AGRICULTURAL DEVELOPMENT AND REGIONAL CARRYING CAPACITY MEASUREMENT OF AGRO-ECOSYSTEM IN JHABUA TRIBAL DISTRICT IN MADHYA PRADESH#

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ABSTRACT

The agro-ecosystem is a system composed of population, natural resources and economic activities related in a dynamic interaction in terms of socio-ecological and socio-economic relations conditioned by endogenous and exogenous factors. With time, the agro-ecosystem undergoes changes. By analyzing the agro-ecosystem dynamics over a period of time, we can plan the agro-ecosystem for higher level of production and productivity, achieving higher level of resource use and environmental efficiency and maximise food security as well as livelihood security.The Carrying capacity of agricultural ecosystem may be measured by taking production, productivity and socio-ecologic criteria. Food security, production and food availability and population and employment are used as indicators for measuring the carrying capacity of any agro-ecosystem. The carrying capacity measurement is important to check the capacity of the agro-ecosystem to support the population, the productivity changes of the ecosystem and food availability and other measures. In this paper, an attempt is made to analyze the adaptation of tribal population to agriculture and changes taking place in the agro-ecosystem and its productivity.

Introduction

Agricultural development throughout the world is being recognized as one of important method of organic and regenerative development process which provides economic security to the local population. The industrial civilization and colonial control of resources has led to environmental degradation and increasing adaptation of tribal communities to agriculture.

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However, the recurring drought has resulted in agro-ecosystem degradation and unsustainability of carrying capacity.

Jhabua district is located in the western part of Madhya Pradesh adjoining Rajasthan, Gujarat, and Maharastra. It is situated on the spur of Vindhya and along the western boundry of Malwa plateau. The district is tribal dominated with almost 86.85 per cent Bhil tribal population by 2001 Census. The net cultivated area of the district in 64 per cent to the total geographical area.

With the centrailised control of forest by the Government during colonial and post colonial period, the tribes have adapted to agriculture as alternative means of economic sustenance. However, the agricultural system is subsistent and provides food security for limited period of time in a year. The low level of irrigation facility and recurring drought further has made the agricultural ecosystem unsustainable. The increasing population further is having anthropogenic impact on its carrying capacity.

The carrying capacity measurement of an ecosystem is a recent approach which explains how the ecosystem productivity provides food security to the population and it is changing over a period of time explained by taking production, productivity, food security, and employment indicators. The factors influencing the carrying capacity of agro-ecosystem are also identified implicitly, so that the policy for carrying capacity development may be taken in the regional agro-ecosystem.

Objective, Methodology and Indicators

The objective of the research article is to provide a method of measurement of regional carrying capacity of agriculture in tribal regions. This would help in taking policies of increasing the carrying capacity of agriculture ecosystem, food security and employment generation in the tribal regions.

The methodology is based on system dynamic relation in which the regional carrying capacity is measured for the periods 1990-91 and 2004-05. The carrying capacity measure has been based on production capacity, food availability and work participation ratio in agriculture.

The following indicators have been used for analysis:

I. *Agro-ecosystem change detection*

   (i) Land use variation and land degradation.

   (ii) Regional pattern of land holding

   (iii) Population change in tribal district

II. *Indicators of agro-ecosystem productivity*

   (i) Temporal variation of food productivity

   (ii) Per capita food availability for 1990-91 and 2000-01.

III. *Agricultural employment capacity*

   (i) Occupational pattern.

The carrying capacity of cultivated area is measured using the formula given by Jasbir Singh (1972) as:

$$Cp = \frac{Co}{Sn} \qquad \dots \text{(i)}$$

Where, Cp = Carrying capacity of food cropped area

           Co = Out put available for ingestion per unit of area in gram

           Sn = Per person annual standard nutritional requirement

Table 1
Regional Variation in land use and Land Degradation
1990-91 to 2004-05 in Jhabua, Madhya Pradesh
(Unit: in hec)

Tahsil/ District	Forest (revenue)	LNAC	Grazzing Land	Fallow land	NCA
Bhabra	-5211	1001	-1831	104	286
Alirajpur	-37300	-4472	-15888	-709	1504
Jhabua	-1068	3893	-3307	-205	615
Jobat	-4609	3304	-3582	413	-692
Pethlabad	-110	-22110	-3839	-531	475
Thandla	-89	1753	-729	-13	-1488
Meghnage	-175	567	198	-366	1011
Ranapur	-351	1411	-1028	191	-23
Dist.Jhabua	-48913	-14653	-30006	-1116	1868

Source: District Statistical Handbook, Jhabua, Madhya Pradesh
       LNAC-Land not available for cultivation
       NCA-Net cultivated area

Analysis

Regional Variation in Land use

The revenue forest area in the region has decreased by almost 48.9 thousand hectares during 1990-91 and 2004-05. During the same period, the net

Table 2
Occupational pattern in Jhabua, M.P.

Year	Cultivator			Ag. L.			HHI			OW			Total worker	
	Person	%	Gr.	Person	%	Gr.	Person	%	Gr.	Person	%	Gr.	Person	Gr.
1981	276542	83.01		13479	7.05		4264	1.28		28860	8.7		323145	
1991	373650	84.11	3.51	16227	5.9	2.04	3948	0.89	-0.4	40438	9.1	4.01	434263	3.4
2001	391775	80.38	0.48	25801	5.29	5.9	5402	1.11	3.68	64409	13	5.93	487387	1.2

Source: District Census Handbook, Jhabua, M.P.
Ag.L.–Agricultural Labour
HHI–House hold industry
OW–Other worker

cultivated land has increased only 1868 hectares. The decrease in grazing land, waste lands and fallow lands are indicators of the process of agro-ecosystem degradation in the region.

