

Aspects of Crop Land Use – Perspective of Development, Planning, And Management, Ajay-Mayurakshi Interfluve, Birbhum District, West Bengal, India

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Abstract: Land is the basic resource of a nation. Utilization of land, maintains reciprocal relationship between the prevailing ecological condition and human society of any region. Observation of Land and its uses are important aspects of geographical studies and also the processes of exploring the land for specific objectives. The concept of land use implies the interaction between land and environment. The increasing population pressure, low man-land ratio, increasing rate of degradation of land are also responsible for the optimal utilization of land resources. The spatial information on land utilization in the modes of statistical data and associated maps is essential for development, planning and management. The degree of utilization of land can be accessed from its detailed analysis which is the proper indicators of regional as well as local development. The present study entails different aspects of crop land use in connection with the qualitative and quantitative aspects of the same. Due to varied environmental situation proper planning and management practices of crop land restoration and development are taken up as a process of holistic development.

Keywords: Land utilization, Cropping Intensity, Crop Diversification, Crop Combination, Land use Planning and Management.

I. Introduction

Landscape is a natural arrangement of integrated tracts of land, which is very complicated and subsequently influences the degree of land use practices. Land use is thus, the result of interaction among morphologic, climatic and socio-economic parameters in macro, meso and micro levels. Land use the key elements of any ecosystem and derive benefit from both and also an essential part of the ecosystem always trying to manipulate and re-organise it. It is also the cumulative output of historical events, the interaction of economic forces with the natural environment, and the values of society. Despite, the significant influence of the natural environment on the land-cover and land use, subsequent adjustments of land use to the cultural ecology are clearly evident. The study of land use is an urgent need for resource planning, cultural advancement as well as overall economic development of any area and the potentiality of any geographical region mostly depending on the extensive and intensive use of land parcels. However, economic and cultural advancement can better be carried out only through the systematic and balanced utilization of land. Thus, geographers can't think about regional and local level development without proper and optimum use of land. So, the integrated land use study is of immense value for human sustenance.

Objectives of the Present Study

The main objectives of the present study are-

- (i) To undertake a detailed and intensive land use survey with special reference to crop land use and to analyse and interpret it scientifically with a view to exploring and unfolding the potential land resources of the region,
- (ii) To identify the cropping pattern as well as to analyse the cropping intensity of the study area,
- (iii) To analyse spatio-temporal variation in diversification of different crops within the study area.
- (iv) To put focus on the regional disparities as well as concerned regional problems as an integral part of the land development, planning and management.

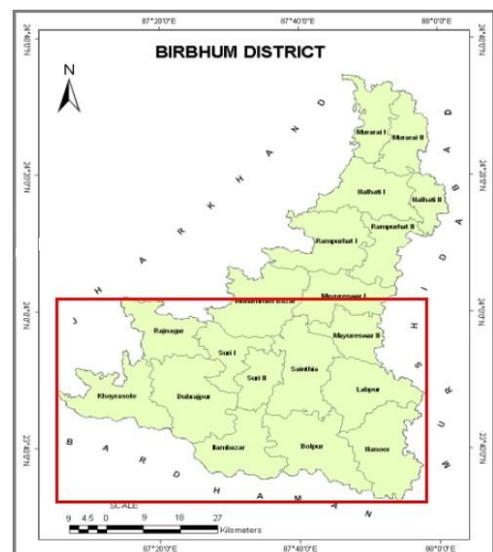
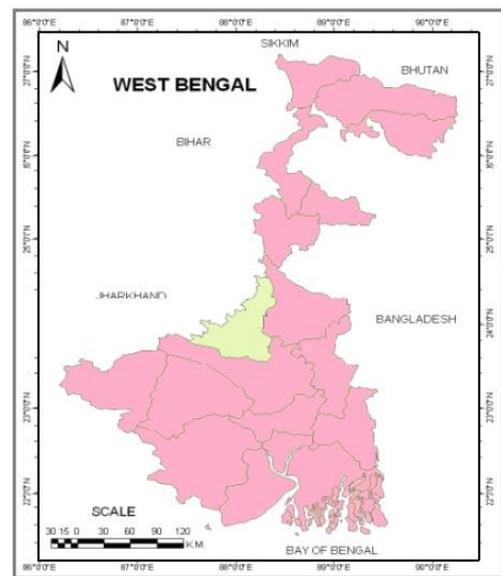
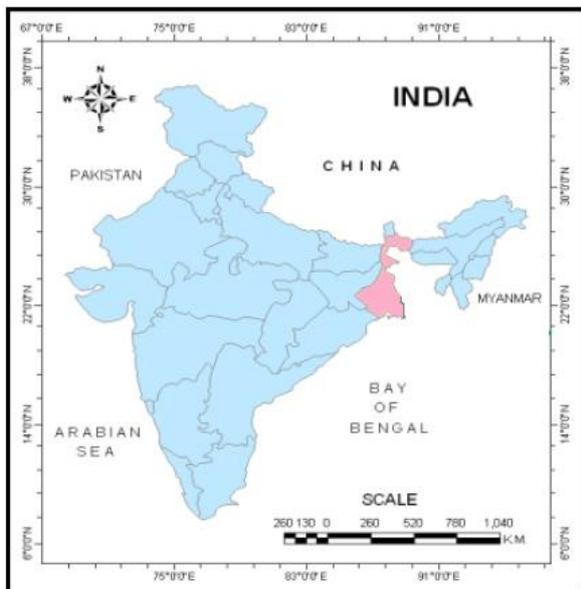
Study Area

