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SOCIO-ECONOMIC VULNERABILITY OF CLIMATE CHANGE IN KARNATAKA

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ABSTRACT

Climate change will have a profound impact on human and eco-systems during the coming decades through variations in global average temperature and rainfall. The present study was done to decipher the socio-economic vulnerability of climate change in Karnataka using the secondary data. Karnataka is the second most vulnerable state in India to be impacted by Climate Change as the North Karnataka regions have the arid and driest regions. Tabular analyses have been used to derive valid conclusions. The Vulnerability index at district level was computed based on the demographic and social, occupational, agricultural and climatic dimensions. Local communities at the micro ecosystem level adapt/cope up with the changing climate conditions. The changing climate results to permanent migration from densely settled areas to less denser areas. It was observed that the large farmers were able to benefit from government subsidies, formal bank credit, and crop insurance while smaller farmers were having less access to benefits caused due to lack of information and dependence on local merchants for credit. A large proportion of talukas in Karnataka are most backward falling in Gulbarga division of the northern Karnataka. Local communities at the Micro ecosystem level adopt/cope up with the changing climate conditions.

Keywords: Climate change, vulnerability and sensitivity.

Introduction

Climate change will have a profound impact on human and eco-systems during the coming decades through variations in global average temperature and rainfall. A growing body of literature in the past two decades has identified climate change as the prime issue in global environment, and analyzed the associated vulnerability and biodiversity loss (Fourth Assessment Report of the Intergovernmental Panel on Climate Change).

The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as "the extent to which climate change may damage or harm a system." It adds that vulnerability "depends not only on a system's sensitivity, but also on its ability to adapt to new climatic conditions". Vulnerability is a function of the character, magnitude and rate of climate change to which a system is exposed, along with its sensitivity and adaptive capacity. Sensitivity is the degree to which a system can be affected, negatively or positively, by changes in climate. This includes change in mean climate and the frequency and magnitude of extremes. The effect may be direct (for example a change in crop yield due to a change in temperature) or indirect (such as damage caused by increased frequency of coastal flooding due to sea-level rise).

Climate Change Implications for India and Karnataka

Climate forecasts indicate implications for India by altering the distribution and quality of India's natural resources ruthlessly affecting livelihoods, more so the vulnerable poor. India may encounter a major threat given its close linkages with its natural resource base economy and climate sensitive sectors like agriculture, water and forestry.

Karnataka is the second most vulnerable state in India to be impacted by Climate Change as the North Karnataka regions have the arid and driest regions. Climate change will impact on natural resources to have social and economic consequences. While some of the impacts are presumed to be beneficial others could be disastrous. The social and economic implications of this would benefit farmers and the other sectors associated with its production. Anonymous (2011) mentioned that the concept of drought varies from place to place depending upon normal climatic conditions, available water resources, agricultural practices and the various socio-economic activities of a region. Parmer et al. (2009) reported that agricultural drought is probably the most important aspect of drought, but that problem is more specialized and complicated than some investigators seem to realize.

Methodology

Karnataka state was selected for the study as it is second most vulnerable state in India to be impacted by Climate Change as the North Karnataka regions have the arid and driest regions. The study is exclusively based on secondary data collected from various sources. The study considers the climate variability for southwest monsoon (rainy) season. District- wise data is obtained by re-gridding the dataset to 0.1° lat. x 0.1° long. and re-aggregating by districts to study the climate variability at district level. The study uses common statistical tool i.e. tabular analysis for analyzing the data. Tabular analysis was employed for meaningful interpretation of the results.

Vulnerability index at district level was computed based on the demographic and social, occupational, agricultural and climatic dimensions. The index attempts to capture a comprehensive scale of vulnerability by including important indicators that serve as proxies. We have used data from Karnataka at a glance to calculate the composite vulnerability Index across the districts of Karnataka.

Result and discussion

Climate change is predicted to bring about diverse impacts with extreme weather conditions across regions like intense rainfall and flood risks while on the other side there would be extreme droughts besides higher tides, intense storms, warmer oceans and erosion along its coastline as an outcome of sea level rise. Climate change can affect lives, livelihoods and production systems posing high risk to people living in rural areas, particularly the poor. Hence, an urgent need for action to avoid irreversible calamities with appropriate climate risk management.

Possible Socio-Economic Impacts of Climate Change in Karnataka

1. Migration Problems

People from the high density rural areas will migrate to low density areas and to cities. The increasing concentration of people in urban areas may increase other risks of calamities like rare climate events causing pressures like heat stress, urban flooding, and urban drought causing immense pressures on infrastructure arrangements to be made. In brief, increase in population will increase vulnerability caused from climate change (Table 1).

