CROPPING LAND USE SHIFT AND FOOD DEFICIT- A DISASTER IN MAKING IN JAMMU AND KASHMIR, INDIA

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ABSTRACT

The present paper attempted to assess the cropping land use dynamics in Jammu and Kashmir and its impact on the food budget of the state. Cropping land use is a highly dynamic process and it keeps on changing with the change in economic returns of the crops, agro-climatic conditions, farm programmes, etc. The state of Jammu and Kashmir experienced a change in the cropping land use though with varying degree of intensity across its spatial units (districts). The analysis of the data reveals that area under paddy has recorded a negative growth in all the districts with the state average of -29.92 percent from 1980 to 2008. The area under maize crop has registered a net decrease from 229925 ha in 1980 to 198464 ha in 2008 (-13.68 percent). Wheat is grown mainly in Jammu and it also registered a negative growth of -21.47 percent in its area during these twenty eight years (109113 ha in 1980 to 85690 ha in 2008). The area under orchards has increased in all the districts of the state though maximum increase has been experienced by Kashmir valley than Jammu and Ladakh divisions of the state. On state average, the area under orchards increased by 176.39 percent. The food deficit of the state increased from 33.9 percent in 1980 to 43.2 percent in 2008. The decreasing area under rice, wheat and maize crop bears negative correlation with food deficit which implies that food deficit increases with decrease in crop

area. Similarly, increase in orchard area directly increases food deficit as the same decreases the area under food crops in the state.

Keywords: correlation, cropping land use, food deficit, hectares (ha), spatial

I. INTRODUCTION

Land use is the human use of land and it involves the management and modification of natural environment into built environment such as fields, pastures, and settlements [1] [2]. Land use is a synthesis of physical, chemical and biological systems and processes on the one hand and human/societal processes and behavior on the other. The monitoring of such systems includes the diagnosis and prognosis of land use changes in a holistic manner at various levels [3]. One of the first land use patterns that geographers studied is the pattern of crops across an agricultural landscape. Different crops represent different agricultural land uses [4]. Cropping pattern refers to the proportion of the area under different crops at a point of time. It also reveals the rotation of crops and the area under double cropping etc. in any state or country [5]. Cropping land-use is a highly dynamic process and the farmer's choice of cropping pattern is determined by various factors, viz; *physical factors* such as soil, climate, *technological factors* like irrigation, improved varieties of seeds, availability of fertilizers and plant protection chemicals; *Institutional factors* like land reform, consolidation of holdings, credit facilities, price structure, procurement policies and storage facilities and other factors like the rate of return, agro-climatic conditions, farm programmes, conservation programmes, and environmental regulations [6] [7] [8] [9]. This cropping land use shift is a direct result of the increase in relative price of labor and changes in domestic and global agricultural policies [10] [11] and was spurred by dramatic improvements in agricultural productivity, and a shift from more labor-intensive agriculture to more capital and technology-intensive agricultural practices that employed new varieties, synthetic inputs, and irrigation [12] [13] [14] [15] [16] [17] [18] [19]. Economic factors play a relatively stronger role in influencing the crop pattern in areas with a better irrigation and infrastructure potential. In such areas, commercialization and market networks co-evolve to make the farmers more dynamic and highly responsive to economic impulses. The cropping system of any locality is the cumulative results of the past and present decisions by individuals, communities or governments and it keeps on changing in consonance with change in prices of goods, Govt. policies and other related factors [20]. The interacting driving forces of population increase, income growth, urbanization and globalization on food

production, markets and consumption have changed food and agricultural system worldwide [21]. The relative importance of crops, crop yields and farm size leads to change in cropping pattern of an area. The introduction of new agricultural technology especially during the period of green revolution in the late sixties and early seventies resulted in wide spread change in cropping land use pattern in India especially from cereals to non-cereals [22]. Agriculture is the main occupation for the people of Jammu & Kashmir. About 65 percent of the people are directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sector of the economy of Jammu and Kashmir and this sector contributed more than 31.29 per cent of Gross Domestic Production (GDP) in 2007 [23]. The cropping land use in the state also underwent drastic changes which led to the decrease in area under food crops and increase in area under cash crops/plantation agriculture. This phenomenon of shift from food crops to cash crops has led to widening the gap between food production and requirement and thus increased the food deficit in the state. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land [24].

