INFLUENCE OF HYDRO-MORPHOMETRY ON AGRICULTURAL LANDSCAPE OF BIRBHUM DISTRICT: AN ASSESSMENT

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Abstract:
Hydromorphometry includes quantitative study of the drainage characteristics and topographical attributes of an area. Both the drainage condition related fluvial activities as well as physiography of an area has its immense influence on the agricultural pattern of that region. From that stand point the present paper attempted to assess whether the district drainage and topographical condition of different CD block of Birbhum district have any influence on the varied agricultural landscape of the said district.
Key words: *Morphometric Parameters, Drainage Aspects, Agricultural Pattern, Dependencies Analysis.*

Introduction:
"Rivers first create the land then fertile it and finally distribute its produce."Hence hydro-morphometry of a region has its immense influence on the agricultural pattern of that region. This paper focuses on spatial pattern of hydro-morphometric parameters and agricultural parameters of Birbhum District and how they are interacted to each other. It principally highlights how hydro-morphometric parameters characterizing the agricultural scenario in different community development blocks of the district. The result shows that, Relative relief, dissection index, stream frequency etc. are negatively controlling over crop intensity, gross cropped area and net sown area etc. but these are encouraging dairy and livestock farming.

Objectives of the Study:

- To find out the pattern of Relative relief, Dissection Index, and Ruggedness Index of different blocks.
- To find out the pattern of Drainage Density, Drainage Texture, Drainage Frequency of the study area.
- To study the intra-regional pattern of some selected Agricultural Parameters
- To articulate co-relation agricultural dependencies on hydro morphometric conditions.

Data base, Materials and Methods:
Hydro-Morprphic datas have been collected from, toposheet of Survey of India, District Planning Map series of Birbhum District and SRTM data. Agricultural data have been collected from District Statistical Handbook of Birbhum District (2007-08). Six morphometric and ten agricultural parameters have been included in this process of analysis and these have measured for each block. SPSS software has used to carry on correlation matrix on the basis of block level morphometric and agricultural data.

Parameters	Formulas	References
Relative relief (Rr)	Rr = RMax-RMin RMax=Highest Elevation, RMin=Lowest levation	Smith,1935
Dissection Index (DI)	DI= Rr/Ar Ar=Absolute relief	Dov, Nir, 1945
Ruggedness Index (Rn)	Rn=(RrXDd)/K K= a conversion Contant and is 1000, Rr=Relative relief, Dd=Drainage Density	-----
Drainage Density (Dd)	Dd=∑L/A L=Length of the river segment , A=Area	Horton,1932
Drainage Frequency (Df)	Df=∑N/A N=Number of river segments	Horton,1932
Drainage Texture (Dt)	Dt=Nμ/P Nμ= Total Number of streams of all segments, P- Block Perimeter	Horton,1945
Cropping Intensity (CI)	GCA/NSA GCA=Gross Cropped Area, NSA=Net Sown Area	Doi.

Location and Physical Environment of the Study area:
The District Birbhum lies between the latitude 23°32´30´´N to 24°35´00´´N and longitude 88°01´40´´E to 87°05´25´´E. The district is a part of tract Rarh having general slope from North West to South East. The northern and western portion is marked by ridges. The exposed geological formations of the district are Archean Gneiss, Gondwana System, Rajmohal Traps, Lateritic Older Alluvium and Newer Alluvium. Climate of the district is Subtropical Monsoonal type with health oppressive hot summer, high humidity and well distributed monsoonal rainfall.

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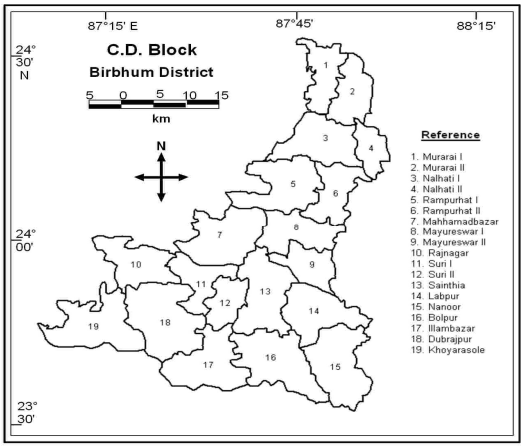

Fig.1

The Drainage System:

The district is well drained by a number of drainages running in every case from West to East with slightly southerly inclination. The major rivers are Mor and Ajay. The rivers of the western part of the district resembles dendritic pattern and become fenced by well-marked undulations. But, the higher order eastern rivers are much more helpful for wide spread agriculturization.

