IDENTIFICATION OF FOOD SECURITY REGIONS IN KARNATAKA FOR SUSTAINABLE DEVELOPMENT

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ABSTRACT

Life cannot be sustained without adequate nourishment. Man needs adequate food for growth, development and an active and healthy life. Dietary habits of population in different regions of the world are determined mainly by the availability of food locally and local practices. Satisfaction of hunger is usually the primary criteria for adequate food intake. But satisfaction of hunger itself is not a safe guide for the selection of proper food. Prof. M. S. Swaminathan says food security consists of three components such as food availability, stability and accessibility and these determine the food security of any region. Therefore in the present study an attempt has been made to evaluate and assess the food security regions and correlate between different factors which lead to widening the food insufficiency and severity. To analyze the food sufficiency, deficiency and severity of 29 districts of Karnataka, 13 components of food availability, stability and accessibility have been considered. The food security regions have been identified with the help of food balance sheet and Z. score technique for the year 1997-98 and 2007-08 data. Standard deviation and co efficient variation has also been implied for grouping the data and to know the variability in various variables. It has been observed that most of the districts from south Karnatak with irrigation facilities showed food sufficiency i.e. high food security. It has been found that during the study period most of the districts from North Karnataka remained in low (severity) food security region, study region as a whole witnessed slight negative development in food security. It has been observed from the fact that the districts from the coastal region and highly urbanized districts witnessed per capita availability of food below the study region average i.e.690 & 642 during both years. This probably points to high proportion of population engaged in secondary and tertiary activities in urbanized districts and, fisheries in coastal districts. At the same time very meager percentage of land available for cultivation also plays a decisive role.

Keywords: hunger, food availability, food security, Food production per head, food accessibility, Karnataka

1. Introduction

Food is the third most important basic requirement for human survival next to air and water, and it is a fundamental right of everyone. Sufficient and balanced amount of food is indispensable for attaining normal growth, development and Maintenance of health throughout life. However, it is a known fact that people never get sufficient intake of all nutrients as there is a wide regional variation in availability of food. The problem of food and nutrition insecurity still remains a great threat to a large number of poor and vulnerable people across the world. The director general of food and agriculture organization (FAO-

2006) has estimated that about 75 per cent more food would be required over the next three decade to meet out the demands of rapid increasing population. It is estimated that about 800 million would go hungry every day in the world. In India, the ever expanding population likely to cross 1330.2 million by 2025 that may require an average of 4 per cent growth in food production to achieve self sufficiency. To feed the ever increasing population more than 250 million tons of food grains would be required in future. "Environmentally sound agricultural technology will not be sufficient to ensure adequate food supplies for future generation unless the growth of population is simultaneously curtailed" (David Dimentel 2001). India ranks 94th in the global Hunger Index of 119 countries in the world. The National Family Health Survey (NFHS 2005-06) highlighted that about 56 per cent of the women in India are anemic, 30 per cent of new born babies are of low birth weight (LBW) , and 47 per cent of the children are underweight.

The basic concept of food security is that all people at all time have both physical and economic access to their basic need. According to World Food Summit (Rome 1996) " Food security exists when all people at all times have physical and economic access to sufficient, safe and nutritional food to meet their dietary needs and food preferences for active and healthy life."