II. OBJECTIVE OF THE STUDY

To determine the cropping land use shift and its impact on the food deficit in Jammu and Kashmir.

III. STUDY AREA

The state of Jammu and Kashmir constitutes northern most extremity of India and is situated between 32° 17′ to 36° 58′ N latitude and 73° 26′ to 80° 30′ E longitude. It falls in the great northwestern complex of the Himalayan Ranges with marked relief variation, snow-capped summits, antecedent drainage, complex geological structure and rich flora and fauna [25]. The state is 640 km in length from north to south and 480 km from east to west. It consists of the territories of Jammu, Kashmir, Ladakh and Gilgit and is divided among three Asian sovereign states of India, Pakistan and China. The total area of the State is 2, 22, 236 km^2 comprising 6.93 per cent of the total area of the Indian territory including 78,114 km^2 under the occupation of Pakistan and 42,685 km^2 under China [26].

IV.MATERIALS AND METHODS

1.4.1 Materials

- The Survey of India toposheets (1971) on scale 1:50,000 were used to generate a base map of the study area.
- Cropping land use data of different crops has been obtained from Financial Commissioner's office, Srinagar/ Directorate of agriculture, Jammu and Srinagar.

1.4.2 Methods

***(i)* Determination of cropping land use shift**

For depicting the spatio-temporal change in the cropping land use, the data sets generated were analyzed. The temporal change has been calculated by using the following formula;

$$\textit{Change } (V_1) = \frac{St1 - St2}{St1} \times 100 \quad [27]$$

Where, V_1 *= Change in any variable,* St_1*= Status at time* t_1*,* St_2 *= Status at time* t_2

***(ii)* Determination of food requirement**

The formula used to calculate food requirement is;

$$FR_y = Tp \times I \times 365 \text{ ..... } (i)$$

Where, FR_y *= Food requirement in a year; Tp= Total Population and I= intake needed per person per day (standard norm)*

***(iii)* Determination of food production**

The agricultural production of the three main crops (paddy, maize and wheat) grown in the state has been determined by multiplying the total area under these crops in different years by their productivity in the corresponding years. The formula used for this purpose is given below;

$$PC_1y = AC_{1y} \times P_{1y}$$

Where 'PC_1y*' stands for total production of a crop* C_1 *in a year 'y', '*AC_{1y}*' is area under this crop in year 'y' and '*P_1y*' for productivity of the crop* C_1 *in the year 'y'*

***(iv)* Determination of food deficit**

The food deficit has been determined by using the formula

$$FD_y = \frac{Fr - Dpy}{Fr} \times 100$$

Where, FD_y = Food deficit in a year 'y', 'F_r' is food requirement in that year, and Dp_y = Domestic Production in the year

***(v)* Food deficit and cropping land use shift**

Food deficit bears direct relationship with cropping land use shift. The relationship of food deficit to cropping land use shift can mathematically be expressed as;

$$\textit{Food deficit} \propto \sum_{i=1}^{4} \frac{x - xi}{x}$$

Where 'x' is area under any variable taken for the study in base year 'x_i' is area under the same variable in current year

V. RESULTS AND DISCUSSION

1.5.1 Spatial variation in the cropping land use dynamics

The cropping land use has not changed uniformly in the state but exhibit greater variations. In order to quantify the spatial variation in the cropping land use, four variables have been taken for analysis, *viz*, area under paddy, wheat, rice and orchards. Since wheat occupies miniscule area in Kashmir valley and orchards do not occupy substantial area in districts of Jammu division, therefore for the respective divisions, they have not been taken into account for analysis. The percent change in different crops grown in the state has been calculated (table 1.1).