Permanent migration is from densely settled areas to less denser areas. The major causes could be attributed to natural disasters which result in loss of land holdings, properties forcing them to relocate besides unfavorable social and economic conditions where livelihoods are insecure. Susceptibility to these implications is mostly due to lack of supportive infrastructure and employment to the poor. It is presumed that migration is likely to increase given the socio-economic impacts of climate change in the future. It is observed that the incidences of migration in northern Karnataka have increased. Coorg region in the South has encountered migration to a large extent because of coffee estates. Chamrajnagar and Kolar districts were also prone to large number of migrants traveling to Bangalore and Mysore. Similarly, farmers from Bijapur and Bagalkot traveled to Goa in search of livelihoods while farmers from Raichur travel to Bangalore as construction workers (Nagaraj, 2008). In families where the couple migrated, the children were left with the elderly to be taken care of making it difficult for them to cope with the physical and emotional pressures.

2. Implications for Agriculture and Food Security

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Change in precipitation patterns will impact agricultural productivity and hence impact on food and livelihood security. A detailed study by (2004), indicates the district level vulnerabilities where adaptive capacity was mapped as a component of biophysical, socioeconomic and technological factors and juxtaposed against a map of sensitivity to climate change indicating several districts with lower degrees of adaptive capacity in the interior regions of the country. Case studies at the community-level highlighted large discrepancies in adaptive capacity across villages, across communities in villages and specifically across individuals depending on land holding size, education etc. It was also observed that large farmers were able to benefit from government subsidies, formal bank credit, and crop insurance while smaller farmers were having less access to benefits caused due to lack of information and dependence on local merchants for credit.

3. Climate Change and Crop Productivity

Climate change is predicted to reduce yields of maize and sorghum by upto 50%. It is indicated that these crops being C4 photosynthetic systems, therefore do not have relative benefits at higher CO_2 concentrations. Similarly analysis of past weather conditions data across locations with respect to coconut growing regions in the Western Ghat areas and yield data have indicated warning trends in majority of the areas. The increase in maximum temperature varied from 0.01 to 0.04°C annually while the average minimum temperature showed a decreasing trend in many regions up to -0.03 to +0.03 annually. Dry spells showed an increasing trend in some regions in Karnataka. Change in dry spells varied from -1.98 to 0.27 days/year and change in coconut yields across the country ranged from -114 to 270 nuts/ha/year.

4. Livestock and Fodder Availability

Implications on livestock and fodder availability have been disastrous in many districts of Karnataka affecting the income of marginal communities and leading to distress sale of livestock. A study by Nagaratna (2009) on the consequences of the 2003 drought in Karnataka emphasizing on livestock and fodder have revealed interesting results. As 2003 drought was one of the severe droughts that occurred in Karnataka, the implications across the state indicated that the total coverage by all crops for the state as a whole was 56% of the normal and was not satisfactory for cereals, pulses and oilseeds. Similarly, the coverage was very less for cash crops, 34% of the normal. Chamarajnagar was a severely drought affected district while Gadag was moderately affected and Gulbarga less drought affected comparatively and the trends in their agricultural situation indicated it as well. All these three districts experienced meteorological, hydrological and agricultural droughts during all the seasons in 2003.

Climate Change Vulnerability

At state level studies, High Power Committee (HPC) for Redressal of Regional Imbalances under the Chairmanship of Prof. D.M. Nanjundappa has considered 35 different indicators for classifying all the talukas and districts of Karnataka into backward, more backward and most backward. It can be seen from Table 2, that most of the backward talukas in the state are located in northern parts of the state. This indicates appropriate project interventions in the northern Karnataka regions on priority. Further it can be seen from Table-2 that a large proportion of talukas in Karnataka are most backward falling in Gulbarga division of the northern Karnataka.

Measurement of Vulnerability based on Four Dimensions:

Vulnerability is often reflected in the state of the economic system as well as the socio-economic features of the population living in that system. By considering climate change relevant parameters, Vulnerability index at district level was computed based on the demographic and social, occupational, agricultural and climatic dimensions.

The index attempts to capture a comprehensive scale of vulnerability by including important indicators that serve as proxies. Table-3 shows the value of the vulnerability index across the districts of Karnataka. In the table rank 1 shows maximum vulnerable district and the vulnerability decreases as we go on increasing the rank. In Karnataka, Gulbarga district is the most vulnerable district based on the composite index of a few important indicators such as demographic and social, occupational, agricultural and climatic indicators. According to the composite vulnerability index, Dakhina Kannada is the least vulnerable district of Karnataka. After developing Composite District Level Vulnerability Index, for identification of suitable interventions at district level and sector wise, dependent population in various economic sectors was considered.