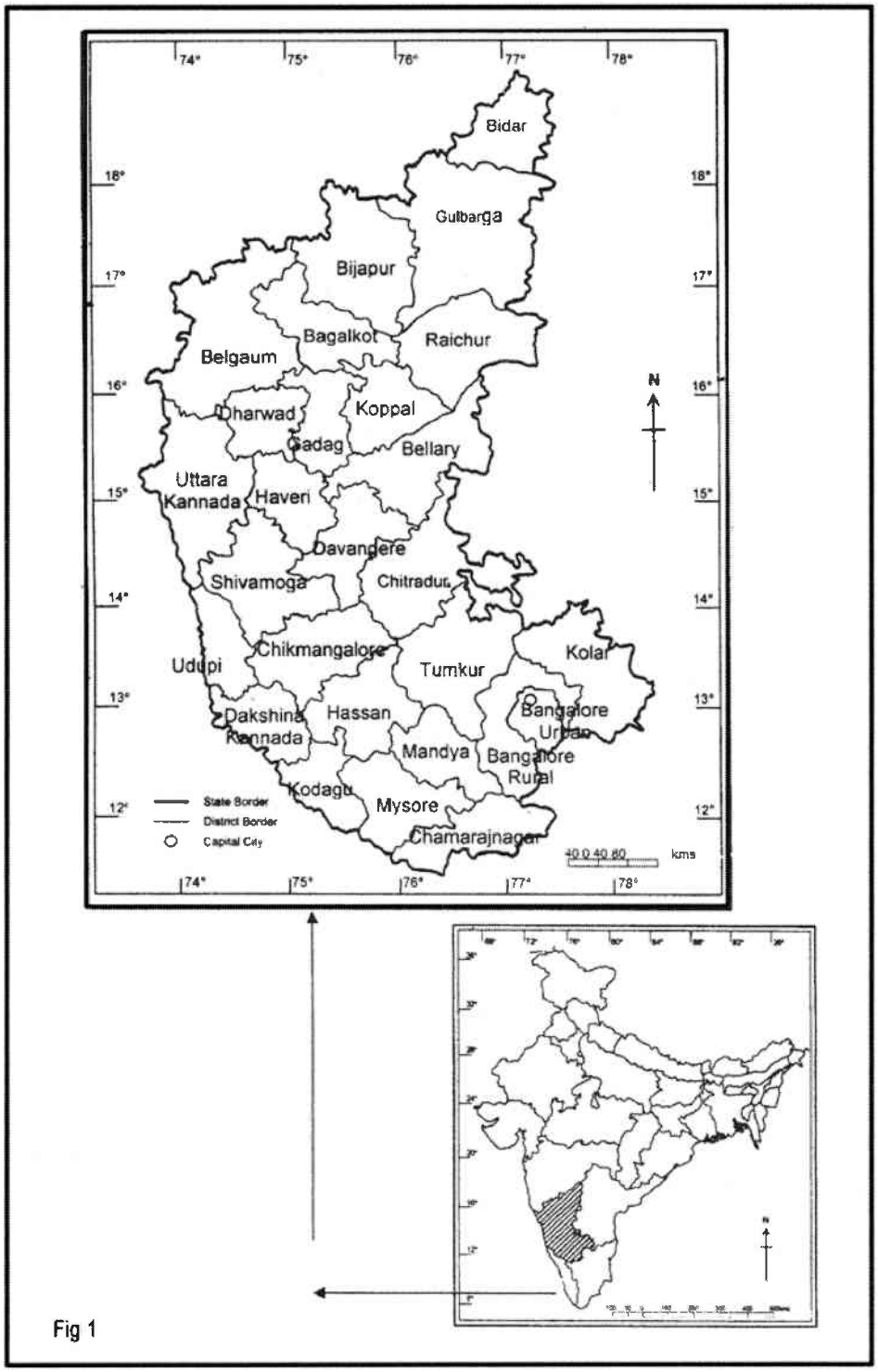
2. Study Area

Karnataka is one of the 8th biggest in respect of area and 9th most populated state in India. It is situated in the Western part of the Deccan peninsular India with a geographical area of 1,19,791 sq kms which accounts 5.84 per cent of the total area of the country. The territorial limit of the study area lies between 11^0-31^1 North latitudes to 18^0-45^1 North latitudes and 74^0-12^1 East to 78^0-40^1 East longitudes (Fig-1). The study region is bounded by the Arabian Sea and Goa state on the West, Tamil Nadu and Kerala on the South West and South respectively. Maharasthra state on the North, and Andhrapradesh on the East. The Area under study consists of 30 Districts, 176 Talukas , 254 Urban Centers and 27,683 in habitates and according to 2001 census the total population was 5.28 crores which contributed 5.1 per cent of the total population of India.

3. Objectives:

The present study has been carried out with the specific objectives mentioned below.

1. To identify the food security regions by considering the interplay of three components of food security, viz. food availability, Food accessibility and Food stability based on food balance sheet and Z score. Standardized technique.
2. To examine the inter district variation among the three components of food security in the study region.
3. To analyze the various factors behind the emergence and growth of food insecurity regions prevailing over the study region.
4. To find out the standard deviation for grouping the data and co-efficient variation to analyze the percentage of variation components among the district in particular and study region in general.
5. To suggest certain measures for sustainable development of the region in relation to food security.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Bellary
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Haveri
Davangere
Shivamoga
Chitradurga
Chikmangalore
Kolar
Udupi
Tumkur
Dakshina Kannada
Hassan
Bangalore Urban
Mandya
Bangalore Rural
Kodagu
Mysore
Chamarajnagar
N
State Border
District Border
Capital City
40 0 40 80
kms

Fig 1

4. Hypothesis:

In order to achieve the above cited objectives following hypothesis have been formulated.

- There is a positive correlation between irrigation facilities and food availability, more the irrigation facilities more will be the food sufficiency.
- Districts with irrigation facilities enjoy increasing trends of per capita availability of food and food grain production but decreasing trends in live stock population where as the districts in and around the malnad and coastal region exhibit the increasing trends in live stock population but decreasing trends in per capita availability of food and food grains production.

5. Data base and Methodology:

The present study is exclusively based on secondary data collected from the Directorate of Agriculture, Bengaluru, Directorate of Food and civil supply corporation, Karnataka, Directorate of Economic and Statistics, Govt. of Karnataka, Karnataka at a Glance, Population Census, and Primary Census abstracts (H-Series) etc.

In the present study an attempt has been made to evaluate the components of food security which determine the food security regions in Karnataka. To estimate net food availability Food balance sheet method suggested by FAO (1957), Shafi (1960), Sukhante (1962), Dube and Mishra (1984), R.P.Mishra (2002), Negatu (2005) Suneeta, P and Others (2010) was adopted with slight modification according to the nature of data. The modified food balance sheet method is as follows.

$$Nij = (Pij+Bij -Sij+Mij)$$

Where Nij is net food available for districts

Pij is total grain produced

Bij is total grain purchased

Sij is total crop utilized for seeds

Mij is marketed out put

I refer to the particular district

J refers to the year.

The prime task of the present study is to find out the food security regions by considering the thirteen variables, three from food availability, five from food stability and five from food accessibility. For analyses of these variables Standard Deviation, co-efficient of variations, and finally Z score standardization techniques have been applied. The result of the standard score obtained for different variable have been added district wise and average has been taken from these variables in order to find out the composite standard score of each district and each set of variables like food availability , Food stability, Food accessibility and overall food security.

Further, maps have been produced showing the relative position of the districts at two different points of time for each indicator.

6. Selection of the variables:

To identify the spatial variation of food security in any region a set of variables are indispensable. Therefore in the present investigation thirteen variables have been taken in to consideration according to the availability and nature of data. The selected indicators have been broadly divided in to three groups namely Food availability (consists of three components), Food

stability (comprises of six components) and Food Accessibility (six components) (Table-1).Since the study depends upon secondary data it was difficult to gather information about the food caloric, therefore it has not been considered.

7. Results and Discussion

I. Trends in food availability

Food availability is a function of both domestic and net imports and this process attains the human needs. Food availability includes per capita availability of food grains, production of food grains per head per annum and live stock per head per annum. Agriculture is the prime sector which provides food requirement of the residents of the state, and live stock is another food resource sector that provides meat and dairy products.

Per capita per day availability of food grains in the area under study shows declining trend from 690 grams in 1997-98 to 642 grams in 2007- 08. However it has been observed from the facts that per capita availability of food grains in Karnatak is more than the national average i.e. 462 grams. The distribution pattern of per capita availability of food grains among the districts in the study region is an un ubiquitous. It varies from 210 grams (Capital city- Bangaluru) to 1,690 grams (Davangere) during 1997 -98 and in 2007-08, 180 grams in Kolar district to 1,620 grams in Gadag district. Three districts from North Karnatak such as Bellary (1330 & 1100), Koppal (1110 & 1200), Raichur (1270& 1140), Bagalkot (840 & 970), Bijapur (770 & 1060), etc registered more per capita availability of food grains during both period of time than the karnatak (690& 642) and national (475 & 454) average. Three districts from North karnatak (Bidar, Belgaum & Dharwad), three districts from South Karnatak (Bengaluru Urban, Chikballapur, and Chamrajnagar) and three coastal districts (U. Kannada, D. Kannada and Udapi) witnessed below the study region average. This probably points to highly urbanized and dry conditions which prevailed over a longer period and less availability of suitable land for cultivation.

Food production per head per annum refers to the domestic production of food grains per head per annum. The food production in the area under study indicates slightly decreasing trend i.e. from 256 kg/ head in 1997-98 to 241 kg/head in 2007-08 because the net sown area has decreased and at the same time population has also increased at faster rate than food production. There is a correlation between the irrigation facility and high food grain production. It is proved that among all the districts of the region, the districts with irrigation facilities recorded highest food grains production in 1997-98 namely Davangere (611), Bellary (496), Raichur (475), Koppal (419), Mysore (375), Bagalkot (323), Bijapur (294), Shimoga (292) etc. Capital city – Bengalore, and coastal districts notably D. Kannada, U. Kannada and Udapi registered very low food grain production i.e. less than 100 Kg/head/ annum.It is observed from the figure that the previous district advanced in secondary and tertiary activities and latter districts known for fishery, where availability of land for cultivation is meager. Most of the maidan and malnad districts scattered all over the study region showed below the study area average in food grains production.