The study area (23°32'N to 23°57'N latitudes and 87°05'E to 87°52'E longitudes, comprising an area about 2569.86 sq. km.) selected for the present study is the interfluve of Ajay-Mayurakshi River, parts of Birbhum district in West Bengal. The approximate elevation of Eastern Alluvium plain ranges between 20 to 60m above msl whereas, it is ranging from 60m to 140m in the westward of undulating plateau (Chotonagpur) regions. The general slope is from northwest to south-east. Geographically, Ajay-Mayurakshi interfluve is a part

of ancient ‘Rarh Bhumi’ of Bengal, having favourable agro-environmental condition. The proposed interfluvium is mainly rain fed and intensified by mono-cropped cultivation system, still suffers by inter-regional disparity in agricultural development. Though, the region has also a range of promising prospect in agriculture for the development of the proposed area.

The climate is in general sub-humid type with a mean annual rainfall varies from 1275 to 1430mm and about 75 percent is received from southwest monsoon during June to September. The maximum and minimum temperature ranges between 41.5°C to 12.7°C. The predominant soil types are old alluvial and red lateritic with low to medium in organic carbon and phosphate content and medium to high in potash. The soil is acidic in nature with pH ranges from 5.0 to 6.5.

Fig 1: Location of the Study Area



Source: SOI, Topographical Map; Administrative Atlas,

II. Data Base And Methodology

Ranges of qualitative and quantitative information have been collected for the preparation of the present paper from different sources. The Most important secondary sources are statistical handbooks (2010-11) and Economic review of Birbhum district, collected from the office of P.A.O., Suri, and Birbhum. The other important sources are agricultural Census (2010-11); some unpublished records have also collected from the Directorate of Agriculture, West Bengal. Basic maps have been extracted from plates and atlases published by

the NATMO, Govt. of India Salt lake, Kolkata. Changing land use pattern has been shown and cropping intensity has been extracted by conventional principles and also the nature of crop diversification is examined through changes in allocation of land towards the cultivation of different crops, in different season throughout the year. The most commonly used method by J. Singh's (1976) has been used here.

Table 1: District profile at a glance on Agricultural point of view

Particulars	Approx. Area in '000 hectares
Reporting area	451.12
Cultivable area	333.28
Area under non-agricultural use	96.82
Barren and uncultivable land	0.28
Permanent pasture and other grazing land	0.18
Cultivable waste land	3.88
Fallow land other than current fallow	2.37
Current fallow	12.34
Forest area	15.85
Land under misc. tree groves and not included in net area	0.86
Net Cropped Area	318.5
Gross Cropped Area	560.8
Area sown more than once	242.3
Cropping Intensity	176
Net Irrigated Area	315.93
Gross Irrigated Area	539.6
Rainfed Area	21.04

Source: District Statistical Hand Book, (2010-11), Birbhum, CDAP, Birbhum, 2010.

