Pattern Identification of Land use and Resource use efficiencies in Agriculture in Jhabua Tribal district in Madhya Pradesh

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Abstract

In the fifties and sixties of 20th century, the regional economists identified a regional process of circular and cumulative causation of under- development of resource-rich but backward regions (Myrdal) and core-periphery relation of developed industrial regions with resource hinterland regions (Friedman). In the seventies, environment and development conflicts were identified leading to ecological and socio-economic degradation in the resource regions. In the regional framework, the tribal regions as sub-national regions have come under serious anthropogenic impacts due to increasing demands for resource materials for trade and industries.

Growing awareness of environmental degradation and depletion, the policy makers, planners, environmentalist and economists have focused their attention to examine the efficiencies of land use and the resource use in agriculture, identifying the ecological and economic efficiencies of the resource use pattern. Agriculture, being an organic economic activity, has a close relation with the natural resources like land and water.

The tribal ecology is changing and the tribes have gradually adapted to agriculture activities and a distinct agro-ecosystem has grown in tribal areas. The tribes are trying to diversify the resource use for their ecological and economic sustenance. The government is also influencing resource use and land use as development strategy in the tribal region. It is necessary to examine the land use and the resource use efficiencies in the agricultural areas in regional and temporal framework. Land use and resource use efficiencies have been measured to evaluate ecologic and economic efficiency and growth in agriculture. Since, agriculture operates in system dynamic framework in which agriculture has close relation with other uses like forestry in ecological landscape in eco-regional framework and is affected by climatic change and other anthropogenic impacts resulting from industrialization and urbanization. it is necessary to identify the land use and resource use efficiencies in agriculture in the tribal eco-system.

Along with land, other natural resources like water are important in agriculture. The efficiency of irrigation may be an indicator to identify the use of water resource and its efficiency in agriculture. The land use and irrigation intensity are used as an indicators for measuring land use and resource use efficiency in this study.

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In this paper, the land use intensity has been measured by

(1) Analysis of the land use extension in agriculture in different tahsils of Jhabua district to identify the level of resource use in different regions.

(2) The land use and irrigation intensity has been used as measure of resource use intensity and efficiency in different tahsils in study area

(3) The agricultural land use efficiency has been measured using standard coefficient, which is a modified Kendall's Ranking Coefficient method for agricultural land use zoning based on land use efficiencies

1. Introduction

Jhabua district is situated in the western-most part of Madhya Pradesh. It lies on a spur on the Vindhyas and along the western boundary of Malwa Plateau. The ridges and hills of the Vindhyan range traverse the district in the west and with a north-south trend. The north-east part of the district particularly Thandla and Petlabad ranges constitute Malwa plateau. The average elevation is 430 meters with a slight gentle slope towards north-west, west and south-west. The entire tract is wide and open with rolling plains of grazing lands alternating with fields of black cotton soil.

The district boarders with Banswara district of Rajasthan in north-west, Panchmahal and Vadodara districts of Gujrat in west, Dhulia district of Maharastra and West Nimar of Madhya Pradesh of south, Dhar district in east and Ratlam district .

Agriculture land use has grown over a long period of time in the district. However, the district is facing serious drought problem negatively affecting agricultural land use and resource use efficiency. Since, tribal areas are environmentally sensitive and lifecycle fragile, increasing the resource use efficiency in agriculture will not only increase the agricultural productivity, but also lead to eco-regeneration and reduce anthropogenic pressure on the forest cover.

In this paper, an attempt is made to study the regional pattern of land use and resource use and their efficiencies in Jhabua district with a view to identify the resource use efficiencies in different sub-regional agricultural zones of the study area. The variation in resource use efficiencies during 1990-91 and 2004-05 would indicate whether resource use and agricultural land use efficiency is increasing or not?

Generally, methods of land use and resource use efficiencies have been applied for specific production systems like specific crop system, animal farming, land use and land degradation and regionalisation of agricultural systems. Whereas Jain (1996), Koppad, et. al. (1997) used resource use efficiency for rain- fed paddy and maize crops respectively by using Cobb-Douglas Production Function as a measure of resource use efficiency, the same technique is used for sheep and goat farming in Himachal Pradesh by Thakur, D.R. et. al. (1997). , Thakur, D.C. et. al. (2001) also used Cobb-Douglas Production Function method for measuring resource use efficiency in all crops in different altitudes in Himanchal Pradesh.