According to the 2007-08 data Davangere (517), Gadag(604), Raichur(425), Koppal

Table. 1 List of Variables, Definition, Mean, Standard Deviation and Co-efficient of variation

Code No. for variables	Name of the variable and Group	Definition	1997- 98			2007- 08		
			Mean	S.D	C.V %	Mean	S.D	C.V %
I	**Food Availability**							
X1	Availability of food	Per capita per day availability of food in gram	66.53	67.12	100	69.15	31.17	50.86
X2	Production of food grains	Production of food grains in kg per head per annum	256.43	128.00	49.91	241.33	141.01	58.43
X3	Live stock	Live stock per head per annum	1.36	0.49	36.40	1.10	0.56	50.00
II	**Food Stability**							
X4	Yield of food grains	Yield of food grains (in per kg)	1494.40	15.22	1.02	1507.24	675.38	45.00
X5	Percentage of irrigated areas	Percentage of irrigated areas to the total cropped area	22.23	11.54	51.91	23.7	12.90	54.43
X6	Fertilizers consumption	Fertilizers consumption (in kg per hectore)				125.55	82.87	65.74
X7	households having access to safe drinking water	Percentage of households having access to safe drinking water	70.76	19.21	27.14	81.82	17.03	20.81
X8	households having access to Toilet	Percentage of households having access to Toilet	20.32	12.40	61.00	32.48	16.42	50.58
III	**Food Accessibility**							
X9	No. of fair price shops	Per 1000 population	0.39	.07	17.94	0.40	0.118	29.58
X10	Percentage of main workers	to the total population	37.01	3.63	9.80	37.02	3.73	10.08
X11	Percentage of literacy	To the Total Population	55.23	10.66	19.30	66.60	9.35	14.04
X12	Human Survival	per 1000 live Births	915	12.92	1.41	943	7.81	0.82
X13	Urbanization	Percentage urban population to the total Population	26.07	14.73	56.50	27.47	15.08	54.89

(443), Bellary(418), Bijapur (382), Haveri (359), Gulbarga (323), Mandya (300) districts registered highest production of food grains, where as lowest production of food i.e less than 150 kg/head /annum was recorded again in Bengaluru Urban, Bengaluru Rural, D. Kannada, Kolar, Udapi and U. kannada districts. Three districts from North karnatak namely Gadag, Gulbarag and Haveri and one district from central karnatak such as Mandya emerged as high food grain producing districts in the study region, in earlier period i.e in 1997-98 these districts were registered under low food producing districts. Bengaluru Rural, Bagalkot,and Mysore districts lost their earlier status of high food grain producing status.

Live stock availability is one more important component of food availability after food grain crops from which meat and all dairy products like milk, butter, ghee etc. are derived; hence district wise number of live stocks per person is taken into account as one of the indicator of food availability. The per head availability of live stock in the study region shows declining trend i.e. from 1.36 in 1997- 98 to 1.10 in 2007-08.The distribution pattern of live stock population per head among the districts is dissimilar. It varies between 0.30 in Bengaluru Rural district to 2.88 in Kolar followed by Bellary (2.74) and Shimoga (1.80) districts during 1997- 98 and in 2007-08 least live stock population was found in Bengaluru Urban (0.09) followed by Chitradurga district (0.54), and highest population of live stock was registered in Bengaluru Rural (2.56) followed by Chikmagalore (2.40). Remaining districts fall under the range of 0.30 to 1.77 and 0.645 to 1.66 in 1997-98 and 2007-08 respectively. It has been observed that all most all the districts of Northern and Souther maidan districts in the region showed decreasing trends due to increase in the use of animals for consumption, shortage of fodder and decrease in the rearing of animals. Districts in and around malnad and coastal region witnessed increasing trend in live stock population where rearing is one of the prime occupation, particularly in Chikmagalore, Shimoga, D. Kannada, U. Kannada, Mysore, Kodagu districts. It has been shown in the figure 2 that the malnad and coastal districts showed the decreasing trends in the components of per capita availability of food and food grain production but increasing trends in live stock population.

Spatial Pattern in Food Availability:

To evaluate the food availability standardize score (Z score) of per capita availability of food , production of food grains and livestock population have been considered and calculated for all the 29 districts with the help of Z score. The spatial pattern of food availability in the state is divided in to food severity, food deficiency and food self sufficiency regions. Coastal districts namely D. Kannada, U. Kannada and Udupi, and all most all districts of South Karnatak except Mysore, Kolar and Tumkur districts represented severity in food availability (Range > - 0.400) in 1997-98.(Fig 3) . Where as deficiency of food (Range +0.549 to – 0.399) was observed in the districts of North Karnataka especially in Bijapur, Bagalkot, Belgaum and Dharwad districts. However food sufficiency (Range > + 0.550) region was identified in the Western part of the study region. Particularly in Koppal,Raichur and Bellary districts. The districts of Western part maintained the same status of food sufficiency in 2007-08 also.

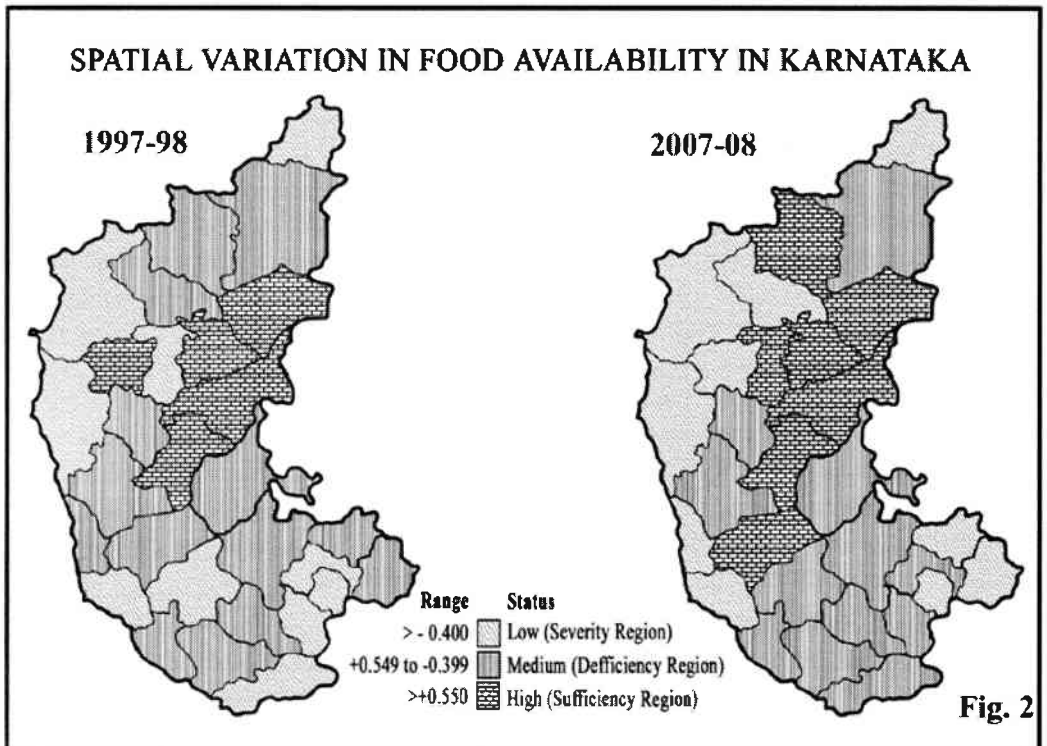
SPATIAL VARIATION IN FOOD AVAILABILITY IN KARNATAKA
1997-98
2007-08
Range
Status
> - 0.400
Low (Severity Region)
+0.549 to -0.399
Medium (Defficiency Region)
>+0.550
High (Sufficiency Region)