III. Results and discussion

• Existing (Spatio-Temporal) pattern of land utilization (2010-11)

Economic and cultural activity on the land has been the major concern for classifying land and its utilization, which is essentially a qualitative rather than a quantitative phenomenon. As, the study of Land utilization is of prime concern to a geographer to know the relationship between man and natural environment, the proper stress has been given to the various aspects of the nature and pattern of land use especially on crop land use pattern. Census of India, have classified land utilization in nine different categories, but, in the present study these have been grouped into five major land use categories, for the convenience of the study. These are-

- (a) Forest Area,
- (b) Land under non-agricultural use,
- (c) Other cultivated land excluding fallows,
- (d) Fallow land,
- (e) Net area sown.

Table-2 Land Utilization of Ajay-Mayurakshi Interfluve, Birbhum District (2010-11)
(Area ('000 hectrs. as of Total Reporting area)

Sl. No	Blocks	Forest Area	Land Under Non-Agricultural Use	Other Cultivated land excluding fallows	Fallows	Net Area Sown
1	Suri-I	8.8	2.69	5.11	10.91	72.48
2	Suri-II	1.7	17.84	4.01	1.05	75.41
3	Sainthia	0.73	21.81	1.37	0.13	75.97
4	Dubrajpur	8.68	6.59	2.93	5.52	76.28
5	Khoyrasol	3.47	10.36	3.69	3.18	79.3
6	Rajnagar	9.38	11.11	9.57	8.81	61.14
7	Bolpur-Sriniketan	1.2	2.01	1.05	1.61	94.13
8	Illambazar	8.33	Negligible	0.98	2.5	88.19
9	Labpur	N	Negligible	0.68	2.07	97.25
10	Nanoor	N	27.38	0.78	0.05	71.8
	District	3.08	9.72	2.6	3.74	80.87

Source: District Statistical Hand Book, (2010-11), Birbhum District, West Bengal CADP, Birbhum, 2010.

Forest Area

It includes all areas of natural forests and scrubland whether reserved, unreserved or protected or administered as a forest under legal enactment. Forest area of the Ajay-Mayurakshi interfluves occupies 9091.94 hectares of land, in which Dubrajpur and Rajnagar blocks covered 4529.2 hectares (50.26% of the total interfluves) of land.

Land under Non-Agricultural Use

There are two sub-categories under this category, Barren and Uncultivable Wasteland and Land put to non-agricultural use, such as, Area occupied by settlements, roads, railways and area under water. This category covers almost 9.84 percent of the total geographical area of the study area (2010-11).

Other Cultivated land excluding Fallows

This category consists of Permanent pastures and Grasslands, Miscellaneous trees and groves, Cultivable Wasteland. Permanent Pastures covers 1920.75 hectares (0.74%), Land under miscellaneous trees and groves covers 1104.34 hectares (0.42%) and Cultivable Wasteland covers 3389.33 hectares (1.30%) of the total geographical area of the district (2010-11).

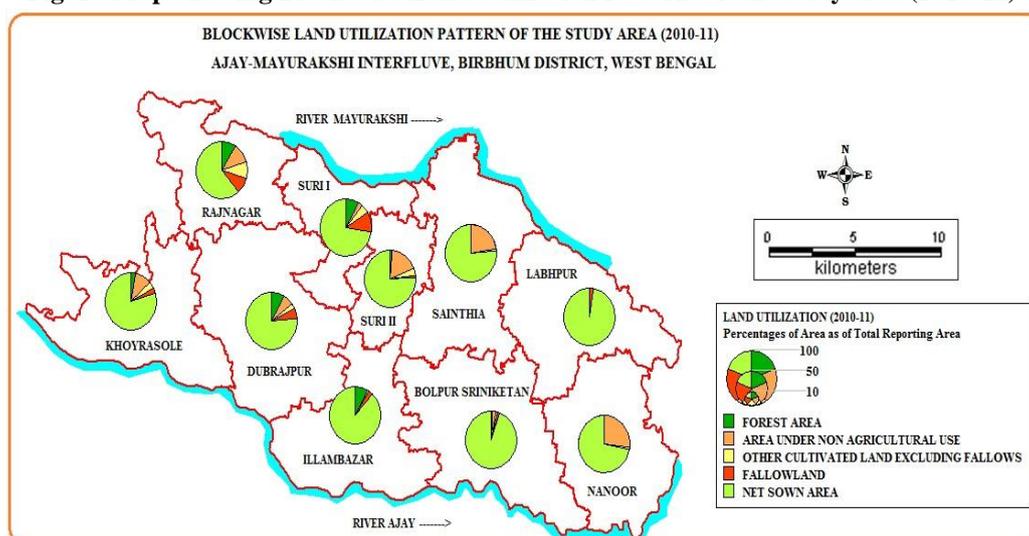
Fallow land

This category of land use consists of two sub-categories, such as, Fallow land other than current fallow and current fallow land. Fallow land other than current fallow covers almost 3370.27 hectares (1.29%) and Current Fallow land covers 3978.53 hectares (1.52%) of the total geographical area.