Land use and resource use efficiencies are also measured with a view to identify the levels of land use and resource utilization in agriculture for taking resource use and land use policies in different regions. Sharma et. al. (1997) studied the environmental problems in resource use in Hariyana taking land degradation as an indicator. Pragathi et. al. (1999) used

modified Kendall's Ranking Coefficient Method as standard coefficient for measuring agricultural land use efficiencies for different districts of Andhra Pradesh for regionalization of agricultural zones for planning purpose.

Agriculture land use and resource use efficiencies have been measured for 8 tahsils of Jhabua district for the period 1990-91 and 2004-05 to identify regional and temporal variations.

2. Objectives, Methodology and Techniques used

2.1 Objectives

(1). To identify the pattern diversities in land use in different tahsils to indicate the regional variation in land use pattern.
(2). To evaluate the variation in resource use efficiencies in agriculture in regional and temporal framework.
(3). To evaluate the regional and temporal variations in agricultural land use efficiencies in Jhabua district.

2.2 Methodology

The resource use efficiencies in agriculture have been calculated using land use intensity and irrigation intensity for the periods 1990-91 and 2004-05 for all tahsils and the district. The agricultural land use efficiency has been calculated using standard coefficient method taking the following variables (i)Net area sown, (ii)Area sown more than once, (iii)Irrigation intensity, (iv)Area irrigated more than once, (v)Canal irrigation, (vi)Maize cultivated area, (vii)Commercial cropping area, (viii)Land not available for agriculture, (ix)Fallow land and (x)Other uncultivable area.

The methodology adopted is based on a modified Kendall's "Ranking Coefficient" method used by Reddy and Ramanaiah (1985) using standard coefficient method. The Standard Coefficient Method for measuring standard coefficient has been used by Pragathi and Ramanaiah (1999) taking ten variables related to agricultural land use for regionalization of Andhra Pradesh on the basis of standard coefficients.

In this paper the first seven variables are positive indicators, whereas the last three are negative ones. For analyzing the regional pattern of agricultural land use efficiency, the tahsils are categorized in high efficiency region (>55), moderate (40-55) and low (<40).

For calculating standard coefficients, the actual percentage of the variables of a particular areal unit are added and averaged. The average value of the variables of a component areal unit is the standard coefficient and denotes a level of efficiency. In resolving the problem of positive and negative variables, the percentage of each variable is converted into "standard value". In the case of positive variables, the highest percentage of each variable among the areal unit is taken as 100 and it is denoted as maximum standard value. With reference to this maximum standard value, the percentages of the variable of the remaining areal unit are computed proportionately to obtain the respective standard value. In case of negative variables, the least percentage of negative variables is assigned a standard value of 100. With reference to this maximum standard value, the percentages of the remaining areal

units are computed to obtain the respective standard value. It may be noted that as percentage of negative value increases, the standard value decreases.

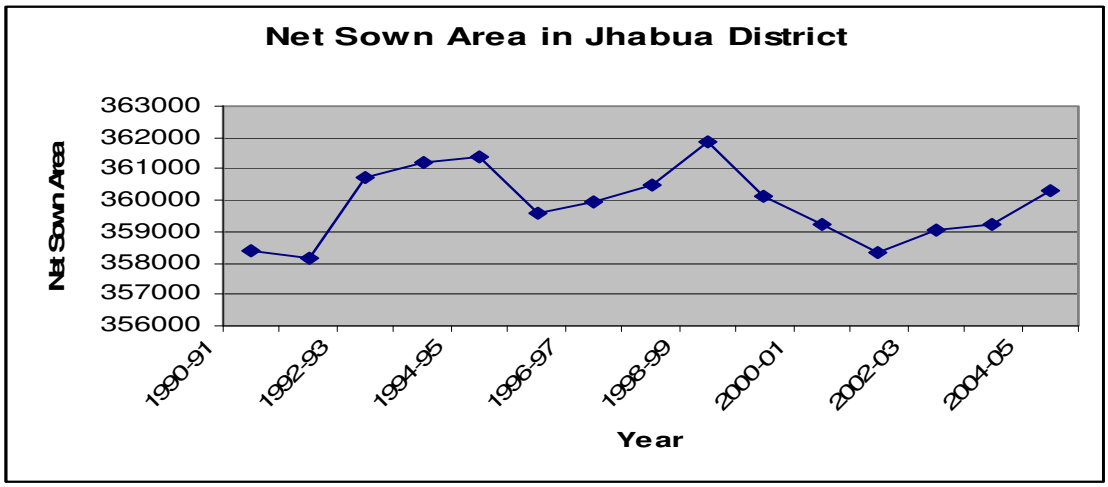
After computing standard values of both positive and negative variables of a component areal unit are added and averaged to obtain the standard coefficient which is directly proportional to the degree of agriculture land use efficiency.