Fig. 2

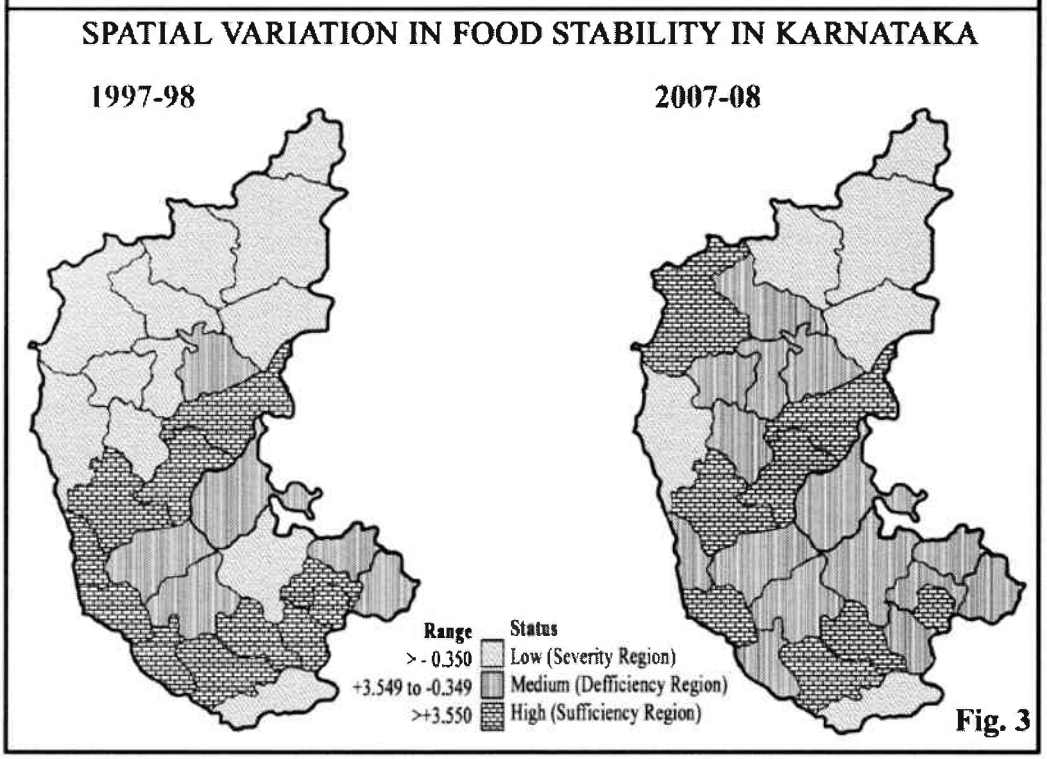
SPATIAL VARIATION IN FOOD STABILITY IN KARNATAKA
1997-98
2007-08
Range
Status
> - 0.350
Low (Severity Region)
+3.549 to -0.349
Medium (Defficiency Region)
>+3.550
High (Sufficiency Region)

Fig. 3

Where as two districts from North Karnataka i.e. Bagalkot and Gadag and one district from South Karnatak (Chikmagalore) gained entry in to the status of food sufficiency, and food severity was again recorded in all most all the districts of Coastal region and South Karnataka excluding Mandya and Mysore. Food deficiency was noticed in six districts spreading all over the study area. Gulbarga, Haveri, Bagalkot, and Gadag districts of North Karnataka showed slight improvement in food availability and fall under food deficiency and sufficiency regions . From South Karnatak one district emerged as food deficiency and three districts namely Tumkur, Chitradurga, and Kodagu emerged as food severity in 2007-08. However food deficiency was noticed in South Eastern districts namely Kolar, Ckikkaballapur, Bengaluru Rural and Hassan. Some changes were noticed from North Karnatak districts in development from food severity to food deficiency, and Southern Karnataka districts showed negative development i.e. from food sufficient to food deficiency.

II. Food Stability

Food stability refers to the stability in production, price, marketing and distribution system, access to safe drinking water and environmental hygiene. Food stability has been examined by considering five components like food grains production, access to safe drinking water, access to toilet facilities and consumption of fertilizers.

Trends in Food Stability:

Yield of food grains is directly proportional to the food production and food availability. Yield of Food grains (kg / hector) in the study region showed increasing trend from 1,494 kg in 1997-98 to 1,518 kg / hector in 2007-08. The rate of yield per kg/ hector of the study area has increased by 32 kg / hectors between 1997-98 to 2007-08. It may be noted that the study area is more or less stable in food grains production level. However, the inter district showed a wide variation in the yield of food grains. The per hector yield of food grains is highest in Kodagu i.e. 2,665 kg / hectors followed by Bengaluru Urban (2,156 kg / hectors) and Bellary (2,003 kg / hectors) district in 1997-98. While lowest was observed the Dharwad , Gadag, Bidar and Gulbarga districts. Where it is even less than 600 kg / hectors.