Net Sown Area

This category of land use shows the extent of cultivated area or net sown area during a year. During the year 2010-11, the Net Sown Area accounted for 183323.06 hectares, which is 70.25 percent of the total reporting area of the whole district.

Fig. 2 : Map Showing Block-wise Land Utilization Pattern Of the study area (2010-11)



Cropping Intensity

The cropping intensity implies a farming region, where more than crops are raised in a single year (Singh, 1979). The rapid growth of population has been creating an immense pressure on land resources. Land is becoming inextensible; therefore, intensification of cultivated area is the only alternative measure for increasing agricultural production. Cropping pattern mainly depends on mainly physical, technological and institutional factors, such as, favourable climate, irrigation facilities, agricultural mechanization, use of chemical fertilizers, pesticides, insecticides, use of HYV seeds etc. Impact of these factors helps to transform land use efficiency, which means the degree of extent to which the Net cultivated area to the net sown area, gives a measure of land use efficiency, in other words, may be termed as cropping Intensity. This index provides a measure of land use efficiency, which may defined as the extent to which the net sown area is cropped or re-sown. Therefore, higher the index of cropping intensity, higher the land use efficiency and lower the index, lower is the land use efficiency and less utilised or underutilized the net sown area. Index of cropping intensity (CI) has been calculated on the basis of the principle below-

$$CI = \frac{GCA}{NCA} * 100$$

Where, GCA stands for Gross cropped area and NCA for the Net area sown.

The district as a whole has Cropping Intensity of 163.1 in the year 2010-11. Table (3a) indicates the cropping intensity of ten C.D. blocks of Ajay-Mayurakshi Interfluvium, for the year 2010-11.

Table- 3a) and 3b) Status of Cropping Intensity in Ajay-Mayurakshi Interfluve (2010-11) Table- 3a)

Sl No.	Blocks	Cropping Intensity (%)
1	Suri - I	155.4
2	Suri - II	144.1
3	Sainthia	179.3
4	Dubrajpur	143.9
5	Khoynasole	127.9
6	Rajnagar	115
7	Bolpur - Sriniketan	156
8	Illambazar	152
9	Labpur	153
10	Nanoor	185.5

Table – 3b)

Class	Range	Blocks
High	> 160	Sainthia, Nanoor
Medium	130-160	Suri- I, Suri - II, Dubrajpur, Bolpur-Sriniketan, Illambazar, Labpur
Low	<130	Khoynasol, Rajnagar

Source: Calculated by the Authors, (2014-15).

On the basis of Cropping Intensity indices, blocks have been grouped into High, Medium and Low category as under-

(i) High Cropping Intensity

Two blocks, Sainthia and Nanoor records high cropping intensity of value more than 160 due to favourable Physio-geological factors especially the presence of two main rivers Ajay and Mayurakshi and their tributaries, fertile lower alluvial soil with heavy to fine textured, medium soil-water-air relationship and high to medium Available Water Capacity, proper irrigation facilities are suitable for mainly Paddy cultivation during Kharif season. Rabi crops and Boro paddy are grown with supplemental irrigational facilities.

(ii) Medium Cropping Intensity

Six blocks, Suri I and II, Dubrajpur, Bolpur-Sriniketan, Illambazar and Labpur belongs to these category of value between 130-160, having very deep, medium textured and gravelly with high to medium available moisture capacity, soils are slightly acidic suitable for rice in Kharif season and wheat, pulse and oilseeds can be grown with the improvement of drainage condition in rabi seasons.

