INTERNATIONAL RESEARCH JOURNAL OF HUMANITIES AND INTERDISCIPLINARY STUDIES
(Peer-reviewed, Refereed, Indexed & Open Access Journal)
DOI : 03.2021-11278686 ISSN : 2582-8568 IMPACT FACTOR : 5.71 (SJIF 2021)

USE OF MULTIPLE REGRESSION ANALYSIS TECHNIQUE FOR QUANTITATIVE EVALUATION OF LANDUSE IN AHMEDNAGAR DISTRICT IN 1960-61 AND 2010-11

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DOI No. 03.2021-11278686 **DOI Link ::** http://doi-ds.org/doilink/06.2021-15617172/IRJHIS2106008

ABSTRACT:

The area of Forest Cover, Net Sown Area Land Not Available for Cultivation, Fallow Land and Cultivable Waste have been converted into percentage to total geographical area are included in agricultural land use. Use of land is an important factor for planning process because of the finite nature of land resource. Ahmednagar district in Maharashtra covered an area of about 17 lakh hectare comprising nearly 73.52 percent area under net sown area in 1971-1972. The multiple regression technique have applied to find out relationship between selected agricultural landuse variables by selecting seventeen variables namely, rice, wheat, jawar, bajara, sugarcane, fruits and vegetables, fodder crops, pulses, cotton, net sown area, population density, agricultural density, irrigated area and condiments and spices. The net sown area in multiple regression points for limitations imposed by population density and agricultural density variables indicating multiple value of 0.9887.

Keywords: *Land Use, Net Sown Area, Multiple Regression*

INTRODUCTION:

Agricultural scientists, economists, geographers and many others are engaged in the study of agriculture. Utilization of land is requires proper planning for being limited resource. The cultivation of crops and their growth are closely related to the decision making process on one hand and adaptation of innovation in agriculture, i.e. use of high yielding varieties, improved and efficient instrument, applications of chemical fertilizers and pesticides. The hectare under individual crop gives relative strength and realistic picture of crop land use in the analysis of crop ranking of the region. The ranks of crops and their combination provide spatial variation in the distribution patterns. In this respect the study of crop combination and diversification manifests the present agricultural

scenario.

This study was based on the data and information to uncover the association between land use and physio-socio-economic variables in the area under review. This established association was evaluated by suitable quantitative methods for further strengthening the results. The point of view, to evaluate relationship between the variables by applied quantitative techniques in the Ahmednagar District.

The present research paper deals with the quantitative evaluation of agricultural land use pattern of the Ahmednagar District with the following objectives:

DATA SOURCE:

Secondary data has been used from Socio-Economic Reviews and District Statistical Abstracts of Ahmednagar District from 1961 to 2011. The data have been collected for various crops for the year 1960-61 and 2010-11 in both kharif and rabbi crops from taluka headquarter office, Ahmednagar District Gazetteer, Socio-Economic Abstract of Ahmednagar District and Census Handbook of Ahmednagar District are sources of data for this study. Seventeen variables were carefully selected to assess the relationship for correlation coefficients were used for finding regression.

OBJECTIVES:

1. To present a real strength of the crops covered area in the tahsil.
2. To find out the correlation between selected agricultural land use variables and environmental variables by applying correlation coefficient quantitative technique.

STUDY AREA:

Ahmednagar district in western Maharashtra region of Maharashtra state is an economically and agriculturally developed area. In 1961-62, there were thirteen tahsils in Ahmednagar district. The District 'Ahmednagar' is located middle part of the bank of Godavari and Mula river. This lays between 18°02′ North 19°09' North to 73°09′ East 75°05′ East longitude with an area of 1701836 hectors of land and in Thirteen tahsils as per 1971-72 District gazetteer. It has an average elevation of 549 metres (1,801 ft) from mean sea level Physiography, rainfall, soil, temperature, and drainage influences on agricultural land use pattern in this district. Rainfall varies between 508 to 635 mms annually. The underline basalt on disintegration and decomposition brought various agents had yielded three kinds of soils viz. Deep black, deep & shallow Alluvial soils in Pravara, Mula and Seena river basins. These rivers are main irrigation source of middle district areas. The rainfall is mainly due to rain shadow area in term of amount of rainfall average receives 571.5 mms in western and middle part of district but southern part of district six tahsil are totally drought prown area. Therefore these areas are mostly hilly and unirrigated. The variation in amount of rainfall & type of soil exerts influence on the Land use pattern of the study region in 1960-61 to 2010-11.

