Livelihood Vulnerability of Rice Farmers of Tamil Nadu, India to Climate Variability and Extremes

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by

Rajkumar R.

Department of Humanities
Indian Institute of Space Science and Technology
Thiruvananthapuram, India

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Abstract

Climate variability and extremes pose substantial challenges to life and livelihoods at global and regional scales. Recent decades have witnessed an increase in the frequency and severity of extremes in temperature and rainfall across the world. These changes in climate have had critical impact on agriculture. In India, agriculture is the largest livelihood providing sector in the economy accommodating nearly half of the nation's work force. Apart from the dependence of such a large share of population on this sector, the viability of agriculture as a means of livelihood is also affected by the structural issues such as the increasing fragmentation of agricultural land, decline in public investment, low accessibility to institutional credit. In this context, the present study examined the degree to which various socio-economic and biophysical factors make the livelihoods of rice farmers of Tamil Nadu, India vulnerable.

The present study started by examining the extent of variability and extremes in temperature and rainfall over the Tamil Nadu region. The analysis was performed over the seven agro-climatic zones of Tamil Nadu. The study used statistical methods such as EEMD, SPEI, and HWMId to identify the variability in temperature and rainfall, spatio-temporal patterns of droughts, and the spatio-temporal characteristics of heat waves and warm nights respectively. The analysis of extreme rainfall episodes was performed using the classification scheme of IMD. The study has used high-resolution temperature and rainfall data from the IMD for the period 1951-2016. The robustness of the results was tested using the Mann-Kendall trend (M-K) test and the Kolmogorov-Smirnov (K-S) test. An initial analysis of the temperature and rainfall data revealed visible changes in patterns starting in the early 1980s. Hence, we decided to divide the data in to two equal sub-periods 1951-1983 and 1984-2016. Also, our analysis of weather sensitivity of rice yield considers the data for the years 1985-86 and 2015-16, we found this division compatible to the context of our study. Later in the study, the K-S test suggested statistically robust differences in the distribution of data between the selected sub-periods.Overall, the study observed statistically significant increase in the variability and extremes in temperature and rainfall over Tamil Nadu. The frequency and severity of extremes increased after the 1980s and the period after 2000 witnessed some of the most severe episodes of heat waves, warm nights, droughts, and extreme rainfall over Tamil Nadu. Further, the study examined the extent to which rice yield

was influenced by the variability and extremes in temperature as well as rainfall. The study used the results of the first objective and the district level time series data on the area, yield, area under HYV, and the area under irrigation for achieving this objective. A Fixed Effects Panel Regression model was used to identify the weather sensitivity of rice yield in the three cultivating seasons and a multiple linear regression model was used to examine the weather sensitivity of rice yield at district level. The study observed that the rice yield was highly weather sensitive in the Kuruva season and the sensitivity was the least in Samba season. Finally, the study assessed the vulnerability of rice farmers of Tamil Nadu using the results derived in the analysis of the first two objectives and a field survey conducted in the Cauvery Delta region. The study observed that the rice farmers in Trichy and Thanjavur districts, those farmers cultivated in the Samba season, and those belonged to small farm size category were highly vulnerable to the climate variability and extremes. It was also observed that, besides the biophysical components, the socio-economic factors also played a substantial role in constituting the vulnerability of the sample households.

The results in the study indicated that urgent policy interventions are required to prevent the adverse effects of climate variations in the region, to promote beneficial diversification of livelihoods, to provide more coverage of institutional credit and insurance among the small farmers, and to improve sanitation facilities at household level.