TABLE 1.1: PERCENT CHANGE IN AREA UNDER DIFFERENT CROPS FROM 1980-2008 CE

District	Change in area under crops (in percent)				Ranking				C.I
	Rice	Maize	Wheat	Orchards	Rice	Maize	Wheat	Orchards	
Srinagar	-48.95	-4.59	-	106.82	1	11	-	2	**14**
Budgam	-41.6	16.3	-	54.68	4	3	-	4	**11**
Baramulla	-29.67	10.83	-	17.22	5	7	-	7	**19**

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Kupwara	-23.69	7.83	-	49	9	9	-	5	**23**
Pulwama	-44.88	-9.44	-	1533.21	3	8	-	1	**12**
Anantnag	-26.27	-6.52	-	64.62	7	10	-	3	**20**
Jammu	-13.3	-14	-15.5	24.53	12	5	6	6	**29**
Kathua	-22.59	-25.5	-29.28	-	10	2	2	-	**14**
Doda	-15.35	-15.48	-23.66	-	11	4	4	-	**19**
Poonch	-27.67	-13.41	-16.4	-	6	6	5	-	**17**
Rajouri	-24.23	-28.78	24.26	-	8	1	3	-	**12**
Udhampur	-46.64	-28.78	-43.46	-	2	1	1	-	**4**
Leh	-	-	-	-	-	-	-	-	-
Kargil	-	-	-	-	-	-	-	-	-

Source: *Compiled by using data obtained from Financial Commissioner's Office Srinagar, 2011.* ***C. I*** *means* ***'Composite Index'***

The percent change in different crops grown in the state has been subjected to ranking method. The first rank was given to the district which showed highest decrease or increase in the cropping land use under any crop taken for the study and last rank or highest value was assigned to the district with lowest change in area under different crops. The cropping land use shift occurs on account of economic considerations, easy advance borrowings, easy availability of food at public distribution outlets, development projects like road and railway construction, lack of irrigation etc. The ranks of all the crops have been added to get composite index and finally a choropleth map has been prepared to highlight the spatial variation in the cropping land use of the state (Fig 1.1).