METHODOLOGY:

Multiple Regression Analysis:

When the focus was on the relationship between dependent variable and multiple independent variables, Regression Analysis has applied to identify degree of association between variables. More specifically, regression analysis helps to understand how the typical value of the dependent variable changes when any one of independent variables varies, while the other independent variables are held fixed. Most commonly, regression analysis estimates the conditional expectation of the dependent variables given the independent variables. In regression analysis, it is also of interest to characterize the variation of the dependent variable around the regression function which can be described by probability distribution. Regression analysis is widely used for prediction and forecasting. A line in a two dimensional or two-variables space defined by the equation $Y=a+b * X$; the Y variable can be expressed in terms of a constant (a) and a slope (b) times the X variable. The constant also referred to as the *intercept*, and the slope as the *regression coefficient* or *Bcoefficient.*

$$Y = a + bX$$

Whereas ; X , Y = variables,

a = constant, b = slope

Table 1: Variables and Symbols Used

Sr. No.	Variables	Symbols used
1	Percentage of net sown area to total geographical area	NSA
2	Population density	Pd
3	Percentage of irrigation to net sown area	IR
4	Agricultural density	Ad
5	Percentage of Bajra to NSA	Bj
6	Percentage of Jawar to NSA	Jw
7	Percentage of Wheat to NSA	Wh
8	Percentage of Oilseed to NSA	Os
9	Percentage of Pulses to NSA	Pl
10	Percentage of Cotton to NSA	Co
11	Percentage of Rice to NSA	Ri
12	Percentage of Vegetables to NSA	Veg
13	Percentage of Fodder crop to NSA	Fo
14	Percentage of Sugarcane to NSA	Sc
15	Percentage of Fruits to NSA	Fr
16	Percentage of Maize to NSA	M
17	Percentage of Condiments and Spices	Cs

(Source: by the research student)

The degree of correspondence between several variables in correlation coefficient is obtained by computing multiple regressions.

$$Y = a + b1X1 + b2X2 + b3X3 + \ldots\ldots + bnXn$$

Multiple regressions have been computed to obtain the degree of correspondence between several variables in correlation coefficient. The variables found significant in correlation coefficient have been taken into account, here, to compute multiple regressions. In the correlation coefficient analysis variables namely net sown area, population density, irrigation, agricultural density, bajra, jawar and wheat shows significant correlation. Hence these seven variables were selected to compute the multiple equations for area under study. The following symbols are used in interpreting the result of multiple regressions is given in Table 1.

1: Net Sown Area:

The variable, net sown area has given a high multiple correlation value of 0.9887 for the area under study. In this regression set variables like Population density(Pd), Irrigation (Ir), Agricultural density(Ad), Bajra(Bj), Jawar (Jw), Wheat (Wh), Oilseeds (Os), Pulses (Pl), Cotton (Co) and Rice (Ri)were included.

The equation for net sown area was as follows;

NSA=50.129 -0.012Pd +0.254Ir +0.929Ad -0.698Bj -0.332Jw -1.790wh -0.450Os -0.849Pl -1.216Co -2.355Ri

$R^2 = 0.9776$

R = 0.9887

Se = 4.5150

The above equation and 't' statistics reveals that the population density, area under bajra, jawar, wheat, oilseed, pulses, cotton and rice largely depends on net sown area, while net sown area was associated with irrigation, agricultural density.

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.9887
R Square	0.9776
Adjusted R Square	0.9029
Standard Error	4.5150

Observations	14

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	2667.50	266.75	13.09	0.03
Residual	3	61.15	20.38		
Total	13	2728.66			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	50.13	13.99	3.58	0.04	5.61	94.65	5.61	94.65
X2	-0.01	0.04	-0.31	0.78	-0.13	0.11	-0.13	0.11
X3	0.25	0.05	4.88	0.02	0.09	0.42	0.09	0.42
X4	0.93	0.13	6.96	0.01	0.50	1.35	0.50	1.35
X5	-0.70	0.09	-8.08	0.00	-0.97	-0.42	-0.97	-0.42
X6	-0.33	0.11	-3.11	0.05	-0.67	0.01	-0.67	0.01
X7	-1.79	0.38	-4.71	0.02	-3.00	-0.58	-3.00	-0.58
X8	-0.45	0.24	-1.90	0.15	-1.20	0.30	-1.20	0.30
X9	-0.85	0.17	-5.00	0.02	-1.39	-0.31	-1.39	-0.31
X10	-1.22	0.29	-4.26	0.02	-2.12	-0.31	-2.12	-0.31
X11	-2.36	0.81	-2.90	0.06	-4.94	0.23	-4.94	0.23