Land Holding

The land holding is a measure of increasing impact of population and impact on access to resource. The number of cultivators in the region has increased from almost 3.7 lakhs to 3.9 lakhs. This has resulted in decline of average land holding from 3.08 hectares to 2.23 hectares.

Table 3
Average land holding in Jhabua, M.P.
(Unit: in hec.)

Region	1985-86	1995-96	Var.
Alirajpur	2.65	1.86	-0.79
Jhabua	3.83	2.64	-1.19
Jobat	2.59	2.16	-0.43
Pethlabad	2.35	1.88	-0.47
Thandla	2.15	1.74	-0.41
Meghnagar		2.15	
Ranapur	3.44	2.07	-1.37
Bhabra	4.32	2.76	-1.56
Dist. Jhabua	3.08	2.23	-0.85

Source: District Statistical Handbook, Jhabua, Madhya Pradesh.

Population Distribution

Density of population is used as an indicator to explain the pattern of population distribution and regional carrying capacity. Alirajpur and Petlabad have lowest level of population density and the rate of redensification is also low. Meghnagar and Thandla are having higher rate of redensification in the region.

Productivity analysis of agro-ecosystem

The ecosystem productivity is measured in terms of food production and food availability in the region. There is decline of food production and per capita food availability in the region. There is decline of food production in kharif season between 1990-91 and 2004-05 with higher temporal variation. Food production in rabi season has increased by 13.4 per cent during the study period. This indicates to the impact of climate change on cropping pattern in the region.

Table 4
Population Density in Jhabua District, Madhya Pradesh

Region	1981	1991	2001
Thandla	139	240	314
Petlabad	107	161	191
Meghnagar		306	387
Jhabua	139	201	247
Bhabra		210	258
Jobat	121	167	207
Alirajpur	95	117	153
Ranapur		220	228
Jhabua dis.	117	167	206

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

Table 5
Food Production in Jhabua, Madhya Pradesh
(Unit: in 000 quintal)

Year	TKFC	Vari.	TRFC	Vari.	TFP	Vari.
1990-91	221.3		59.8		281.1	
1991-92	221.3	0	36.4	-23.4	257.7	-23.4
1992-93	196.6	-24.7	144	107.6	340.6	82.9
1993-94	183.3	-13.3	126.6	-17.4	309.9	-30.7
1994-95	195.7	12.4	147	20.4	342.7	32.8
1995-96	194.2	-1.5	97.4	-49.6	291.6	-51.1
1996-97	248	53.8	146.5	49.1	394.5	103
1997-98	223.3	-24.7	150.2	3.7	373.5	-21
1998-99	242.5	19.2	161.7	11.5	404.2	30.7
1999-00	174.9	-67.6	24.2	-137.5	199.1	-205
2000-01	88.3	-86.6	1.4	-22.8	89.7	-109
2001-02	205.8	117.5	20.2	18.8	226	136
2002-03	183.9	-21.9	39.5n	19.3	223.4	-2.6
2003-04	236.9	53	88.8	49.3	325.7	102
2004-05	201.7	-35.2	117.1	28.3	318.8	-6.9
Gr.	-8.86		95.82		13.41	

Source: Agriculture Department, Jhabua (M.P.)
TKFC-Total Kharif Food Crop
TRFC-Total Rabi Food Crop
TFC-Total Food Crop
Vari.- Variation

Table 6
Per Capita food availability in Jhabua, M.P.
(Unit: in Kg.)

Year	TFP	TP	PCFA	AFD
1990-91	281100000	1130405	248.7	401
2000-01	89700000	1394561	64.32	104

Source: Agriculture Department, Jhabua (M.P.)
    TFP-Total Food Production
    TP-Total Population
    PCFA-Per Capita Food Availability

The per capita food availability during 1990-91 and 2000-01 indicates that per capita per annum food availability of 248.7 kgs. in 1990-91 declined to 64.32 kgs in 2004-05. The food availability for 401 days declined to 104 days between 1990-91 and 2004-05.

Carrying capacity of agricultural land

The carrying capacity of the agricultural has increased from 2.86 to 3.22 during 1990-91 and 2004-05 respectively. However, the carrying capacity has serious fluctuation largely determined by environmental factors.

Table 7
Carrying Capacity of per hec. Net Area sown in Jhabua
District in Madhya Pradesh

Year	TFP in 000 Kg.	Cp
1990-91	281.1	2.86
1991-92	257.7	2.62
1992-93	340.6	3.44
1993-94	309.9	3.12
1994-95	342.7	3.46
1995-96	291.6	2.96
1996-97	394.5	3.99
1997-98	373.5	3.78
1998-99	404.2	4.07
1999-00	199.1	2.02
2000-01	89.7	0.91
2001-02	226	2.3
2002-03	223.4	2.67
2003-04	325.7	3.31
2004-05	318.8	3.22

Source: Basic data from Dept. of Agriculture & District Census Handbook, Jhabua, M.P.
    Total food grain requirement per day is average 620 g. per day.

Summary and Conclusion

The above analysis reveals that though population is growing at a high rate, the production and carrying capacity of agriculture is declining in the region. This is leading to food insecurity, malnutrition, unemployment, poverty and distress migration. The environmental factor is much more responsible. Through proper resource conservation of water, forest and land, the production may be increased in the region. The tendency of non-farm employment in non-agricultural employment may be encouraged through proper resource based production cycle in the region.

The short-term policy of employment generation and food supply is necessary to save the tribes from hunger. However, the long-term strategy would require efficient resource use and diversification and specialization in the region.

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