Irrigation and fertilizer consumption are important components of food stability which determines the production of food grains. Domestic use and all kinds of agriculture activities depend upon an adequate supply of water. Therefore irrigated area and fertilizer consumption have been taken in to consideration for assessing the food stability. The area under study reported increasing trends in irrigated area from 22.23 per cent in 1997-98 to 23.70 per cent in 2007-08 with a net increase of 1.47 per cent within ten years. In 1997-98 lowest percentage was recorded in Kodagu (2.50%) and Ckikamagalore (7.46%) districts. Bagalkot, Belgaum, Davanagere, Mandya and Koppal are other important districts where more than 30 percentage irrigated area was reported during 2007-08. Shimoga (51 %), Mandya (52 %), D.Kannada (54 %), district maintained the same status of high proportion of area under irrigation, while Chikamagalore (10.71%) and Kodagu (2.75%) districts again emerged as lowest irrigated area in the study region. It has been noticed that almost all the districts in the study region showed increasing proportion in irrigated

area. It is a fact that the situation of fertilizer consumption per hector among the districts of the study region is more or less similar to percentage of irrigated area.

Lack of access to clean drinking water and poor environmental hygiene lead to poor assimilation of the food that is consumed and Nutrition security cannot be achieved without clean drinking water security. (Gopalan 2007) The percentage of household having access to water indicates increasing trend from 70.76 per cent in 1997-98 to 81.82 per cent in 2007-08 with a net increase of 11 per cent. It is due to implementation of various Govt. and non - Govt. Programs, especially in rural areas the proportion of house hold having water facilities has increased. Almost all the districts from South Karnataka recorded with more than 90 per cent of house holds having access to safe drinking water during the study period. While coastal districts namely U.Kannada , D. Kannada and Udupi represented very least i.e. only less than 30 per cent of house hold having safe drinking water. Remaining districts exhibited fair percentage of house holds having safe drinking water. The causes for the uneven availability of safe drinking water for the house holds are innumerable.

The proportion of house holds having access to toilet facilities indicates increasing trends from 20 per cent in 1997-98 and 32 per cent in 2007-08 with net increase of 12 per cent. At the district level the data indicates a wide variation in the proportion of house holds having access to toilets ranging from 6.95 per cent in Bijapur district to maximum of 72 per cent in Bangalore Urban. It is interesting to note that almost all the districts of North Karnataka witnessed lowest proportion i.e. less than 15 per cent of house holds having access to toilet facilities, because the rural people still prefer open places rather than use of constructed toilets. Bengaluru urban district and coastal districts maintained the same status of high proportion of toilet facilities in 2007-08 also. Remaining districts have showed improvement in the availability of toilet facilities.

Spatial Pattern of Food Stability:

To assess the food stability regions five indicators have been considered, and district wise Z score has been calculated separately and then composite Z score has been worked out. The inter district variations in composite Z score of food stability may conveniently be arranged into three suitable groups such as high (> +3.550), medium (+3.549 to -0.349) and low (> - 0.350). There are ten districts three from Coastal region (U.Kannada, D.Kannada,and Udupi). Five from South most Karnataka (Capital city, Bengaluru Rural, Ramanagar, Mysore and Hassan) and one each from malnad (Shimoga) and North Karnataka (Bellary) emerged under the group of high food stability region(Range + 3.550) in 1997-98 (Fig.3). It is important to mention that food stability in these districts is high mainly due to the facts that modern technologies have been adopted in the agriculture sector, irrigation facilities and fair consumption of fertilizer. Low food stability was observed (Range > - 0.350) in all the districts of North karnataka. Because these districts are located under semi -arid region where less natural rain fall, meager irrigation facilities and dry climatic conditions prevailed, as a result food un stability existed. However food deficiency (Range + 3.549 to – 0.349) was observed in the central part of the

study region. Southern most districts of Karnataka maintained the same status of high stability during 2007-08 also. One district (Belgaum) from North Karnatak gained entry in to high food stability from low stability level. Low food stability (>-0.350) was recorded only in four districts of North Karnataka. While the other districts namely Bijapur,Bidar, Raichur, Gadag and U. Kannada of North Karnatak showed slight improvement in food stability and fall under medium food stability from low food stability level. Medium food stability was noticed in south eastern districts namely Kolar, Ckikkaballapur, Bangalore rural, Hassan, and some changes were noticed in central Karnatak districts.

III. Food Accessibility:

Food availability, Food stability and Food Accessibility are some of the important components which determine the food security regions of an area (Prof. M.S.Swaminathan - 2010). Majority of malnourished population cannot produce or afford to buy enough food. They have inadequate access to natural resources, jobs, income or social scores (Chaturvedi, 1997). Number of fair price shops, main workers, literacy rate, Human survival and urbanization are the main indicators taken in to account to examine the food accessibility.

Trends in Food Accessibility:

Fair price shop is one of the important components of food accessibility as to store and distribute food, near by fair price shops are very essential other wise all the poor people have to struggle to get food. Hence the availability of fair price shops is taken as an indicator of food accessibility .The study area consists of 19,547 fair price shops but it is much lower than the total number of villages (27,683). It indicates that the public distribution system (PDS) in the study region is suffering from an urban bias. Most of the fair price shops are concentrated in urban areas, as a result of which majority of poor and rural population are not much benefited by food distribution system.

Percentage of main workers to the total population is another important component which represents total employment scenario of the study region. The study region reported 37.02 per cent in 1997-98 and 37.02 in 2007-08. There is no change in the proportion of main workers during both the period of time, but there is wide variation among the district. The highest percentage of main workers was observed in Kodagu district during two periods (45.10 and 44.13) and lowest was found in Bidar district (28.30% in 1997-98 and 28.28 % in 2007-08). It may be noted that agriculturally developed six districts notably Chikkaballapur, Gadag, Hassan, Kolar, Tumkur reported high proportionate of main workers (More than 40%) as compared to other districts. There are thirteen districts namely Bijapur, Davangere, Dharwad, Haveri, Koppal, Mysore, Raichur, Shimoga and D.Kannada which reported below the study region average of 37 per cent during 1997-98, and 2007-08, and these districts are spreading all over the study region.

Literacy is an important indicator of food severity which play a decisive role in availability and stability of food as well as overall development of an area. Most of the earlier studies revealed that literacy can eradicate poverty, and control the rapid growth of population and help to secure food. Generally it has been observed that literate people have more access to food and

adopt advanced and suitable technologies for increasing the food. The study region showed increasing trend in literacy from 65.60 per cent in 1997-98 and 66.60 in 2007-08 with a net increase of 1 per cent between 1997-98 and 2007-08. The literacy rate among the districts in the study area showed wide variation i.e.35.96 per cent (Raichur) to 76.27 per cent (Bengaluru Urban) in 1997-98.. But in 2007-08 it has increased to 48.8 per cent (Raichur) to 84.8 per cent (D.Kannada) in 1997-98 but from all most all the districts of Karnataka represented positive growth in the literacy during study period. Survival of human is calculated as the number of survivors per 1000 live birth. Malnutrition is an important cause for the high maternal and infant mortality rate in developing countries (Gopalan1969). It has been observed from the data that study region has witnessed improvement in human survival i.e. from 915 in 1997-98 to 943 / 1000 live birth in 2007-08. Across the districts in the study area coastal districts namely D.Kannada (941) and Udupi (941) recorded highest human survivors followed by Shimoga (1940). While lowest was in Koppal (808) in 1997-98. It is pertinent to note that in 2007-08 all most all the districts showed positive growth in survivors and again the highest (More than 955) was found in coastal districts and least was 931 / 1000 live birth in Dharwad district.