Pattern of Drainage Frequency, Drainage Density and Drainage Texture:

The western portion of the district is an extension of Chotonagpur Plateau. The upland ridges, hillocks, high erosion rate, badland topography have resulted the formation of numerous lower order streams which runs through deep cutting of lateritic tract. Hence, stream frequency, drainage density is remarkably high in Rajnagar, Dubrajpur, Khoyrasole, Md.Bajar, Rampurhat block. Drainage texture of this region is fine**.**

Stream frequency in the eastern part is less pronounced specially in the south eastern part because; this region is gradually merges into the broad alluvial Plain of the Gangetic Delta. Infact, Labpur, Bolpur, Sainthia, Nanoor, Mayureswar blocks are more deltaic structure and all the drainage parameters count low.

The Morphometric pattern of different blocks:

Throughout the entire western part of the district, terrain is remarkably undulating. The undulations are more marked in Blocks of Dubrajpur, Rajnagar, Khoyrasole and Md. Bazar. In these blocks relative relief is high with high ruggedness index and dissection too as these high areas of laterites are separated by valleys a mile or more in width.

To the south east, these upland ridges are less pronounced where the valley becomes narrow and gradually merges into the broad alluvial plains of Gangetic Delta. Actually, Labpur, Bolpur, Sainthia, Nanoor, Mayureswar blocks are nothing but flat country akin. Hence, all the morphometric aspects count low. Throughout the greater part of Nalhati and Rampurhat block are high and surface is slightly undulating. The western portion of Mayureswar and Suri blocks are covered with high ridges extending many miles to the south east. The blocks count moderate relative relief, dissection index and ruggedness index.

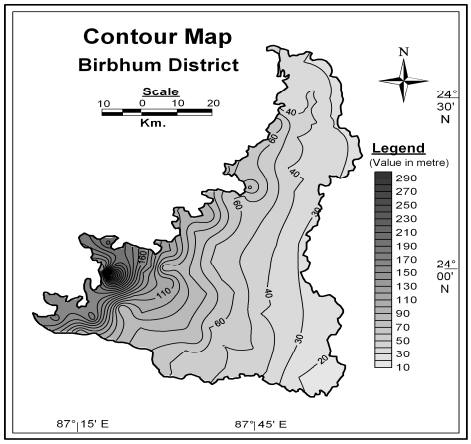

Fig.2

The Agricultural Landscape:

The block wise agricultural pattern shows that, Gross cropped area Nanoor, Bolpur, Sainthia, Labpur is high Although, the Net Sown Area of these blocks are not so high covering ¾ portion. Rajnagar, Khoyrasole, Dubrajpur, Rampurhat-I, account Gross Cropped Area little more than Net Sown Area. Consequently, Cropping Intensity of the former blocks is high but for the later it counts low. As geographical land is limited, so over a piece of land how many times cultivation takes place (i.e. cropping intensity) should be understood, subject to the availability of irrigation facilities. The status of irrigation is considerably good in Nanoor, Bolpur, Labpur and Sainthia. But, it is very much lacking in Rajnagar, Suri-I, Khoyrasole, Dubrajpur, Mayureswar. Interestingly, although the yield of amon and boro is low but that of pulses and oilseed is higher in these 5 blocks. This is because; these winter crops need little water. The hydro-physical prospects of the south eastern blocks like Labpur, Nanoor, Sainthia, Bolpur, Mayureswar-I, Suri-II exhibit high production of fish but lower number of livestock and poultry except Bolpur probably to mitigate its high internal demand. In Rajnagar, Khoyrasole, Dubrajpur, Rampurhat-I, Mayureswar, Illambazar the number of livestock and poultry is significantly high. These Block level disparities of agricultural landscape must be understood subject to hydro- physical conditions of the respective blocks.

