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PHYSICAL FACTORS IN LAND CONCENTRATION: A CASE STUDY OF EASTERN UTTAR PRADESH

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ABSTRACT : An attempt has been made in this paper to analyse the distribution of land concentration in Eastern Uttar Pradesh at district level. Various physical factors has been taken to analyse the distribution of land concentration. In the Eastern Uttar Pradesh highest land concentration is found 0.671 in Mirzapur and 0.521 in Jaunpur districts. It has been recorded from the result of the correlation matrix and stepwise regression analysis that stream frequency and ruggedness number are the most dominant variable in explaining land concentration significant at 1% level of significance, among all selected twelve variables of physical factors.

INTRODUCTION

Indian economy is predominantly agricultural which is heavily dependent on nature. The institutional and technological factors play only secondary role. Among the natural factors the quality and quantity of land conspicuously play most significant role as it constitutes the basic resource base of the Indian agriculture. Attempts have been made by geographers and economists to focuss attention on spatial and temporal variation of agriculture, with particular reference to productivity. Neither there have been any studies regarding the conditions responsible for the uneven concentration of the land. Though the quality of land in terms of its overall fertility is undoubtedly an important parameter influencing agriculture but the quantity of the land in terms of its availability too can have a major impact on agricultural production.

The main objectives of the present study are as follows:

1. To describe the distribution of land concentration of Eastern Uttar Pradesh.

2. To analyse the variation of land concentration through physical factors.

The ginis co-efficient (land concentration) is worked out by following formula:

$$\text{Ginis co-efficient} = \frac{1}{100 \times 100} \sum_{i=1}^{n} Xi\ Yi + 1 \cdot (\sum xi + 1.\ Yi)$$

Where Xi is the cumulative percentage of household and Yi is the cumulative percentage of area.

The physical parameters have been computed by using the following methods:

a) Drainage Density = $\frac{\text{Total Stream Length (Miles)}}{\text{Total Area (p. sq. Miles)}}$

b) Contour line or spot heights which have maximum height have been taken for identifying absolute relief.

c) Relative Relief = Maximum height – Minimum height.

d) Stream Frequency = $\frac{N}{A} = \frac{\text{Total No. of Streams}}{\text{Area}}$

e) Slope = $\frac{\text{Average No. of Contours crossing per mile x Contour-interval}}{\text{3361 (Constant)}}$

f) Soil Rating index has been calculated adopting the storie been collected from S. P. Ray Chaudhury's articles – Rating of Soils of India.

g) Moisture Index, Aridity Index Humidity Index and Rainfall data have been collected from the Renewable Resources in India by C. S. R. D./S. S. S., J. N. U., New Delhi, 1980.

h) Ruggedness Number = $\frac{\text{Drainage Density x Relative Relief}}{5280}$

i) Dissection Index = $\frac{\text{Relative Relief}}{\text{Absolute Relief}}$

LAND CONCENTRATION (GINIS CO–EFFICIENT)

Ginis co-efficient is the concentration of operational holdings in preference to the land. It provides the level of inequality in the distribution of an attribute (Cumulative percentage of household) in relation to the other attribute (cumulative percentage of area).

The gini's co-efficient (land concentration) ranges from 0.521 to 0.671 in Jaunpur to Mirzapur District respectively. Firstly at low peak gini's co-efficient ranges from 0.521 to 0.559 and then increases to 0.578. Keeping all the reservations in mind one is still left wondering why gini level is so much fluctuating from one district to another. For example District Allahabad (0.598), Azamgarh (0.599), Ballia (0.613) and Mirzapur (0.671) fall within the some gini's range though located in contrasting physical terrain which gives a wrong picture as for as land concentration is concerned. To normalize the gap of gini's co-efficient quartiling method has been adopted that is why the first range is subsumed at this level. Thus to analyse the type of patterns in ginis co-efficient it is divided into four segments by quartiling method which are discussed below:

High land concentration is seen (Table 1) in Mirzapur (0.671), Allahabad (0.598), Ballia (0.613) and Azamgarh (0.599) districts medium land concentration is observed in Gonda (0.587), Sultanpur (0.578), Varanasi (0.588) and Basti (0.594) districts. In the segment of low land concentration falls Bahraich (0.563), Gorakhpur (0.559), Deoria (0.577) and Ghazipur (0.569) district. Very low land concentration districts are Faizabad (0.545), Pratapgarh (0.535) and Jaunpur (0.521).

PHYSICAL FACTORS IN LAND CONCENTRATION

The physical factor influences land concentration. In the physical factors various parameters of relief, drainage, soil and climate are studied which are as follows:

1. Drainage Density
2. Absolute Relief
3 Relative Relief
4. Stream Frequency
5. Slope
6. Soil Rating Index
7. Moisture Index
8. Humidity Index
9. Aridity Index
10 Rainfall
11. Ruggedness Number
12. Dissection Index

In this analysis the relationship of above mentioned physical variables with land concentration is explained through correlation co-efficient. The explanatory power of above variables in relation to land concentration is assessed with the help of stepwise regression.