3. Analysis

3.1 Land use variation in Jhabua district

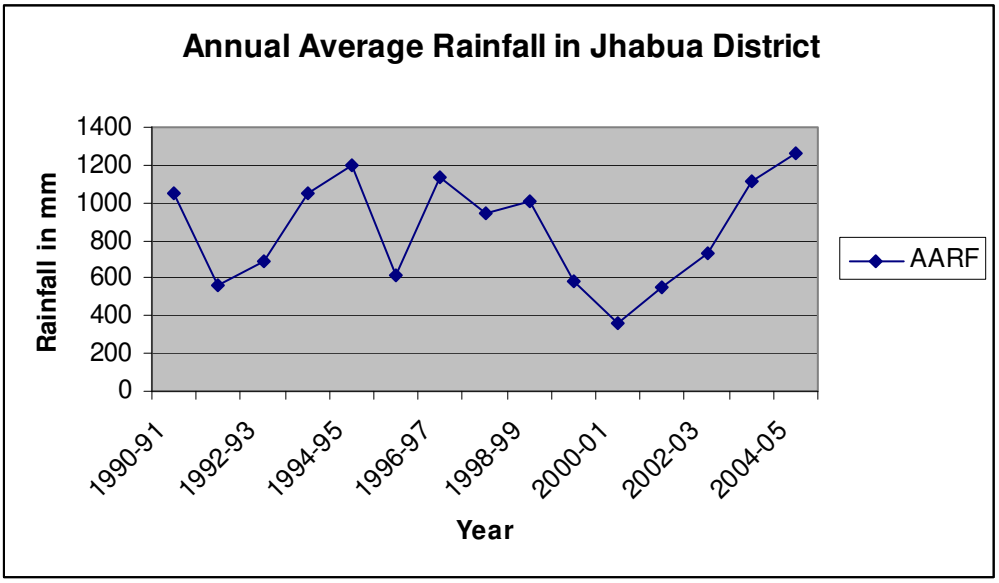
The net cultivated land was 52.76 percent of the geographical area during 1990-91 in Jhabua district, which has negligibly changed to 53.04 percent in 2004-05. As revealed by the variation in the grazing land cover, almost 30 thousand hectares of grazing land has decreased from 43 thousand hectares to 13 thousand between 1990-91 to 2004-05. During the same period, the revenue forest area decreased by almost 49 thousand hectares in the district. This shows that the forest and grazing lands are fast being substituted by agriculture use. This phenomenon reveals that, on the one hand, cultivable land has reached near saturation, on the other, the extensive agriculture land use practice has substituted forest cover and grazing land due to anthropogenic impact of population on the land use due to increasing food demand.

Figure - 1



The regional pattern of land use variation reveals that in most of the tahsils, revenue forest and grazing lands have drastically decreased between 1990-91 to 1998-99 and 1990-91 to 2004-05 respectively. The percentage of net cultivated area is higher in Ranapur, Jobat and Bhabra tahsils between 64 to 70 percent of geographical area, whereas Alirajpur, Meghnagar tahsils have less than 50 percent of net cultivated area. During 1990-91 and 2004-05, the net cultivated areas have declined in Jobat,

Figure - 2



Thandla and Ranapur tahsils and increased in Bhabhra, Alirajpur, Jhabua, Petlabad and Meghnagar tahsils slightly. This reveals the near stagnation of agriculture land use in different tahsils, whereas the population pressure on agriculture is increasing.

The data on climatic change reveals a fluctuation in rainfall condition between 1990-91 to 2004-05. The variation in rainfall reveals below normal rainfall in the district during 1991 to 1993, 1995-96, 1999 to 2003. These variations result in serious environmental problem and drought condition under which agriculture is being practiced in the district. This has a direct bearing on fluctuations in net area sown in the district during the drought periods.

3.2 Land use and resource use intensity in Jhabua district

Agricultural intensity as measured in terms of cropping intensity reveals that the cropping intensity has decreased in Bhabhra tahsil, whereas, it has slightly increased in all other tahsils between 1990-91 and 2004-05 periods. There is marginal inter-regional variation in cropping intensity. The lowest cropping intensity is in Alirajpur, whereas it was found highest in Meghnagar in both the periods of observation.