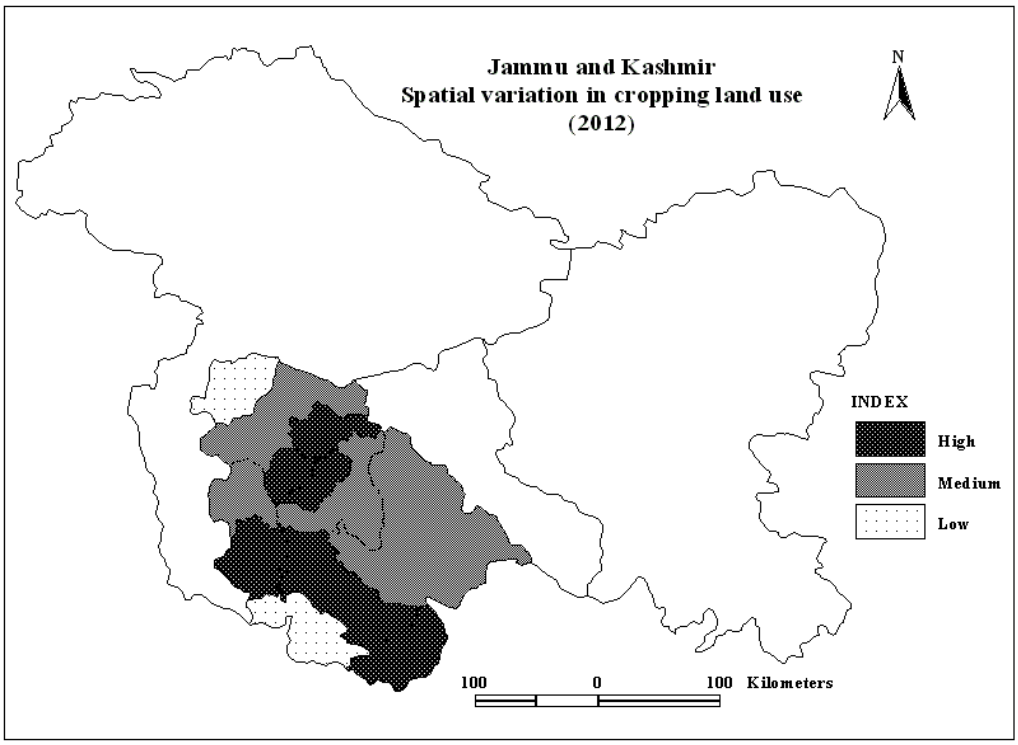

Fig 1.1: Spatial Variation in Cropping Land use in J&K

1.5.2 Food requirement

Food requirement means the total food needed to support the population for ensuring food security. The food requirement has been calculated by using the standard consumption intake of rice, wheat or maize per capita/head (400grams/head/day) fixed by food and agricultural organization [28] and world health organization [29] [30]. The significant increase in population in the state (5808929 persons in 1980 to 12517860 in 2011) has led to the growing food demand in the state. The food requirement has increased by 860768 metric tonnes during these twenty eight years, *i.e.,* more than what was needed in 1980. The average rate of increase per annum is 3.62 percent. The food requirements in the different districts of the study area have increased in consonance with the rate of population growth in the respective districts. The highest requirement in absolute values is in Jammu district (256880 metric tonnes) followed by Srinagar (211194 metric tonnes) and Anantnag (201778 metric tonnes), while as lowest requirement is in Kargil district (19730 metric tonnes).

1.5.3 Domestic production

The domestic production in the study area has been calculated by addition of production of the three crops taken for the study in the state (Table 1.3). This production table has been worked using the productivity of these crops.

TABLE 1.3: DOMESTIC PRODUCTION IN JAMMU AND KASHMIR (1980-81 TO 2008-09)

District	Domestic production (in '000 metric tonnes)							
	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2008-09	Change (%)
Srinagar	27.55	25.41	26.98	27.40	27.48	31.78	31.39	**13.95**
Budgam	42.14	45.41	48.70	50.76	57.62	61.64	62.12	**47.41**
Baramulla	70.10	74.39	80.46	93.84	97.82	104.62	109.70	**56.48**
Kupwara	30.91	34.82	39.23	43.27	52.35	64.00	66.96	**116.60**
Pulwama	42.32	41.59	46.87	52.23	53.57	57.68	52.95	**25.10**
Anantnag	66.52	77.79	85.02	97.88	108.18	117.42	118.54	**78.20**
Jammu	104.99	115.93	129.02	145.64	163.66	181.78	186.78	**77.90**
Kathua	43.78	47.66	53.78	59.87	66.25	70.87	74.01	**69.05**
Doda	35.25	39.61	42.74	45.02	48.48	54.75	55.13	**56.41**
Poonch	25.94	28.33	31.03	37.05	42.72	48.75	48.82	**88.23**
Rajouri	39.99	43.81	47.36	51.64	58.28	63.85	63.85	**59.67**
Udhampur	49.05	48.36	53.80	63.50	70.85	74.77	74.26	**51.40**
Leh	1.76	1.89	2.24	2.53	3.16	3.65	4.40	**149.56**
Kargil	1.50	1.92	2.25	2.86	3.01	3.63	4.22	**180.72**
Total	**581.80**	**626.90**	**689.48**	**773.48**	**853.43**	**939.21**	**953.12**	**63.82**

Source: *Compiled from data obtained from Financial Commissioner's Office, Srinagar/Jammu, 2011*

The overall domestic production has increased from 581803 metric tonnes in 1980 to 953118 metric tonnes in 2008, thus recorded an absolute increase of 371315 metric tonnes. The highest increase in absolute values is observed in Jammu (81786 metric tonnes), while the lowest is observed in Leh (2639 metric tonnes). In terms of percentage increase, highest change is observed in Kargil (180.72 percent), Leh (149.56 percent) and Kupwara (116.60 Percent) because more area has been brought under cultivation in these districts. The lowest increase is recorded in Pulwama (25.10 percent), Budgam (47.41 percent) and Udhampur (51.40 percent). The overall trend

of domestic production is increasing in the state on account of increasing productivity, but it does not increase in consonance with increasing population.