2: Population Density:

This variable as a population density shows spatial variations. Multiple regression analysis shows that variables like Agricultural density (Ad), Jawar (Jw) shows a high degree of association with population density. Population density has given high multiple correlation value of 0.9091 for the study area. Population density was associated with Net Sown Area, Irrigation, Agricultural density, Bajara, Wheat, Oilseeds, Pulses and Cotton.

The equation for population density was as follows;

Pd = 140.834 +0.986NSA +0.216Ir -0.581Ad +0.463Bj -0.671Jw +3.814Wh +3.547Os +0.906Pl +1.977Co.

$R^2 = 0.8265$

R = 0.9091

Se = 61.9779

3: Irrigation:

The variable, percentage of irrigation to net sown area has given a high multiple correlation value of 0.9836 for the area under study. In this regression set variables like Net Sown Area, Population density, Agricultural density, Bajra, Jawar, Wheat, Oilseed, Pulses, Cotton, Rice and Vegetable were included.

The equation for irrigation was as follows;

IR = -111.162 +3.311NSA -0.033Pd -3.300Ad +2.362Bj +0.719Jw +5.759Wh +2.2030Os +3.079Pl +3.861Co +5.856Ri -1.753Veg.

R^2 = 0.9675

R = 0.9836

Se = 19.4596

The above equation and 't' statistics reveals that the percent of Net Sown Area, Bajra, Jawar, Wheat, Oilseed, Pulses, Cotton and Rice associated with Irrigation while Population density, Agricultural density and Vegetable were largely depends upon irrigation.

4: Agricultural Density:

This variable as an agricultural density shows spatial variations. Multiple regression analysis shows that variables like irrigation and percentage of vegetable have governed the Agricultural density and Net Sown Area, Population density, Jawar, Wheat, Oilseeds, Pulses, Cotton and Rice shows a high degree of association with agricultural density. Agricultural density has given high multiple correlation value of 0.9931 for the study area.

The equation for agricultural density was as follows;

Ad = 38.835 +1.001NSA +0.004Pd -0.278Ir -0.718Bj +0.267Jw +1.790Wh +0.618Os +0.922Pl +1.208Co +2.044Ri -0.336Veg.

R^2 = 0.9864

R = 0.9931

Se = 7.0196

5: Area Under Bajra:

The variable, area under bajra has given a high multiple correlation value of 0.9891 for the area under study. In this regression set variables like Net Sown Area (NSA), Population density (Pd), Irrigation (Ir), Agriculture density (Ad), Jawar (Jw), Wheat (Wh), Oilseed (Os), Pulses (Pl), Cotton Co), Rice RI) and Vegetable (Veg) were included.

The equation for area under bajra was as follows;

Bj = 60.138 -1.361NAS +0.002Pd +0.361 Ir +1.304Ad -0.395Jw -2.483Wh -0.761Os -1.213Pl -1.686Co -3.087Ri +0.397veg.

R^2 = 0.9784

R = 0.9891

Se = 7.6122

The above equation and 't' statistics reveals that the net sown area, percent of Jawar, Oilseed, Pulses, Cotton and Rice were associated with Bajara while Population density, Irrigation, Agricultural density and Vegetable were largely depends upon area under bajra.

6: Area Under Jawar:

The variable, area under jawar has given a high multiple correlation value of 0.9871 for the area under study. In this regression set variables like Net Sown Area (NSA), Population density (Pd), Irrigation (Ir), Agriculture density (Ad), Bajara (Bj), Wheat (Wh), Oilseed (Os), Pulses (Pl), Cotton Co), Rice RI) and Vegetable (Veg) were included.

The equation for area under bajra was as follows;

Jw = 134.182 -1.409NSA -0.141Pd +0.277Ir +1.225Ad -0.997Bj -2.953Wh +0.096Os -0950Pl -2.177Co -5.713Ri -1.915Veg

R^2 = 0.9745

R = 0.9871

Se = 12.0869

The above equation and 't' statistics reveals that the Net Sown Area, Population density, Bajara, Cotton, Rice and Vegetable were associated with Jawar while Irrigation, Agricultural density and Oilseed were largely depends upon area under bajra.