It is generally observed that the urban population has more access to attain the food than the other rural areas. Hence it has been considered as one of the indicator to measure the food security. The proportion of urbanization of the areas under study area has increased from 26 in 1997-98 to 27.47 per cent in 2007-08. (as increase of 1.47 %). But this proportion varied in different district. Three districts one each from North Karnataka (Bijapur), Central Karnataka (Chitradurga) and South Karnataka (Kodagu) showed negative rate of change in urbanization. The remaining districts showed significant increase in urbanization. It is quite natural that the state capital city Bengaluru urban recorded highest percentage of urban population i.e. more than 92 % while least urban population was noticed in Kodagu district i.e. 13 percent

Spatial Pattern of Food Accessibility:

To find out the food accessibility regions for the year 1997-98 and 2007-08 district wise z score of five indicators (Table.1) have been calculated separately and the z score are worked out (Table -2) . State capital city and surrounding districts like Ramanagar and Bengalore Rural and coastal districts and one district (Bidar) from North Karnatak had witnessed high (Range > +0.400) food accessibility (Fig.4) in 1997-98. Low food accessibility (Range > - 0.400) was recorded exclusively in five districts of North Karnataka (Bagalkot, Bijapur, Gulbarga, Raichur and Koppal). It may be noticed that these districts are known for socio-economically backwardness in the state; where as medium food accessibility was found (Range + 0.399 to - 0.399) in all most all the districts (Except four districts of coastal region, three districts of south most Karnataka and five districts of north Karnataka) which are scattered all over the study region. South most and coastal districts of Karnataka maintained the same status of high (Range > + 0.400) food accessibility during 2007-08, and some changes were noticed in two districts namely Bidar and Gadag from North Karnatak and one district from (Chitradurga) central

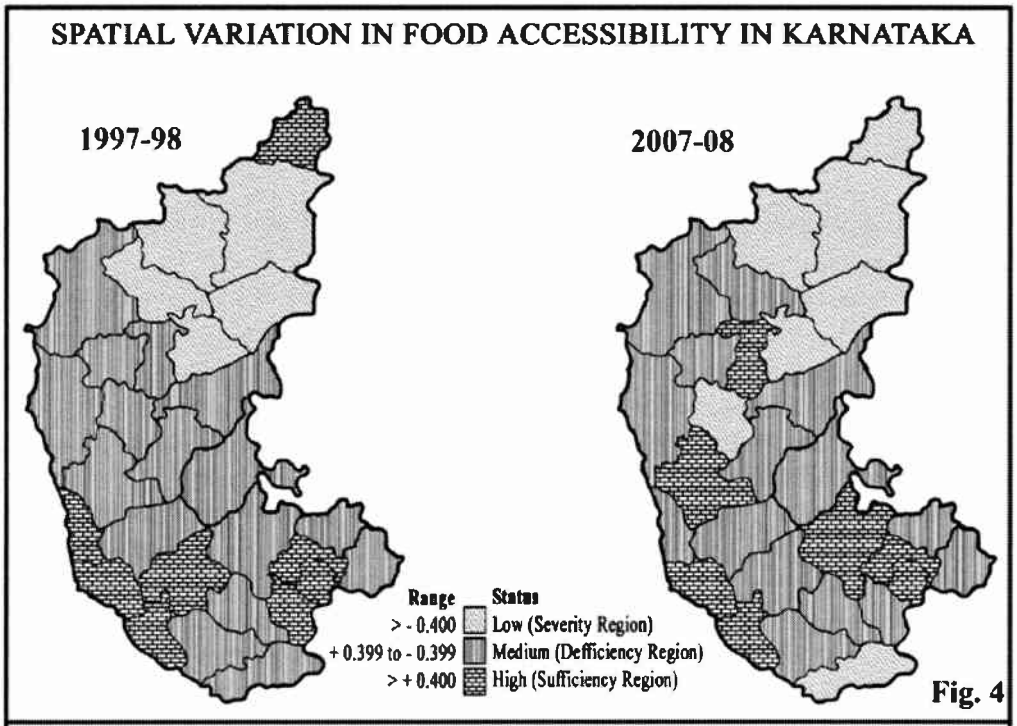
SPATIAL VARIATION IN FOOD ACCESSIBILITY IN KARNATAKA
1997-98
2007-08
Range
Status
> - 0.400
Low (Severity Region)
+ 0.399 to - 0.399
Medium (Defficiency Region)
> + 0.400
High (Sufficiency Region)

Fig. 4

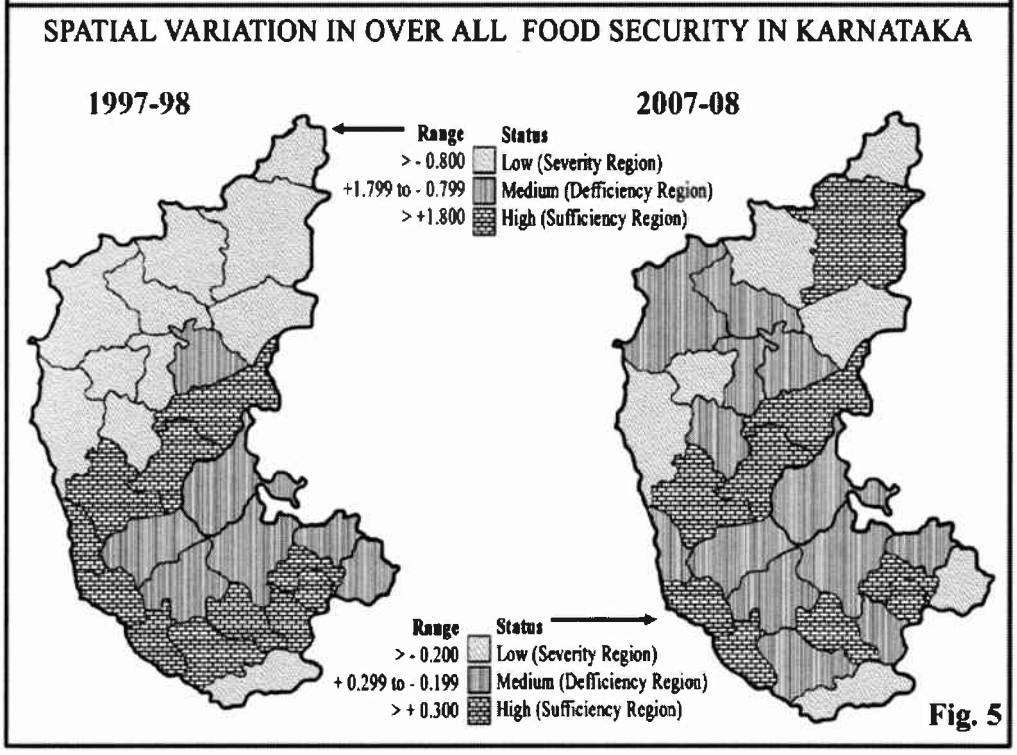
SPATIAL VARIATION IN OVER ALL FOOD SECURITY IN KARNATAKA
1997-98
2007-08
Range
Status
> - 0.800
Low (Severity Region)
+1.799 to - 0.799
Medium (Defficiency Region)
> +1.800
High (Sufficiency Region)
Range
Status
> - 0.200
Low (Severity Region)
+ 0.299 to - 0.199
Medium (Defficiency Region)
> + 0.300
High (Sufficiency Region)