Coping Mechanisms to Vulnerability

Local communities at the Micro ecosystem level adapt/cope up with the changing climate conditions. This coping mechanism again is both external and internal. External in terms of government/NGO programmes/schemes, and internal in terms of their strategies, like change in cropping pattern, species composition of livestock, migration, wage labour, etc. In the process, some may be better off, some may remain same, and some may be worse off (detailed studies are required in these areas). The degree varies depending upon the socio-economic background of the households in question.

Conclusions

The rainfall analysis IMD gridded data shows that there is a long-term negative trend of about 6% in precipitation over Karnataka for the period 1951-2004. The rainfall variability is

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very high in Chikballapur, Chitradurga, Gadag, Kolar, Mandya and Tumkur districts natural ecosystems. Annual mean minimum and maximum temperatures are highest in Raichur, Gulbarga and Yadgir districts of North Interior Karnataka. Bidar and Gulbarga districts indicate a larger inter-annual variability with respect to annual mean minimum and maximum temperature. A steady warming trend is observed in both the minimum and maximum temperature over Bijapur, Gulbarga and Raichur. The study reveals that the changing climate results to Permanent migration from densely settled areas to less denser areas. It is observed that the large farmers were able to benefit from government subsidies, formal bank credit, and crop insurance while smaller farmers were having less access to benefits caused due to lack of information and dependence on local merchants for credit. A large proportion of talukas in Karnataka are most backward falling in Gulbarga division of the northern Karnataka. Local communities at the Micro ecosystem level adapt/cope up with the changing climate conditions.

References

Anonymous, 2011, 69 taluks in 20 districts drought-hit. The Hindu, October 5. p. 4. State of Environment Report of Karnataka, 2003;

Parmar, V. R. and Shrivastava, P. K., 2009, Variability of temperature in south Gujarat coast. J. Agric. Meteorol., 11: 204-207.

IPCC (2007) Climate Change 2007: Working Group II Report: Impacts, Adaptation and Vulnerability. WMO and UNEP, Geneva.

Nagaratna Biradar and Sridhar, K., 2009, Consequences of 2003 drought in Karnataka with particular reference to livestock and fodder. J. Human Ecol., 26 (2): 123-130.

Table 1: Population in different districts

Sl.No	Districts	1991 Census	2001 Census
1	Bangalore	4839162	6523110
2	Bangalore (R)	1673194	1877416
3	Chitradurga	1312717	1510227
4	Davanagere	1559222	1789693
5	Kolar	2216889	2523406
6	Shimoga	1452259	1639595
7	Tumkur	2305819	2579516
8	Belgaum	3583606	4207264
9	Bijapur	1533448	1808863
10	Bagalkot	1394542	1652232
11	Dharwad	1374895	1603794
12	Gadag	859042	971955
13	Haveri	1269213	1437860
14	Uttara Kannada	1220260	1353299
15	Bellary	1656000	2025242
16	Bidar	1255798	1501374
17	Gulbarga	2582169	3124858
18	Raichur	1351809	1648212
19	Koppal	958078	1193496
20	Chikmagalur	1017283	1139104
21	Dakshina Kannada	1633392	1896403
22	Udupi	1060872	1109494
23	Hassan	1569684	1721319
24	Kodagu	488455	545322
25	Mandya	1644374	1761718
26	Mysore	2281653	2624911
27	Chamarajanagar	883365	964275
	STATE	44977200	52733958

Source: 1991, 2001 Census Data

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Table 2: Regional Imbalances in Karnataka

Divisions	Most Backward	More Backward	Backward	Total
Gulbarga	21	5	2	28
Belgaum	5	12	14	31
Bangalore	11	13	9	33
Mysore	2	10	10	22
Total	39	40	35	114