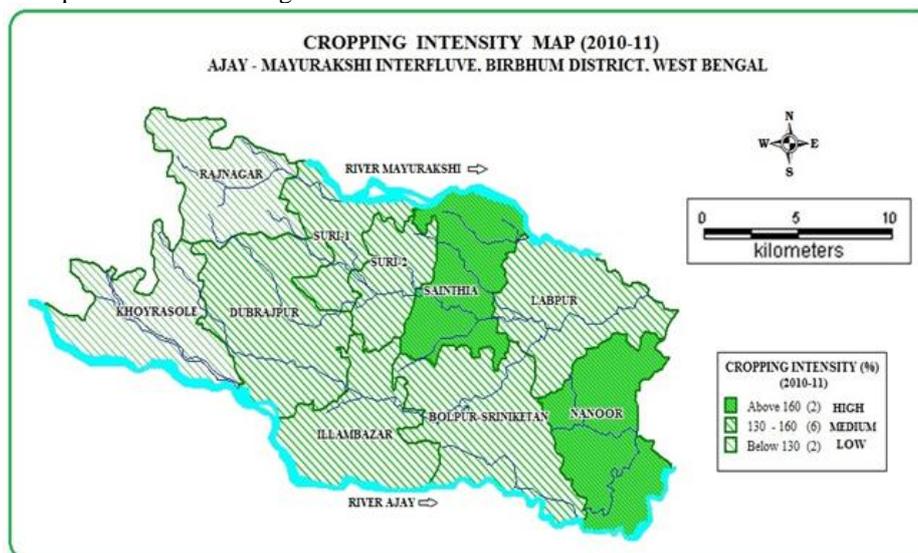


Fig. 3: Map Showing Block-wise Cropping Intensity Status (2010-11)

(iii) Low Cropping Intensity

Two blocks, Khoynasole and Rajnagar having low cropping intensity of value below 130, due to moderately shallow, gravelly and higher texture with low moisture holding capacity, partly cultivated to paddy and rainfed crops and partly are under degraded forest and shrubs forest and shrubs.

Cropping Pattern

Cropping Pattern denotes the proportion of agricultural land under different crops at a point of time. The Crop Land use analysis of the Ajay-Mayurakshi Interfluve, reveals that Kharif or Summer Monsoonal Crops, which are usually sown in the month of June/July are harvested in October/November; Rabi or Winter Seasonal Crops

are sown in October/November and harvested in March/April, together occupy almost all of the total cropped area with almost negligible area under Rabi-Summer Crops (the intermediary crops occupying the soils from March to June). Table 4a reveals that, food crops such as Kharif Paddy and Wheat dominate the other crops within the study area. The cultivation in the western part (Rajnagar, Khoyrasol, Suri I and II) is primarily rainfed and depends on monsoonal rain. Crops covering about 65% of the reporting areas are in Kharif season. Kharif crops in order to rotation are aman Rice, maize and vegetables. Rabi Crops, which occupy only 25 to 30 percent of land, in order to importance are Boro Rice, Wheat, Potato, Mustard and Gram. The Pre-Kharif of Rabi-Summer season crops is Aus paddy followed by, Maskalai and Lentil.

Table 4a): Area under Crops as Percentages of Total Cropped Area (2010-11)

ID	Blocks	Aus	Aman	Boro	Wheat	Maize	Musur	Maskalai	Gram	Mustard	Till	Potato	Sugarcane
1	Suri - I	N	60.37	5.7	7.97	N	1.61	N	3.33	12.03	1.64	7.15	0.2
2	Suri - II	N	61.34	15.81	4.55	N	1.15	N	2.43	9.67	1.32	3.61	0.11
3	Sainthia	N	51.13	21.87	7.32	N	0.87	N	0.68	8.97	1.59	8.21	0.36
4	Dubrajpur	N	68.28	9.0	10.32	N	0.82	N	0.86	5.68	1.11	3.94	N
5	Khoyrasol	N	73.13	N	14.42	N	0.008	0.12	N	6.52	1.77	3.89	0.15
6	Rajnagar	N	72.34	N	10.29	0.16	1.27	0.02	1.89	10.39	N	3.27	0.37
7	Bolpur-Sriniketan	0.4	56.62	18	4.9	N	1.24	N	2.01	8.35	2.67	5.69	0.14
8	Illambazar	0.03	54.25	30.07	4.7	N	0.96	N	1.16	4.07	1.09	3.48	0.18
9	Labpur	N	49.46	26.98	4.72	N	1.32	N	1.61	6.98	1.71	6.89	0.33
10	Nanoor	5.27	46.65	23.52	4.75	N	0.86	0.15	1.55	10.96	2.66	3.17	0.46

Source: DSHB, (2010-11), Birbhum, West Bengal. Compiled by the Author; N-Negligible

Table 4b) : Cropping Pattern in Ajay – Mayurakshi interfluve, Birbhum District, West Bengal (2010-11)