Fig. 5

Karnataka from high to low and medium to high food accessibility respectively. There are fourteen districts scattered all over the study region which exhibited medium food accessibility.

Over all Food Security Regions:

To evaluate and access the overall spatial patterns of food security regions Z score of the 13 indicators have been calculated district wise. Further all the concerned indicators have been added district wise and average is obtained to find out the Z score of food security region. The standard deviation technique has been applied to divide the study region in high (Food sufficiency), Medium (Deficiency) and low (severity) food security regions. Table – 2 represents the wide variation of composite Z scores among the districts of study area.

I. High Food security regions –Sufficiency:

During the study period i.e. 1997 – 98 and 2007-08 study region as a whole had witnessed slight negative development in food security. In 1997-98 there were eleven districts from South most Karnatak i.e. in and around the capital city, two from coastal region, two from North Karnatak and one from Malnad (Shimoga) region showed food sufficiency i.e. high food security regions (Range > + 1.800). During 2007-08.the same districts had maintained the pace of high (Range > +0.300) food security, except three districts, two from south most Karnataka (Ramanagar & Mysore) and one from coastal region.(Udupi), these districts emerged as food deficiency and fall under medium food security region .Raichur is the only district which emerged as high food security (2007-08) district from low food security (1997-98). High food security regions may be attributed to IT / BT centers, high literacy, suitable physical environment, high concentration of urban population, better public distribution system, infrastructural and industrial development etc.

II. Medium Food security Regions - Deficiency:

During 1997-98 food deficiency (Range + 1.799 to -0.799) was identified in seven districts of Karnataka, of which four and two districts concentrated in the central and South East Karnatak respectively, and only one district i.e. Koppal from North Karnataka. In 2007-08 districts from South Karnatak showed stagnant growth and remained in medium food severity region except Kolar district which lost its earlier (1997-98) status of medium food security and fall under low food security region (2007-08). However many districts from North Karnataka which earlier (1997-98) belonged to severity food security region (Range > -0.800) represented better development and gained medium (Deficiency) food security status in 2007-08.

III. Low Food Security Regions – Severity:

In 1997-98 low (Range > -0.800) food security region was observed in eleven districts, of which ten districts from North Karnataka and only one district (Chamaraj Nagar) from South Karnatak. During 2007-08 low food security (Range > -0.200) was recorded in six districts (Bidar, Bijapur, Raichur, U. Kannada and Dharwar) most of these again situated in North karnatak and two from (Kolar & Chamarajnagar) South Karnatak. It has been observed that during the study period most of the districts of North Karnataka remained in low food severity region. (Food severity). These districts have disadvantages both in terms

Table 2: District wise Z Score (Composite standard score) for Food availability, Food stability, Food accessibility and Overall Food security -1997-98 & 2007-08

Sl.No	Name of the District	Food availability		Food stability		Food accessibility		overall Food security	
		1997-98	2007-08	1997-98	2007-08	1997-98	2007-08	1997-98	2007-08
01	Bagalkot	0.4422	0.6703	-4.6351	-0.188	-0.4067	-0.392	-2.0018	-0.0689
02	Bengaluru Urban	-1.3075	-1.3852	10.5102	1.25	0.7410	0.872	4.0298	0.6561
03	Bengaluru. Rural	-0.7117	-0.0576	5.4081	0.206	0.6164	0.566	2.1528	0.4839
04	Belgaum	-0.9018	-0.5729	-6.3976	0.544	0.1186	0.146	-2.6231	0.1324
05	Bellary	2.1882	1.1597	6.9011	0.642	-0.1938	-0.062	3.0846	0.6411
06	Bidar	-0.5912	-0.6187	-11.2555	-0.806	0.5038	-0.702	-4.5848	-0.9302
07	Bijapur	0.0621	0.6018	-9.5814	-0.646	-0.615	-0.814	-3.9046	-0.5969
08	Chamrajnagar	-0.4572	-0.3827	-1.9902	-0.130	-0.2284	-0.512	-1.0197	-0.3977
09	Chikaballapur	-0.0028	-0.5412	1.5576	0.344	0.1942	0.212	0.7130	-0.0115
10	Chikmaglore	-0.4366	0.6868	0.8702	-0.046	0.1026	-0.012	0.2718	0.1151
11	Chitradurga	0.3899	-0.2358	0.5202	-0.234	0.1522	0.094	0.3420	-0.1265
12	D. Kannada	-0.8258	-1.1011	8.7441	0.586	0.9235	1.008	3.5277	0.4358
13	Davangeri	2.0166	1.1777	11.8655	0.564	0.1457	0.412	5.4967	0.8305
14	Dharwad	0.7458	-0.7726	-14.7499	-0.394	-0.1408	-0.212	-5.9500	-0.4602
15	Gadag	-0.5615	1.94	-14.009	-0.816	0.3560	0.620	-5.8587	0.2431
16	Gulbarga	-0.2013	0.0925	-12.0779	-0.402	-0.6968	-0.812	-4.9598	-0.6333
17	Hassan	-0.1598	-0.0681	3.3383	0.188	0.5222	0.228	1.4614	0.1551
18	Haveri	0.0571	0.5476	-3.7484	-0.200	-0.1327	-0.456	-1.5893	0.0079
19	Kodagu	-0.1451	-0.3762	15.3517	0.254	0.9159	0.566	6.1713	0.4024
20	Kolar	0.1979	-0.8014	1.5576	0.234	0.3347	0.058	0.9177	-0.2667
21	Koppal	1.0742	1.7847	0.9886	0.094	-0.6869	-0.742	-0.3723	0.1302
22	Mandya	-0.2898	0.1098	6.8919	0.840	-0.1545	-0.350	2.5245	0.3845
23	Mysore	0.0645	0.186	6.5541	0.460	-0.0253	0.1525	2.8567	0.2558
24	Raichur	1.1527	0.8643	-2.4523	-0.566	-0.5566	-0.5425	-0.9060	-0.2150
25	Ramnagar	-0.7123	-0.2904	5.4554	-0.014	0.9054	0.356	2.3968	0.1693
26	Shimoga	0.4770	0.031	4.2217	0.838	0.3880	0.412	1.8803	0.6737
27	Tumkur	0.2626	-0.1957	-2.0599	-0.174	0.2840	0.452	-0.7961	0.0284
28	Udapi	-0.1026	-0.4878	6.0321	-0.310	0.4814	0.182	2.5110	-0.0705
29	U.Kannada	-0.8535	-0.5526	-5.0532	-0.630	-0.2581	0.024	-2.2398	-0.2263

