

Understanding Droughts in India



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ABOUT THIS ISSUE

The word disaster may invoke the imagery of rattling earthquakes, torrential deluges or great fires. However, droughts which are insidious by nature are equally devastating catastrophes. Countries like India which depend on an increasingly erratic monsoon for their water requirements are extremely susceptible to droughts. In the past decade itself, India has witnessed three major droughts which resulted in widespread crop failure, groundwater depletion and paucity of drinking water. All these factors have adversely affected the level of the overall economic development and well-being of the citizens of the country.

This issue of *Southasiadisasters.net* focuses on the important theme of 'Understanding Drought in India'. India's overdependence on rainfed agriculture and the increasing variability of monsoons due to climate change underscore the importance of understanding the varied impacts of droughts in the country. Since the impacts of droughts are manifold, this issue focuses on the various aspects of droughts such as their incidence, their typology, their impacts on agriculture and other means of livelihood along with the plight of persons with disabilities (PwDs) living under drought conditions. All these factors serve to highlight the urgent need to evolve suitable mitigation and preparedness strategies to safeguard the country from the adverse impacts of this slow onset disaster.

Meticulously researched and engagingly written, this issue of *Southasiadisasters.net* is an attempt to further the understanding on this important theme. A must read for all who are interested in understanding the risk of droughts in India. ■

- Kshitij Gupta, AIDMI

IMPACT OF DROUGHT

Drought Risk and Agricultural Research in India

Assessing Agricultural Vulnerability in India due to drought risk and research for developing site-specific adaptation & mitigation strategies

Increased variability in rainfall and occurrence of extreme weather events viz., unseasonal rainfall, hailstorms, heat and cold wave, drought and floods during last three decades have adversely impacted Indian agriculture when productivity from rainfed agriculture was required to be increased to meet the growing demand for food, fibre, fodder and agricultural commodities. This change has caused economic and political volatility in the country besides hardship to millions of small and marginal farmers especially in the Deccan region of India encompassing Vidharbha, Marathwada, Telengana, Rayalseema and Karnataka. The Indian Council of Agricultural Research (ICAR) launched a national program titled: National Initiative for Climate Resilient Agriculture in February 2011 in order to develop appropriate strategies for mitigation of hardships and for improving adaptive capacity among rainfed farmers in India.

In order to study impact of extreme weather events and imperceptible change in climate, time-series satellite data and Normalized Difference Vegetation Index (NDVI)

data products were used to analyze change in land use - land cover and variations in vegetation index to assess drivers of stress to agriculture. Geospatial tools and techniques provide a unique platform for undertaking temporal and regional analysis of bio-physical factors on earth surface to understand drivers and impacts of extreme weather events and slow but insidious change in climate. NDVI was used to understand these processes while precipitation and temperature data were used to corroborate findings. Agricultural vulnerability was analysed using CV of Max NDVI from NOAA-AVHRR (15-day, 8km) and TERRA-MODIS (16-day, 250m) NDVI data products from 1982 - 2012. AVHRR dataset was found suitable for estimating regional vulnerability at the state and agro-eco-sub-region (AESR) level while MODIS dataset was suitable for drawing district-level strategy for adaptation and mitigation.

A methodology was developed to analyze NDVI variations which were corroborated with Standard Precipitation Index (SPI) instead of actual rainfall data. Study indicated

- Increased vulnerability of rainfall as manifested in the occurrence of droughts has adversely affected agriculture in India.
- The increased incidence of drought in India spells economic volatility and hardship for many small and marginal farmers.
- The Indian Council of Agricultural Research had launched a program titled the National Initiative for Climate Resilient Agriculture to mitigate these hardships.
- This programme helped in disseminating the information necessary for the implementation of strategies to help improve the adaptive capacity of farmers against droughts.

large variations in vegetation dynamics across India owing to climate change and occurrences of drought and flood events besides existing limitations of bio-climate type and natural resource base in various regions. IPCC Framework of Vulnerability and Exposure were used to identify agricultural vulnerability in India extending from arid western Rajasthan to semi-arid and dry sub-humid regions in central India and Deccan Plateau. This is a major agricultural region with sizable human and livestock population. Exposure to climatic variability at local and regional levels have national implications and study indicated that over 122 districts extending over 110 million ha was vulnerable to climate change that spreads across 26 typical AESR in 12 states in India. Of the 74 million ha under agriculture in this region, TERRA-MODIS dataset indicated 47 million ha of Net Sown Area as agriculturally vulnerable (Fig-1) while the coarse resolution of NOAA-AVHRR dataset indicated a conservative estimate of 29 million ha. First ever estimates of agricultural vulnerability for India indicates that 33.1% of New Sown Area from arid western Rajasthan to dry sub-humid parts in Telangana, Karnataka and Maharashtra is under risk from aberrant weather condition, extreme weather condition like drought and from climate change.