7: Area Under Wheat:

The variable, area under wheat has given a high multiple correlation value of 0.9828 for the area under study. In this regression set variables like Net Sown Area (NSA), Population density (Pd), Irrigation (Ir), Agriculture density (Ad), Bajara (Bj), Jawar (Jw), Oilseed (Os), Pulses (Pl), Cotton Co), Rice RI) and Vegetable (Veg) were included.

The equation for area under bajra was as follows;

Wh = 24.505 -0.495NSA -0.001Pd +0.127Ir +0.469Ad -0.358Bj -0.169Jw -0.236Os -0.432Pl -0.654Co -1.237Ri +0.058Veg.

R^2 = 0.9660

R = 0.9828

Se = 2.8913

The above equation and 't' statistics reveals that the Irrigation, Agricultural density and percent of Vegetable were associated with Jawar while Net Sown Area, Population density, Bajara, Jawar, Oilseed, Pulses, Cotton and Rice were largely depends upon area under bajra.

CONCLUSION:

- The multiple regression technique have applied to find out relationship between selected agricultural land use variables by selecting seventeen variables namely, rice, wheat, jawar, bajara, sugarcane, fruits and vegetables, fodder crops, pulses, cotton, net sown area, population density, agricultural density, irrigated area and condiments and spices.
- The net sown area in multiple regression points for limitations imposed by population density and agricultural density variables indicating multiple value of 0.9887.
- Population density shows multiple correlation value of 0.9091 for limitations imposed by net sown area and irrigation.
- Irrigation shows high multiple correlation value of 0.9836.
- Agricultural density and bajra in multiple regressions Points for limitations imposed by net sown area and population density variables indicating multiple values of 0.9931 and 0.9891.
- Jawar reveals high degree of association with population density and irrigated area of value of 0.9871.
- Wheat reveals high degree of association with population density and irrigated area of value of 0.9828.

REFERENCE:

1. Ali Mohammad, 1979, "Dynamics of Agricultural Development in India" (Ed.), Concept Publication, New Delhi.
2. Anderson, J.R., 1970, "Geography of Agriculture Wm." Brown Company, Dubuane, Iowa (U.S.A.).
3. Basu, S., 1988, "Landuse in Malkauria village- A Case Study in Banker District", Geographical Review of India, Calcutta, Vol. 50 No.5.
4. Bhatia, S.S. 1965, "Patterns of Crop Concentration and Diversification in India", Economic Geography. Pp 471
5. Bhatia, C.R. 1981, "Changing Landuse and Cropping Pattern in Bihar", Perspective in Agricultural Geography, Concept Publication, New Delhi.
6. Das, M.M., 1984, "Crop-Combination Regions of Assam" A Quantitative Analysis", National Geographer of India, Varanasi, Vol. 30 No. 3.
7. Government of India, 1976, Gazetteer of Ahmednagar District.

8. Government of Maharashtra, 1961, 1971, 1981, 1991, 2001, 2011 Socio- Economic Abstract, Ahmednagar District.
9. Hussain, M., 1996, "Systematic Agricultural Geography", Rawat Publication, Jaipur and New Delhi.
10. Hussain, M., 1972," Crop Combination Regions of Uttar Pradesh: A Study in Methodology", Geographical Review of India, Calcutta, 38/1.
11. Shastri, P., 1981. "Changes in Landuse and Cropping Pattern in Cotton Belt of Vidharbha", Perspective in Agricultural Geography (Ed.), Noor Mohammed, Concept Publication, New Delhi.
12. Singh, B.B., 1967, "Landuse and Cropping Pattern and their Ranking", National Geographical Journal of India, Varanasi, 13/2.
13. Singh, J.and Dhillon, S.S., 1984, "Agricultural Geography", Tata- Mcgraw-Hill, Publishing Company Limited, New Delhi.
14. Singh, J., 1976, "Agricultural Atlas of India", Vishal Publication, Kurukshetra, Haryana.
15. Kuniyal, J.C., 1987, "Crop Concentration and Diversification in Nainital District, Uttar Pradesh", Himalaya, National Geographical Journal of India, New Delhi, 33/2.
16. Noor Mohammad, 1970, "Crop Combination in Trans-Ghagara Plain", Geographical Review of India, Calcutta, 32/1.
17. Weaver, J.C. (1954): "Crop Combination Regions in the Middle West", The Geographical Review", Vol.44 (2), pp.176-181.