1.5.4 Food deficit analysis

Food deficit of any geographic area may be defined as a gap between the food requirements minus the domestic production of that area. The food deficit across the districts from 1980 to 2008 is presented in table 1.4.

TABLE 1.4: FOOD DEFICIT IN JAMMU AND KASHMIR (1980-81 TO 2008-09)

District	Food deficit (in percent)							
	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2008-09	Change (%)
Srinagar	73.50	79.96	80.55	82.34	84.67	83.07	82.97	**9.47**
Budgam	19.06	27.54	26.96	20.69	25.22	23.23	18.46	**-0.6**
Baramulla	11.94	13.60	21.21	22.43	37.77	38.30	39.28	**27.34**
Kupwara	32.85	36.01	38.99	43.06	41.81	38.95	41.58	**8.73**
Pulwama	25.12	34.94	35.17	35.88	41.46	44.26	52.51	**27.39**
Anantnag	27.68	26.69	30.75	30.85	33.75	36.43	40.44	**12.76**
Jammu	20.41	23.03	24.96	25.10	26.33	24.71	26.28	**5.87**
Kathua	14.71	16.65	15.59	14.75	14.52	13.64	10.81	**-3.9**
Doda	41.01	41.38	44.01	47.68	50.00	50.97	54.76	**13.75**
Poonch	17.07	20.52	23.62	19.42	18.07	17.32	23.15	**6.08**
Rajouri	4.45	7.53	12.07	14.53	14.04	16.73	22.64	**18.19**
Udhampur	22.29	32.31	34.14	31.26	31.97	33.74	37.20	**14.91**
Leh	81.49	82.73	82.13	81.91	80.72	80.12	77.67	**-3.82**
Kargil	83.79	82.08	81.91	80.03	81.90	80.14	78.30	**-5.49**
Mean	**33.96**	**37.50**	**39.43**	**39.28**	**41.59**	**41.54**	**43.29**	**9.33**
Mean, K.D	**31.69**	**36.46**	**38.94**	**39.21**	**44.11**	**44.04**	**45.87**	**14.18**
Mean, J.D	**19.99**	**23.57**	**25.73**	**25.46**	**25.82**	**26.19**	**29.14**	**9.15**
Mean, L.D	**82.64**	**82.41**	**82.02**	**80.97**	**81.31**	**80.13**	**77.98**	**-4.66**

Source: *Compiled by authors*

The food deficit in the state has increased from 33.96 percent to 43.29 percent (9.33 percent increase) during the time period taken for the study. The food deficit at provincial level in the state has been presented in Fig. 1.3. It is evident from the figure that Ladakh has maximum food deficit, but it improved its domestic production over the period of time due to which its food deficit decreased from 82.64 percent in 1980 to 77.98 percent in 2008 (-4.66 percent). Though Jammu province had lower level of food deficit in 1980, but it shows an increasing trend and it increased from 19.99 percent in 1980 to 29.14 percent in 2008. In the Kashmir province, the food deficit increased at a higher rate (14.18 percent) from 31.69 percent in 1980 to 45.87 percent in 2008.