Fig 1: **Composite index of Vulnerability across Districts of Karnataka**

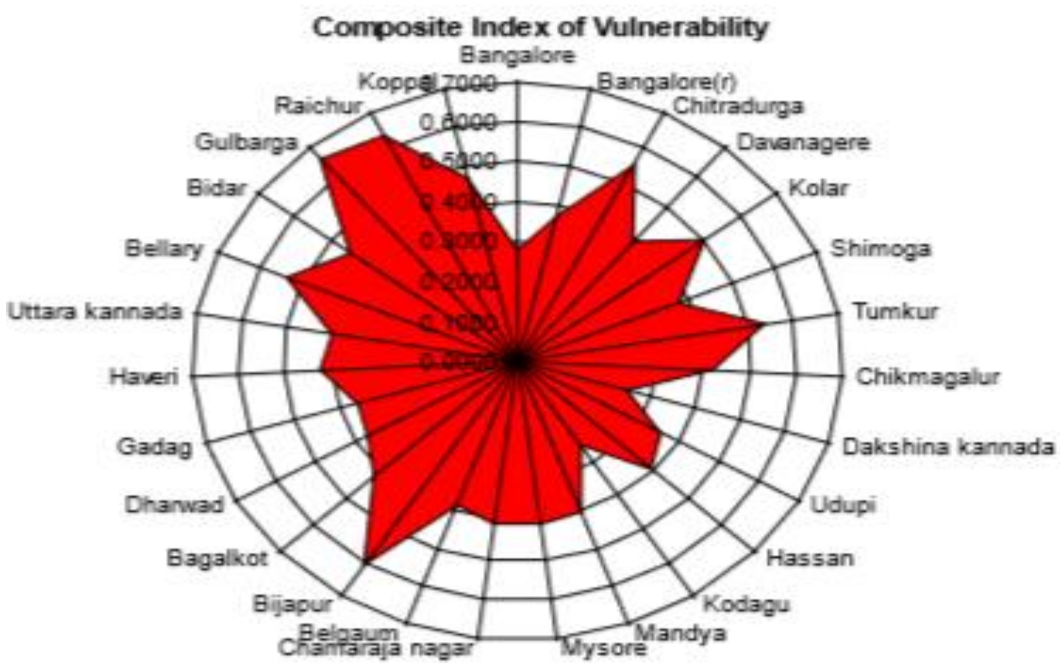

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Table 3: District-wise Vulnerability Indices of Karnataka

District	Index of Demographic and Social Vulnerability	Rank	Index of Occupational Vulnerability	Rank	Index of Agricultural Vulnerability	Rank	Index of Climatic variability	Rank	Composite Index	Rank of Composite Index
Gulbarga	0.5780	2	0.5467	7	0.7169	1	0.7897	2	0.6578	1
Raichur	0.6616	1	0.5928	1	0.5698	7	0.6959	4	0.6300	2
Bijapur	0.4350	12	0.5472	6	0.5174	14	0.9294	1	0.6072	3
Chitradurga	0.4877	7	0.4938	14	0.5219	13	0.6908	5	0.5486	4
Tumkur	0.3580	18	0.4663	18	0.6143	3	0.7150	3	0.5384	5
Bellary	0.5483	4	0.4520	21	0.5122	17	0.6303	6	0.5357	6
Kolar	0.4404	10	0.4959	13	0.5713	6	0.5103	7	0.5045	7
Koppal	0.5567	3	0.5719	4	0.4160	23	0.3333	9	0.4695	8
Bidar	0.5255	5	0.5345	8	0.5164	15	0.2090	15	0.4463	9
Haveri	0.4434	9	0.5275	9	0.5238	12	0.1979	16	0.4232	10
Bagalkot	0.4523	8	0.5065	12	0.4033	24	0.3091	11	0.4178	11
Chikmagalur	0.3732	16	0.3820	23	0.5831	5	0.3284	10	0.4167	12
Mysore	0.4321	13	0.5072	11	0.4603	19	0.2382	14	0.4095	13
Chamaraja nagar	0.5089	6	0.5883	2	0.4293	22	0.1111	26	0.4094	14
Uttara kannada	0.2858	24	0.5563	5	0.6492	2	0.1199	25	0.4028	15
Mandya	0.2963	23	0.5849	3	0.4427	20	0.2777	13	0.4004	16
Hassan	0.3324	20	0.4748	17	0.5914	4	0.1751	19	0.3934	17
Davanagere	0.4390	11	0.4917	15	0.5008	18	0.1244	22	0.3890	18
Belgaum	0.4040	14	0.4650	19	0.5276	11	0.1206	24	0.3793	19
Shimoga	0.2993	22	0.4798	16	0.5439	9	0.1869	18	0.3775	20
Bangalore(r)	0.3345	19	0.4561	20	0.5597	8	0.1383	21	0.3722	21
Dharwad	0.3157	21	0.3774	24	0.3880	25	0.4067	8	0.3720	22
Gadag	0.3606	18	0.4374	22	0.3652	27	0.2789	12	0.3605	23
Udupi	0.2592	27	0.5103	10	0.5320	10	0.1207	23	0.3555	24
Bangalore	0.3861	15	0.1694	25	0.3723	26	0.1891	17	0.2793	25
Kodagu	0.2818	25	0.0799	27	0.5156	16	0.1207	23	0.2495	26
Dakshina kannada	0.2654	26	0.1250	26	0.4378	21	0.1553	21	0.2459	27