Table 1: Regional Variation in Agricultural Intensity in Jhabua District (Madhya Pradesh)

(Unit: Area in hec.)

Tahsil/ District	G.A.		Net cropped area		Agri. Intensity	
	1990-91	2004-05	1990-91	2004-05	1990-91	2004-05
Bhabra	33788	28692	21742	22028	0.64	0.77
Alirajpur	225001	173064	98141	99645	0.43	0.57
Jhabua	86377	85214	56139	56754	0.64	0.67
Jobat	70535	67085	51350	50658	0.72	0.75
Pethlabad	89642	85360	50716	51191	0.56	0.6
Thandla	44681	44602	29412	27924	0.66	0.63
Meghnagar	32425	32304	22562	23753	0.69	0.73
Ranapur	39950	39609	28355	28332	0.71	0.71
Dist.Jhabua	692329	675716	358417	360285	0.52	0.64

Source: District Statistical Handbook, Jhabua, M.P.

GA - Gross Area

The gross and net irrigated area has increased substantially between 1990-91 and 2004-05 in most of the tahsils revealing the increasing irrigation potential in the agricultural system in the district. Petlabad (33.65 %), Thandla (30.05%) and Jhabua (19.21%) tahsils have the highest net irrigated area in the district, whereas Alirajprur (8.98%) and Bhabhra (9.54%) have the lowest net irrigated land. The irrigation intensity in the district in most of the tahsils has decreased from 1990-91 to 2004-05, revealing the climatic impact and the lack of stable irrigation system in most of the areas.

Table 2 : Regional Variaton in Irrigation Intensity in Jhabua District (Madhya radesh)

(Unit: Area in hec.)

Tahsil/	Gross irrigated area		Net irrigated area		Irrigation intensity	
District	1990-91	2004-05	1990-91	2004-05	1990-91	2004-05
Bhabra	981	2101	981	2101	1.00	1.00
Alirajpur	3401	8947	3399	8947	1.0005	1.00
Jhabua	6618	10909	6572	10904	1.007	1.0004
Jobat	3443	7156	3436	7147	1.002	1.001
Pethlabad	13459	18129	12021	17224	1.119	1.053
Thandla	4918	8390	4776	8390	1.029	1.00
Meghnagar	1803	4487	1791	4419	1.006	1.00
Ranapur	2383	4519	2383	4519	1.00	1.00
Dist.Jhabua	**37006**	**64605**	**35359**	**63651**	**1.0465**	**1.0149**

Source: District Statistical Handbook, Jhabua, M.P.

3.3 Agricultural land use efficiency in Jhabua district

The agricultural land use efficiency has been calculated using standard coefficients taking 7 positive and 3 negative indicators of agricultural growth. The land not available for agriculture, fallow land and other uncultivable land are taken to be negative. As per the calculated values of standard coefficient for all the tahsils, the high agricultural efficiency

Table 3(i): Standard value and Standard coefficient of the indicators of Landuse and resource use efficiencies in Jhabua District (Madhya Pradesh)

Tahsil/	Net area sown		ASMO		Irrigation intensity		AIMO		Canal irrigation	
District	90-91	04-05	90-91	04-05	90-91	04-05	90-91	04-05	90-91	04-05
Bhabra	90.75	92.01	70.02	68.65	0	0	0.00	0.00	38.09	22.61
Alirajpur	61.53	62.53	32.64	18.94	0.45	0	0.00	0.47	40.98	27.05
Jhabua	76.01	76.90	85.52	72.28	0.63	0.76	0.50	0.63	64.50	67.41
Jobat	95.19	93.99	64.99	38.41	1.79	1.9	0.59	100.00	41.70	36.7
Pethlabad	74.75	75.52	69.98	40.57	100	100	0.17	0.00	37.43	46.17
Thandla	76.13	72.34	72.64	65.83	25.92	0	100.00	6.40	43.77	42.76
Meghnagar	63.65	66.57	100.00	100.00	5.36	0	24.83	0.00	65.34	25.34
Ranapur	100.00	100.00	89.73	65.02	0	0	5.60	0.00	100.00	100
Dist.Jhabua	74.43	74.88	65.15	38.77	41.55	28.38	38.96	12.32	49.72	47.2

regions are Petlabad and Thandla tahsils, whereas most of the other tahsils except Alirajpur were in moderately agricultural efficiency areas during 1990-91. Alirajpur tahsil was found to be of low agricultural efficiency during this period. It is found that the agricultural efficiency in Bhabhra, Alirajpur, Thandla and Meghnagar tahsils has decreased, whereas in Jhabua, Jobat, Petlabad, Meghnagar and Ranapur, it has increased. It is surprising that Thandla tahsil having highest agriculture efficiency (61.11) during 1990-91, revealed a

moderate efficiency (46.78) during 2004-05. During 2004-05, the high efficiency zones where Petlabad and Ranapur, whereas Alirajpur continued to be a low efficiency region with declining standard coefficient during the study period.