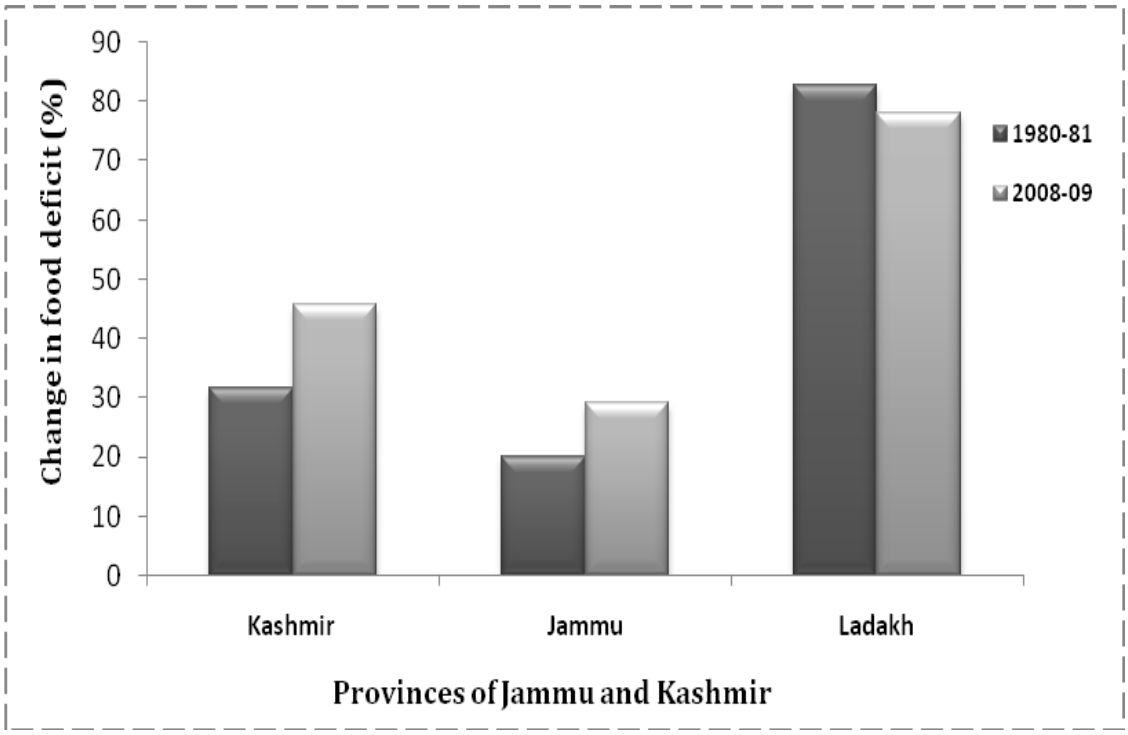

Fig. 1.3: Percent change in food deficit in provinces of Jammu and Kashmir (1980-2008)

1.5.5 Levels of food deficit

In order to determine the levels of food deficit across the districts of the state, the food deficit calculated above (Table 1.4) has been divided into five levels, *viz*, very high (80-100 percent), high (60-80 percent), medium (40-60 percent), low (20-40 percent) and very low (below 20 percent) [Fig. 1.4]. From the figure, it is clear that only Srinagar district has very high food deficit (82.97 percent)

because of being home to more urban people, while as high level of deficit on account of paucity of suitable agricultural land is observed in two districts of Ladakh division of the state namely Leh (77.67 percent) and Kargil (78.30 percent); Four districts (Kupwara, Doda, Anantnag and Pulwama) have medium level of deficit and five districts (Baramulla, Poonch, Rajouri, Jammu and Udhampur) have low level of deficit and the remaining two districts (Budgam and Kathua) have very low food deficit (18.46 percent and 10.81 percent respectively).