(1) ALLUVIAL REGION			
Rainfed Area	Kharif	Rabi/Winter	Rabi - Summer
(a) Undulating Upper Alluvial Plain	Paddy/Vegetables	Mustard/Wheat	Till
(b) Lower Alluvial Plain	Paddy	Musur/Mustard/Wheat	Maskalai/Till/Fallow
(c) Flood Plain	Paddy	Musur/Mustard/Wheat	Paddy/Till/Fallow
Irrigated Area			
(a) Undulating Upper Alluvial Plain	Paddy	Musur/Mustard/Vegetables/Wheat/Potato	Vegetables/Paddy/Sugarcane
(b) Lower Alluvial Plain	Paddy	Musur/Mustard/Vegetables/Wheat/Potato	Paddy/Sugarcane/Fallow
(c) Flood Plain		Musur/Mustard/Vegetables/Wheat/Potato	Paddy/Sugarcane/Fallow
(2) LATERITIC REGION			
Rainfed Area	Kharif	Rabi/Winter	Rabi – Summer
(a) Undulating Uplands/Dissected Plateau	Paddy/Maize	Musur/Mustard/Maskalai	Fallow
(b) Moderately Sloping Pediments	Paddy	Mustard/Musur	Til/Fallow
(c) Gently Sloping Plateau	Paddy	Mustard/Lentil/Gram	Til/Fallow
Irrigated Area			
(a) Undulating Uplands/Dissected Plateau	Paddy/Maize/Vegetables	Mustard/Wheat/Pulses	Vegetables/Fallow
(b) Moderately Sloping Pediments	Paddy	Mustard/Wheat/Pulses/Potato	Maskalai/Vegetables/Fallow
(c) Gently Sloping Plateau	Paddy	Paddy/Vegetables/Pulses/Mustard/Wheat	Till/Vegetables/Fallow

Source -DSHB(2010-11), CDAP,2010, Birbhum, WB

Crop Diversification

It is an indicator of multiplication of agricultural activities, which involves basically intense competition, among various activities for space. The keener the competition, higher the magnitude of diversification, and lesser the competition, greater will be the trend towards specialization or mono-cultural farming, where emphasis is on one or two crops (Singh and Dhillon, 1984). For proper execution of agricultural planning, agricultural regionalization in meso and micro level are indispensable and in this endeavour crop diversification may play a pivotal role. Concept of Agricultural Development is a multi-dimensional concept, which includes a variety of aspects, such as, Agricultural Land Utilization, Crop Diversification and Concentration, Crop Productivity, Intensity of Cropping, Commercialization of Agriculture, maintenance of ecological balance etc. The magnitude of agricultural diversification shows the impact of physical, socio-economic and techno-organizational influents, especially physical environments. Therefore, an attempt has been undertaken to study the changing scenario of crop diversification during the year 2010-11 in the Ajay-Mayurakshi Interfluve, by employing Jasbir Singh's (1976) Index of Crop Diversification:

Index of Crop Diversification (ICD) - % of Total Cropped Area under n Crops / No. of n Crops
Where, 'n' crops are those which individually occupy 5 percent or more of the total cropped area.

Crop Diversification Indices have been computed for all the blocks in Ajay-Mayurakshi Interfluve, with the help of J. Singh's (1976) Index of Diversification are presented in Table – 5a

Table -5a: Index of Crop Diversification

Sl. No.	Name Of The Blocks	Index Of Crop Diversification
1	Suri - I	18.64
2	Suri - Ii	28.94
3	Sainthia	19.3
4	Dubrajpur	23.31
5	Khoyrasol	31.36
6	Rajnagar	31.01
7	Bolpur-Sriniketan	22.16
8	Illambazar	42.16
9	Labpur	12.58
10	Nanoor	19.6

Based on the index values, the blocks are grouped into High, Medium and Low Diversification levels. High level of Diversification are found in four blocks , namely Suri-I, Sainthia, Labpur and Nanoor; medium range of index value observed in Suri – II, Khoyrasol, Dubrajpur , Bolpur-Sriniketan and Rajnagar blocks, shows comparatively lower values. Low diversification index found in only one block, namely Illambazar.