Sources: Based on Table 2,3, & 4 .

of natural resources, topography, and dry region of Karnataka with very low rain fall , poor composition of soil and subjected to frequent droughts and famine conditions, as a result these districts are known as back ward districts in Karnataka state.

Major Findings

▶ Food availability

- Per capita availability of food in karnatak is 642 grams, which is more than the national average of 462 grams. However, there is a wide variation among the districts of karnatak ranging 210 grams (Capital city- Bengaluru Urban) to 1,690 grams (Davangere) during 1997 -98, and 180 grams in Kolar district to 1,620 grams in Gadag district in 2007- 08.
- It has been observed from the fact that the districts from the coastal region and highly urbanized districts witnessed per capita availability of food below the study region average i.e.690 & 642 during both the years. This probably points to high proportion of population engaged in secondary and tertiary activities in urbanized districts and fisheries in coastal, districts. At the same time very meager percentage of land available for cultivation also play a decisive role.
- Food grain production in the area under study indicated slightly decreasing trend i.e. from 256 kg in 1997-98 to 241 kg/head/annum during 2007-08.It is due to decrease in the net sown area and at the same time population has also increased at faster rate than the food production.
- It is proved that the districts with irrigation facilities recorded highest food production per capita in 1997-98 and 2007-08 (more than 350 kg). Capital city – Bengaluru, and coastal districts registered a very low food grain production i.e. less than 100 Kg/ head/annum.
- Per head/ annum availability of Live stock population in the study region exhibited decreasing trend i.e. from 1.36 in 1997-98 and 1.10 in 2007-08. However, some districts showed positive progress.
- Districts in and around the malnad and coastal region recorded increasing trend in live stock population where animal rearing is one of the basic occupation. But the districts which showed high per capita availability of food and food production presented decreasing trends (except Kolar &koppal) .
- Coastal districts, and all most all the districts of South Karnatak (except Mysore, Kolar and Tumkur) districts represented severity in food availability (Range > - 0 .400) in 1997-98. Where as deficiency of food (Range +0.549 to – 0.399) was observed in the districts of North Karnataka especially in Bijapur, Bagalkot, Belgaum and Dharwad districts. However food sufficiency (Range > + 0.550) region was identified in the Western part of the study region. The districts of Western part maintained the same status of food sufficiency in 2007-08 also

▶ Food Stability

- Yield of Food grains (kg / hector) in the study region showed increasing trend

from 1,494 kg in 1997-98 to 1,518 kg/ hector in 2007-08. The rate of yield per kg/ hector of the study area have increased by 32 kg / hectors between 1997-98 and 2007-08. It may be noted that the study area is more or less stable in food grains productivity level. However, the inter district showed a wide variation in the yield of food grains.

- The area under study reported increasing trends in irrigated area from 22.23 per cent in 1997-98 to 23.70 per cent in 2007-08 with a net increase of 1.47 per cent within ten years.
- The percentage of household having access to water indicated increasing trend from 70.76 per cent in 1997-98 to 81.82 per cent in 2007-08 with a net increase of 11 per cent. Almost all the districts from South Karnataka recorded with more than 90 per cent of house holds having access to safe drinking water during the study period.
- The proportion of house holds having access to toilet facilities indicates increasing trends from 20 per cent in 1997-98 and 32 per cent in 2007-08 with net increase of 12 per cent. It is interesting to note that almost all the districts of North Karnataka witnessed lowest proportion i.e. less than 15 per cent of house holds having access to toilet facilities because the rural people still prefer open places rather than use of constructed toilets whereas urbanized districts noticed high proportion of house holds with toilet facilities.
- There are ten districts, three from Coastal region, five from South most Karnataka and one each from malnad and North Karnatak which emerged under the group of high food stability region(Range + 3.550) in 1997-98 Where as low food stability (Range > -0.350) was observed in all the districts of North Karnataka.

► Food Accessibility

- The employment scenario in the state reported 37.02 per cent in 1997-98 and 37.02 in 2007-08. There is no change in the proportion of main workers during both the period of time.
- The study region showed increasing trend in literacy from 65.60 per cent in 1997-98 and 66.60 in 2007-08 with a net increase of 1 per cent between 1997-98 and 2007-08. however there is greater variation among the districts. Hence coastal districts and capital city – Bengaluru Uraban reported high per cent of literacy i.e. more than 80 per cent, and districts of North karnatak witnessed below 65 per cent.
- It has been observed from the data that study region has witnessed improvement in human survival i.e. from 915 in 1997-98 to 943 / 1000 live birth in 2007-08. Across the districts in the study area coastal districts recorded highest (> 956 / 1000) human survivors While lowest was in North Karnataka. (< 950)
- State capital city and surrounding and coastal districts, and one district (Bidar) from north Karnataka witnessed high (Range > +0.400) food accessibility. Less food accessibility (Range -0.399) was recorded exclusively in five districts of north Karnataka.

- During the study period i.e. 1997 – 98 and 2007-08 study region as a whole witnessed slight negative development in food security.

Suggestions

The path towards sustainable development is not that easy as it seems to be , especially in the districts of the study region there is a wide variation. If some districts are deprived some are meager natural resources. The districts endowed with high natural resources certainly sustain its population on its own. There are many districts in the region which not in a position to produce and provide enough food to their population. Keeping this view in mind some suggestions are initiated for the sustainability of region in respect of food security.

- Removing pressure on land and water and conserving natural resources for sustainable food water and supply are essential in some of the districts,
- At the same time it is important to increase land productivity, diversifying agriculture, improving infrastructure, providing market linkage. Instead of using cultivable lands use of waste lands for the and development is beneficial. Waste lands and water logged areas can be reclaimed and converted in to fertile lands by using latest scientific measures this way land can be saved for future use. so that at least severity and deficiency of food can be minimized and sustainability in the food can be brought in the study area.

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