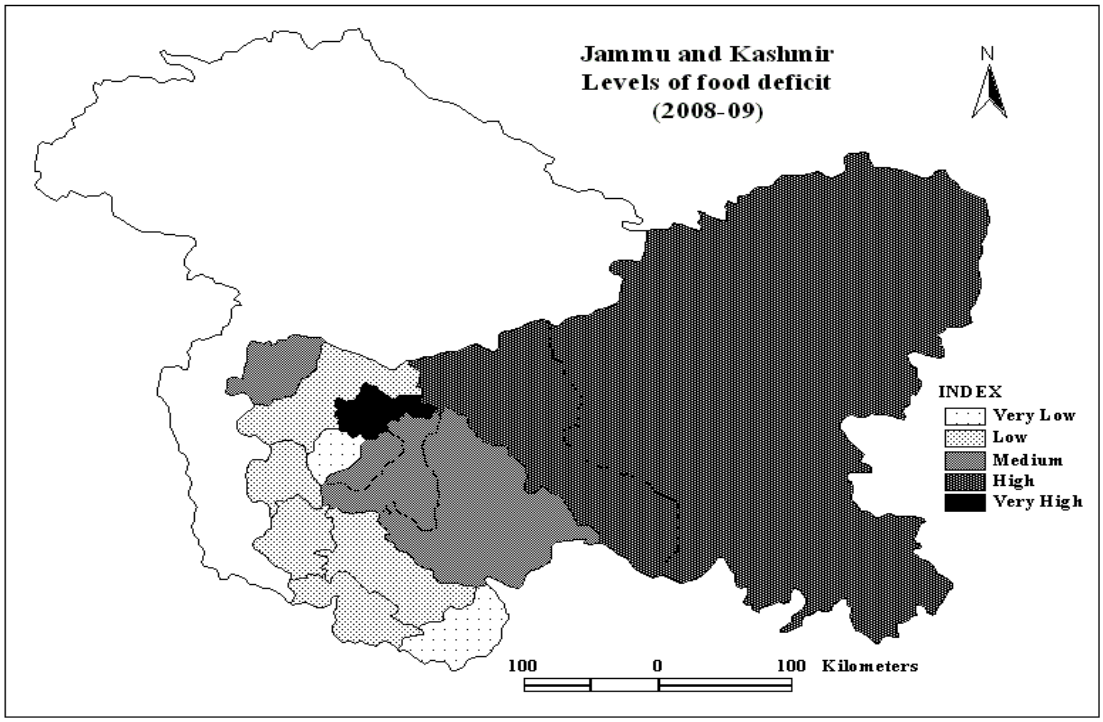

Fig. 1.4: Levels of food deficit in Jammu and Kashmir (2008-09)

1.5.6 Correlation between cropping land use shift and food deficit

The correlation between percentage change of cropping land use variables and percentage of food deficit across the districts have been found (table 1.5). The table depicts that decreasing area under rice, wheat and maize crop bears negative correlation with food deficit which implies that food deficit increases with decrease in crop area. This is on account of staple food area is decreasing and area under commercial crops is increasing. Similarly, increase in orchard area directly increases food deficit as the same decreases the area under food crops. Thus the cropping land use shift from food

crops to orchards (Commercial Agriculture) poses a strong threat to the availability of staple food like rice, wheat and maize. Hence, a food disaster is inevitable if concrete steps are not taken to control further cropping land use shift in the state.

TABLE 1.5: CORRELATION BETWEEN CROPPING LAND SHIFT AND FOOD DEFICIT

Variables	Value of Coefficient of Correlation (r)
Rice Vs Food Deficit	-0.51
Wheat Vs Food Deficit	-0.15
Maize Vs Food Deficit	-0.11
Orchards Vs Food Deficit	+0.49

VI. CONCLUSION

The analysis and interpretation of the data revealed that on an average, the area under the three major food crops grown in the state (*Paddy, Maize and wheat*) has decreased at state level though with regional variations, it has increased in some districts as well. But the area under paddy recorded a decline in all the districts and the area under orchards has registered a high positive growth in all the districts. This increase is largely explained by the shifting of cropping land use from food crops to plantation agriculture (orchard cultivation). This cropping land use shift over the period of time increased the food deficit in the state and hence for ensuring food security the food imports of the state are on rise. Any imbalance in the food imports from other states like Punjab, Haryana can prove disastrous for the state. Therefore, the need of the hour is to evolve such strategies that the horizontal disparities and vertical inequalities may be minimized in respect of agricultural growth and levels of socio-economic development in the state. Moreover, a comprehensive agricultural policy for the state is need of the hour to protect the cropping land shift and other allied problems for the sustainable agricultural development and food security of the state.

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