Typologies of agricultural vulnerability were mapped to help develop appropriate strategies for management of climatic stress and for improving adaptive capacity among farmers. Predominant cropping systems vulnerable due to occurrence of drought resulting in decrease in length-of-crop-growing-period (LGP) were oilseeds in 35 districts, cereals in 66, pulses in 6 and cash crops in 15 districts in the states of Gujarat, Rajasthan, Maharashtra, Karnataka, Telangana, AP, Tamil

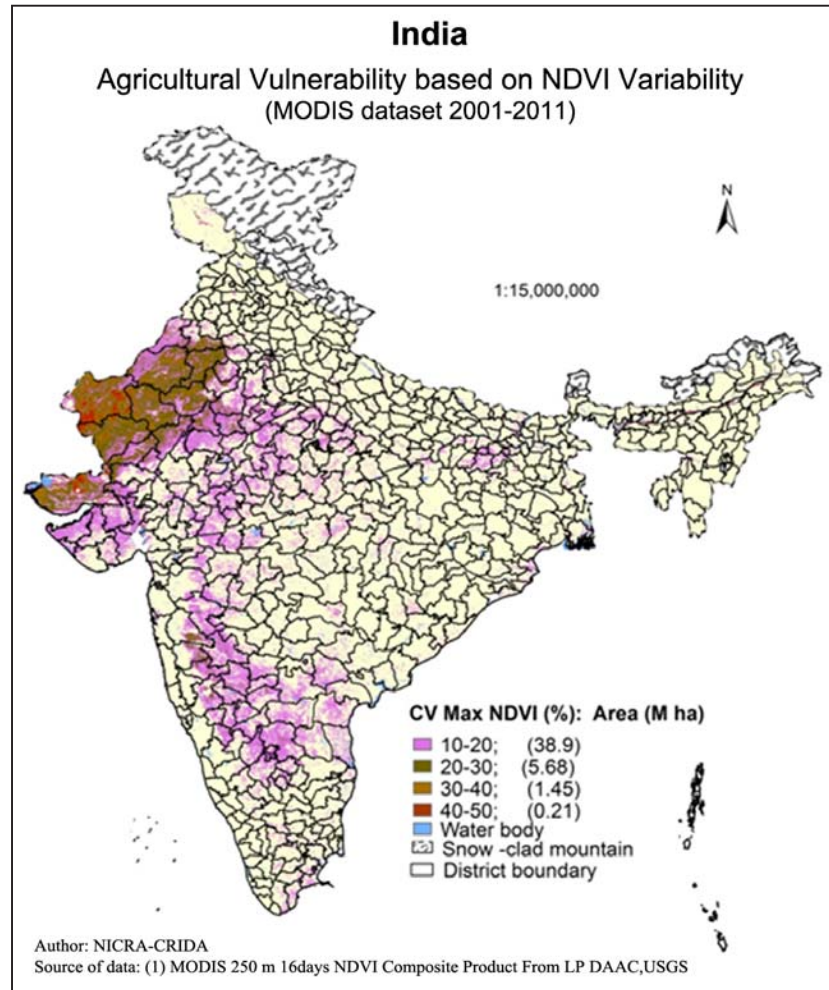


Fig.1: Extent of agricultural vulnerable region at district-level identified from MODIS

Nadu, MP, Haryana and Chattisgarh. Sixteen districts with predominantly buffalo population, 51 with milch cattle, 3 with poultry, and 36 with small ruminants were also vulnerable. Eighty districts with >50% Net Sown Area (NSA) would experience a decrease in LGP (6 in arid, 70 in semi-arid & 4 in sub-humid) where 0.83 million ha land is under paddy, 0.26 million ha under cotton & sugarcane and 0.48 million ha under oilseeds predominantly soybean. Thirty-one districts with >50% NSA indicated an increase in LGP (23 in arid & 8 in semi-arid) which accounted for 0.64 million ha under pearl millet, pulses and groundnut. Eleven districts with >50% NSA indicated no change in LGP (1 in arid, 2 in semi-arid & 8 in sub-humid). Study indicated a

decline in LGP in moist semi-arid Gangetic Plains, sub-humid Central India, Southern Plateau and Coastal region which forms an important agricultural region in India.

This information has facilitated the implementation of strategies for improving adaptive capacities of farmers at the district-level which include Crop Contingency Planning in the event of drought, implementation of watershed projects for soil and water conservation, agronomic practices and management. The study has helped to identify areas where policy initiatives are required. ■

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