Table 3(ii): Standard value and Standard coefficient of the indicators of Landuse and resource use efficiencies in Jhabua District (Madhya Pradesh)

Tahsil/	Maize Culti. Area		CC		LNAA		Fallow land		OUCL		SC	
District	90-91	04-05	90-91	04-05	90-91	04-05	90-91	04-05	90-91	04-05	90-91	04-05
Bhabra	63.27	74.18	8.38	13.11	93.71	18.8	99.10	62.08	56.34	73.65	51.97	42.51
Alirajpur	23.31	34.70	21.08	19.42	36.00	8.97	71.43	59.11	100.00	100.00	38.74	33.12
Jhabua	76.63	80.17	56.22	64.65	62.88	14.59	51.89	71.00	8.02	60.22	48.28	50.86
Jobat	35.05	42.50	16.70	29.31	100.00	19.59	55.84	100.00	23.95	75.69	43.58	53.81
Pethlabad	47.70	64.07	100.00	100.00	36.74	100	90.91	24.16	8.95	43.78	56.66	59.43
Thandla	69.71	71.99	64.75	64.28	54.85	13.6	100.00	39.78	4.43	90.83	61.22	46.78
Meghnagar	100.00	100.00	50.40	50.24	70.59	18.87	48.67	42.38	5.73	90.83	53.46	49.42
Ranapur	63.44	78.08	44.99	50.62	65.86	15.99	52.88	95.91	10.13	68.13	53.26	57.38
Jhabua D.	51.03	63.13	44.31	47.65	53.23	17.59	74.83	49.81	14.98	85.83	50.82	46.46

ASMO- Area sown more than once
AIMO - Area irrigated more than once
CC - Commercial Cropping
LNAA - Land not available for agriculture
OUCL - Other uncultivable land
SC - Standard Coefficient

4. Conclusion

As per the foregoing analysis, it is found that extensive agricultural practices have increased during the study period, which has impacted the forest and grazing land depletion and increased environmental and natural ecologic unsustainability of agricultural practices. Though, the net cultivable land has increased in the district, the cropping intensity has not changed indicating to the lack of resource use efficiency in agriculture in the district.

The resource use efficiency in agriculture is measured through cropping and irrigation intensity. Though there is slight increase in the cropping intensity from 1.16 to 1.18, there is variation within tahsils in cropping intensity. This indicates the lack of localization of necessary resource base for agricultural intensification.

The irrigation intensity is one indicator which indicates to the resource use efficiency. The percentages of area under irrigation are very low ranging between 8.98 to 33.65 percent of the net cropped area. Petlabad and Thandla tahsils have the highest percentage of irrigated land of 33.65 and 30.05 percent to net cropped area, whereas Alirajpur and Bhabhra have the lowest irrigated land by 2004-05. The percentage of irrigated land is changing almost in all tahsils during 1990-91 to 2004-05, which indicates to the positive government policy of development of irrigation infrastructure. However, the irrigation intensity has declined in the district and in most of the tahsils indicating to the inefficiency of the irrigation system.

The agricultural land use efficiency indicates the instability of agriculture system indicated by the decline of coefficient values in most of the tahsils of the district and the district as a

whole. The standard coefficient of 50.82 during 1990-91 to 46.46 during 2004-05 indicates increasing inefficiency of agricultural land use. Alirajpur, Bhabhra, Thandla and Meghnagar tahsils have indicated decline in land use inefficiency. Most of the inefficiencies are the result of inefficiencies in resource use in these regions and calls for a serious resource use policy for conservation and development in the tribal region and high dependence on rains.

On the basis of foregoing analysis, it may be concluded that the agriculture has extended to its fullest limit even at the cost of revenue forest and grazing land. An integrated agriculture development programme would require increasing the irrigation intensity to enhance agricultural intensity and diversify the agriculture with agro-forestry and animal husbandry which will ensure agro-ecologic diversification and economic growth in the region.

An agro-ecologic balance may be ensured by intensifying resource use in agriculture along with conservation and development of forestry in geographical landscape for ensuring ecological balance and economic growth.

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