Results and Analysis:

Influence of Hydro-Morphometry on agricultural parameters of Birbhum district:

Table 1: Correlation Matrix of Different Hydro-Morphometric and Agricultural Parameters

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1	.717(**)	.655(**)	.808(**)	.852(**)	.993(**)	-.061	-.486(*)	-.762(**)	-.598(**)	.251	-.384	-.384	-.389	-.226	-.049	.207
2		1	.376	.583(**)	.765(**)	.743(**)	-.092	-.417	-.483(*)	-.530(*)	.020	-.131	-.129	-.266	-.036	.129	.347
3			1	.883(**)	.691(**)	.594(**)	-.152	-.500(*)	-.634(**)	-.480(*)	-.030	-.196	-.197	-.118	-.229	.128	.337
4				1	.854(**)	.763(**)	-.110	-.524(*)	-.719(**)	-.580(**)	-.035	-.262	-.261	-.190	-.199	.099	.267
5					1	.823(**)	.134	-.332	-.842(**)	-.493(*)	.151	-.268	-.267	-.380	-.248	.093	.324
6						1	-.061	-.474(*)	-.740(**)	-.577(**)	.285	-.372	-.372	-.394	-.241	-.035	.186
7							1	.872(**)	-.400	.700(**)	.545(*)	.208	.210	-.327	-.536(*)	.259	.102
8								1	.080	.884(**)	.404	.320	.322	-.154	-.392	.144	.026
9									1	.178	-.406	.304	.304	.359	.454	-.305	-.137
10										1	.349	.400	.401	-.119	-.348	.213	.064
11											1	-.175	-.173	-.499(*)	-.269	.026	.169
12												1	1.000(**)	.009	-.132	.041	.001
13													1	.008	-.133	.042	.002
14														1	.429	-.043	-.365
15															1	-.158	-.130
16																1	.030
17																	1

* means correlation is significant at the 0.05 level (2-tailed); ** means correlation is significant at the 0.01 level (2-tailed);

1. Relative Relief 2. Dissection Index 3. Drainage Density 4. Drainage Frequency 5. Drainage Texture 6. Ruggedness index 7. Net Sown Area (In Hect.) 8. Grossed Cropped area (In Hect.) 9. Cropping Intensity 10. Irrigated Area (In Hect.) 11. Number of Livestock and poultry farming 12. Net Area under Effective Pisciculture(Hect.) 13. Annual Production from Pisciculture (qtl.) 14. Yield of Amon (Kg/Hect.) 15. Yield of Boro (Kg/Hect.) 16 Yield of Pulses (Kg/Hect.) 17. Yield of Oilseeds (Kg/Hect.)

It is clear from the table that, the hydro-morphometric parameters control agricultural parameters both in negative and positive ways. Some significant positive relations among hydro-morphometric parameters themselves and

agricultural parameters themselves or between these parameters are Relative Relief and Dissection Index; Relative Relief and Ruggedness Index; Relative Relief and Drainage Texture; Relative Relief and Drainage Frequency, Dissection Index and Yield of Pulses, oilseed; Net Sown Area and Irrigated Area, Area under Dairy and Poultry; Gross Cropped Area and Irrigated Area; Area under Dairy and Poultry.

Some negative relations are Relative Relief and Gross Cropped Area; Cropping Intensity; Irrigated Area; Dissection Index and Cropping Intensity; Irrigated Area; Drainage Texture and Cropping Intensity .Drainage Density and. Grossed Cropped area ; Cropping Intensity

It means the region where drainage frequency, density, texture, relative relief is high Gross Cropped Area, Cropping Intensity, Yield of Aman, Boro paddy etc. are low. Dissection Index, Relative Relief, Drainage Texture etc. Control Area under Pisciculture is in negative way but where Relative Relief and Dissection Index are more tendencies of Livestock Farming and Poultry Farming is less.

Spatial Relation between Hydro-Morphometry and Agricultural Condition:

Significantly, the east central blocks, where the Drainage Density, Drainage Frequencies are significantly low; the Relative Relief, Dissection Index, Ruggedness Index are also low and the agriculture is status worthy. This is because, these blocks are more deltaic structure and characterized by higher order drainage, low elevation, relatively flat land and wider river valley, meandering course, clayey etc.

On a contrary, the western fringe of the district especially the South Western blocks, where in both the drainage elements as well as morphometric parameters are high, the agricultural status is poor. This poor status is due because these western fringe bocks are an extended part of Chotonagpur Plateau land having upland ridges, high erosion rate, badland topography, and numerous lower order streams running through deep cutting of lateritic tract. .

Conclusion:

After analyzing the relational landscape, it can be said that, hydro-morphometric scenario of a region has its immense influence on the agricultural pattern of that region although, there are some minor exception. So, development of agricultural planning should be streamlined keeping in base the hydro-morphometric pattern to make the landscape economically viable. Moreover, conservation strategies should also be taken regarding development of some specific agricultural practices against hydro-physical conditions of the land in some parts of the district in terms of economic plans.

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