderately slopping	1400-1600 mm, below 1400 mm	Medium to poor	Moderate	Max. part of Bankura-I, Indpor, Seranga, Raipur, Ranibandh, Ranibandh, Gangajalghati ,Onda, Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, Bishnupur, , Patrasayar, Joypur, Hirabandh,
V	Max. Lateritic Soil, Red and Yellow Soil, Red Sandy Soil	Deep-Mod.deep, Shallow-Mod.deep	Fine - Fine Loamy, Fine Loamy Sandy, Fine Loamy-Coarse Loamy, Gravelly Loam - Loam, Gravelly Loam	Gental to moderate slopping, Moderately slopping	Max. below 1400, Some part 1400-1600 mm	Poor, Medium to poor	Moderate to poor	Max. part of Saltor, Bishnupur, Khatra, Gangajalghati,Onda,Mejia, Simlapal, Bankura-II, Taldanga, Sonamukhi, Barjora, , Patrasayar, Indus, Kotolpur, Joypur, Ranibandh, Hirabandh, Seranga, Raipur
VI	Max.Lateri-tic Soil, Red & Yellow Soil, Red Sandy Soi, Red Gravelly Soil	Mod. Deep, Shallow-Mod. Deep, Shallow	Gravelly Loam,Gravelly Loam - Coarse Loam, Fine Loamy-Coarse Loamy	Gental to moderate slopping, Moderately slopping	Max. below 1400, Some part 1400-1600 mm	Medium to poor	Moderate to poor	Max. part of Ranibandh, Chatna, Sonamukhi, Bishnupur, Joypur, Simlapal, Serenga, Raipur, Bankura-I & II, Gangajalghati, Mejia, Saltor, Taldanga, Khatra
VII	Mix. Lat. Soil, Red & Yellow Soil, Red Sandy Soi, Red Gravelly Soil	Shallow-Mod. Deep, Shallow	Max. Gravelly Loam,Gravelly Loam - Coarse Loam	Moderately slopping	Below 1400	Poor	Poor	Max. part of Khatra, Ranibandh, Hirbandh, Raipur, Serenga, Chatna

Table: 1 Land capability classification of Bankura

CONCLUSIONS:

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. According to the foregoing discussion and analysis, the capability is high in the eastern part of the district whereas it is low in the south-western part and rest of the part of the district experience moderate capability. This study area as well as other area may be benefited by the findings of the present work to understand the characteristics and capabilities of the land that will help in the field of land management.

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