1. DRAINAGE DENSITY

Drainage lines are essential for strengthening agricultural base of an area as the arteries are essential to circulate the blood in the body. The perenial drainage system is obviously more useful as it provides water through out the year. The drainage density is defined as length per unit area which has more values in the southern part of the region and decreases towards north. In this region drainage density varies from 0.20 per sq. mile in Basti District to 2.82 per sq. mile in Mirzapur district as given in Table 1. High drainage density (more than 0.28 per sq. mile) is observed in Mirzapur, Allahabad, Faizabad, Ballia, Pratapgarh, Jaunpur, Deoria and Ballia District. Low drainage density (less than 0.28) per sq. mile) is found in Ghazipur, Varanasi, Gorakhpur, Bahraich, Azamgarh, Gonda and Basti districts. There is significant positive correlation between land concentration and drainage density significant at 1% level of significance as given in the Table 2 because high number of drainage lines provide more scope for extensive agriculture leading to high concentration of land holdings.

2. ABSOLUTE RELIEF

The absolute relief in the Eastern Uttar Pradesh has a value of 1375 feet in Mirzapur in south and low absolute relief 142 feet in Gorakhpur in north contour of 1250 feet may be taken as a demarcating (Table 1). The land concentration values seem to be higher in the high absolute relief, one because of high relief and disrupted topography land concentration is high. The people are owning the land but cannot afford much technological use as afforded in Israel and other countries. Thus few rich people are land holder. There is significant positive correlation between land concentration and absolute relief.

3. RELATIVE RELIEF

The relative relief has a close relationship with land concentration. There is 1% significant positive correlation between these two variables because it leads to undulated surface which is difficult to plough and other technological inputs cannot be properly used. The relative relief is high in Mirzapur and low in Gorakhpur district.

4. STREAM FREQUENCY

Stream frequency is referred as number of drainage lines per unit area. The stream frequency is seen high in high land concentrated districts. There is significant positive correlation between stream frequency that may provide good water potentialities for agriculture. But it is to be noted that higher frequencies are observed on hill slopes where land concentration is high.

TABLE 1 : EASTERN UTTAR PRADESH PHYSICAL FACTOR

S. No.	Districts	Drainage Density	Absolute Relief	Relative Relief	Stream Frequency	Slope in Degrees	Soil Rating Index	Moisture Index	Humidity Index	Aridity Index	Rainfall in mm.	Ruggedness Number	Dissection Index
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Allahabad	0.63	855	570	4.35	1.20	60.8	-33.1	16.0	49.1	976	0.068	0.67
2.	Azamgarh	0.29	130	97	5.23	1.60	64.0	-17.0	20.1	38.1	1021	0.004	0.54
3.	Bahraich	0.25	245	177	4.27	2.70	64.0	-23.2	20.8	34.3	1148	0.008	0.72
4.	Ballia	0.36	158	70	5.63	1.40	61.2	- 9.0	29.2	38.2	1412	0.005	0.44
5.	Basti	0.20	208	115	4.13	2.70	64.6	-18.3	28.3	39.7	1264	0.004	0.55
6.	Deoria	0.28	219	84	2.58	1.70	61.2	-14.8	23.5	33.2	1045	0.004	0.38
7.	Faizabad	0.45	218	126	2.75	1.10	60.6	-13.2	22.8	34.8	1008	0.011	0.58
8.	Ghazipur	0.28	299	204	6.30	1.20	57.6	-10.4	25.3	36.0	1052	0.006	0.68
9.	Gonda	0.24	183	124	3.64	3.00	57.6	- 9.3	26.7	37.2	1150	0.011	0.68
10.	Gorakhpur	0.26	142	69	3.86	2.20	64.0	-18.6	27.3	39.8	1364	0.003	0.49
11.	Jaunpur	0.29	266	136	3.28	3.40	64.0	-21.8	17.8	41.3	1000	0.007	0.51
12.	Mirzapur	2.82	1375	915	10.13	7.00	60.8	-25.3	19.3	43.2	1134	0.49	0.66
13.	Pratap Garh	0.32	315	217	3.89	3.30	57.0	-28.6	20.1	42.9	978	0.013	0.69
14.	Sultanpur	0.38	196	100	1.86	2.90	68.8	-27.8	23.7	46.9	1000	0.006	0.52
15.	Varanasi	0.27	277	146	5.63	3.70	68.8	-26.9	20.0	47.9	1056	0.007	0.53

TABLE II : PHYSICAL FACTOR IN LAND CONCENTRATION RESULT OF THE CORRELATION MATk.