Table - 5b): Levels of Crop Diversification

Class	Icd	Name of the Blocks	Different Crops (No.)
I	< 20 (High)	Suri - I	R (Am), R(B), W, M,P (5)
		Sainthia	R (Am), R(B), W, M,P (5)
		Labpur	R (Am), R(B), W,M,P (5)
		Nanoor	R (Au)R (Am), R(B), M,P (5)
II	20-40 (Moderate)	Suri - Ii	R (Am), R(B), M (3)
		Dubrajpur	R (Am), R(B), M(3)
		Khoyrasol	R (Am),W, M (3)
		Rajnagar	R (Am),W, M (3)
		Bolpur - Sriniketan	R (Am), R(B), M,P (4)
III	> 40 (Low)	Illambazar	R (Am), R(B) (2)

Crops: R(Am) –Aman Rice; R(Au) –Aus Rice; R(B)– Boro Rice; W – Wheat; M – Mustard; P – Potato
 Calculated and compiled by the Authors,

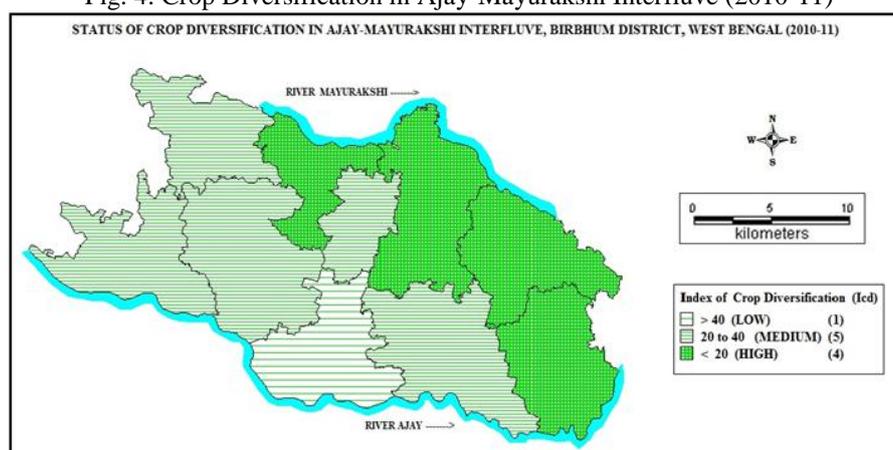
Levels of Crop Diversification in Ajay-Mayurakshi Interfluve (2010-11):

In spatial context, there is a large range of Value of crop diversification among the blocks of the interfluve. To study the pattern of crop diversification (higher is the value of the index, lower will be the degree of diversification and vice versa), three categories are high, medium and low have been considered.

(i) High Crop Diversification:

During the year 2010-11, four blocks are within this category where, Icd value ranges from 0 to 20. In Nanoor block, crop diversification is highest in this category. Five crops namely, Rice (Aus, Aman and Boro), Wheat, Mustard and Potato have been cultivated.

Fig. 4: Crop Diversification in Ajay-Mayurakshi Interfluve (2010-11)



(ii) Medium Crop Diversification

In 2010-11, five blocks have accounted such type of crop diversification and the values ranges from 20 to 40. Three important crops like Aman Rice, Mustard and Potato were being cultivated. In these blocks, dominance of Aman rice is distinctly prominent.

(iii) Low Crop Diversification

During 2010-11, Illambazar block (Icd value 42.16) has been included in the low category. In this category, Rice (both Aman and Boro) is the single crop has been cultivated. Irrigation facilities encouraged paddy cultivation during the monsoonal rain and the nature of crop diversification has been influenced by flood hazards of Ajay River.

IV. Conclusion And Suggestions

From different indices, analysis and interpretation of the above study of *agricultural land use and cropping pattern* it appears that the interfluvial commands a high status regarding agricultural activities due to favourable agro-environmental condition in the respective region. Rice is the distinctive crop in the region and less diverse combination is found within the study area. It is observed that, east-central part of the interfluvial is highly diversified and south-western part of the study area is moderately to less diversified. One single factor which has influenced the agricultural development to the higher degree is the availability of irrigation facility. So, it has been suggested from the above study that, output of all existing crops should be increased to meet the diversified consumption needs of the people. It is possible to bring sustainability in agriculture based economy of the study area, by bringing out changes in the expansion of irrigation, improving livestock production and modernization of agriculture. From the planning perspectives, the region of low development should given highest priority, because without proper planning and crop development policy of these low developed region, an all-round development of the total geographical region are not possible. An ideal land use survey and associated land use planning and development played a decisive role for land management practices and only then it will accelerated the growth of agricultural development in future.

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