	Variables	Correlation	Level of Significance
Y_1	Land Concentration	1.000	–
X_1	Drainage Density	0.706	1%
X_2	Absolute Relief	0.649	1%
X_3	Relative Relief	0.633	1%
X_4	Stream Frequency	0.721	1%
X_5	Slope	0.503	5%
X_6	Soil Rating Index	- 0.015	Insignificant
X_7	Moisture Index	- 0.016	"
X_8	Humidity Index	- 0.070	"
X_9	Aridity Index	- 0.195	"
X_{10}	Rainfall	0.136	"
X_{11}	Ruggedness Number	0.718	1%
X_{12}	Dissection Index	0.049	Insignificant

5. SLOPE

The slope in southern part of the region is high and low (northern) in plain areas. There is significant positive correlation between land concentration and slope which is significant at 5% level of significance because in high number of slope region it is difficult to plough and slight rainfall leads to erosion and the moisture retaining capacity of the soil is low which are not good, for agricultural production. Thus, due to non-agricultural suitability of land, it remains much to a few households.

6. SOIL RATING INDEX

Soil rating index is the scientific system of soil evaluation. It is the determination of productivity ratings which is defined as capacity of soil to produce the crops. Soil rating index is high in low land concentrated areas and there is insignificant correlation between these two variables.

7. MOISTURE INDEX

Moisture Index is high in the northern part of the region and low in southern. There is negative correlation between these two variables which is insignificant.

8. HUMIDITY INDEX

Humidity too has a similar impact on land concentration i.e. these two have inverse relationship. The humidity index is the region ranges from 29.20 in Ballia district to 16.00 in Allahabad district. There is negative insignificant correlation between these two variables.

9. ARIDITY INDEX

Aridity index value in Eastern Uttar Pradesh varies from 33.2 in Deoria to 49.1 in Allahabad district. There is insignificant positive correlation between aridity index and land concentration.

TABLE NO. III : PHYSICAL FACTOR RESULT OF STEP WISE REGRESSION

Variables	Intercept	Regression Co-efficients	S. E.	T	R^2	Increase in R^2	$\bar{R}$	$\bar{R}^2$	F
1	2	3	4	5	6	7	8	9	10
Step 1)(4	0.3211	0.013	0.003	3.75***	0.319	–	0.721	0.519	14.084***
Step 2)(4	0.54120	0.007	0.005	1.387*	0.552	+0.033	0.742	0.539	8.358***
)(11		0.0114	0.085	1.335*					

NOTES : * Significant at 10% level of significance
*** Significant at 1% level of significance.

10. RAINFALL

The variations in the rainfall is quite considerable but rainfall and land concentration has no close association in the region as given in the Table 2. The positive relationship between rainfall and land concentration is insignificant.

11. RUGGEDNESS NUMBER

The ruggedness number in the region varies from 0.003 in Gorakhpur to 0.490 in Mirzapur district. Districts having high ruggedness number may have high land concentration because there is less possibilities of agricultural activities in ruggedness areas and there is less surity of profit, so the poorer and not the holder of land. Only few land holders are holding all lands. Thus there is significant positive correlation between land concentration and ruggedness number significant at 1% level of significance.

12. DISSECTION INDEX

Dissection index in other words in the intensity of cutting by denuding agents in a particular region. Dissection index is high in northern part of the region. There is insignificant positive correlation between dissection index and land concentration.

STEPWISE REGRESSION ANALYSIS

It is noted from the correlation analysis between land concentration and various variables of physical parameters. Among selected 12 variables 7 variables are significant. For the stepwise regression analysis it was not possible to programme all the variables. In this analysis only significant variables are selected which are as follows:

1. Drainage Density
2. Absolute Relief
3. Relative Relief
4. Stream Frequency
5. Slope
6. Ruggedness Number

The stepwise regression analysis provided encouraging results. In the first step variable x_4 (stream frequency) is entered (Table 3) and explains 32% variation in land concentration, significant at 1% level of significance. In the second step variable x_{11} (ruggedness number) is entered which explains 55% variation in land concentration with variable x_4.

The subsequent variables in stepwise regression analysis are x_4 and x_{11} which are significant in explaining the variation of land concentration, while the other insignificant variables of stepwise regression analysis are not shown in the table. In these two steps F value is found to be significant at 1% level of significance.

CONCLUSION

The total variation in land concentration is explained 55% by various set of environmental parameters. However, the interaction between the set of environmental factors and land concentration provides a clue of significance. Soil rating index, moisture index, humidity index, aridity index, rainfall and dissection index are least important in explaining variations of land concentration because of insignificance. The other environmental variables are stream frequency and ruggedness number followed by absolute relief, relative relief, drainage density and slope. Due to multicollinearity only stream frequency and ruggedness number are explaining 55% variation of land concentration significant at 1% level of significance while other variables are subsumed.

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