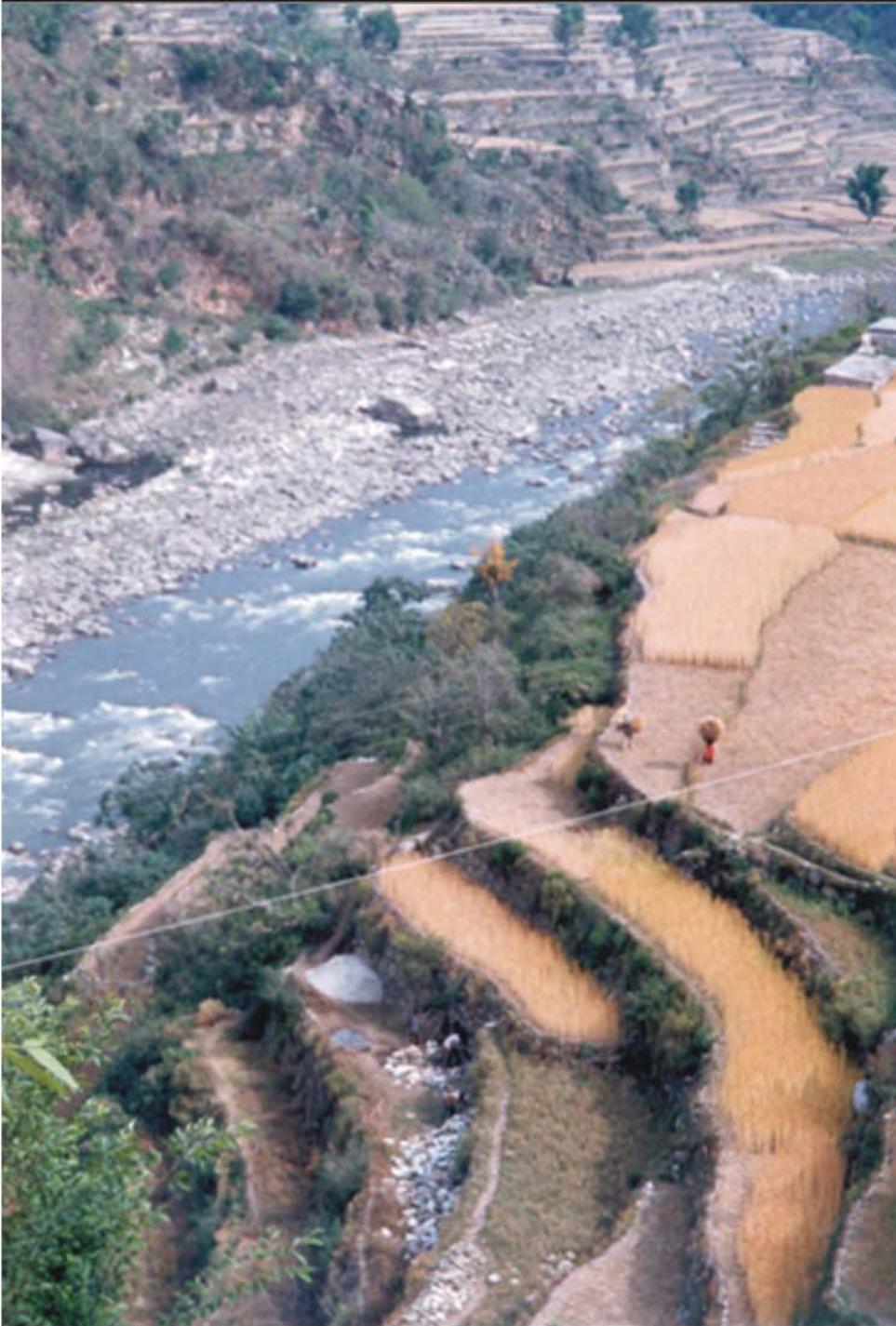


# Understanding Droughts in India



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*The views expressed in this publication are those of the author.*

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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

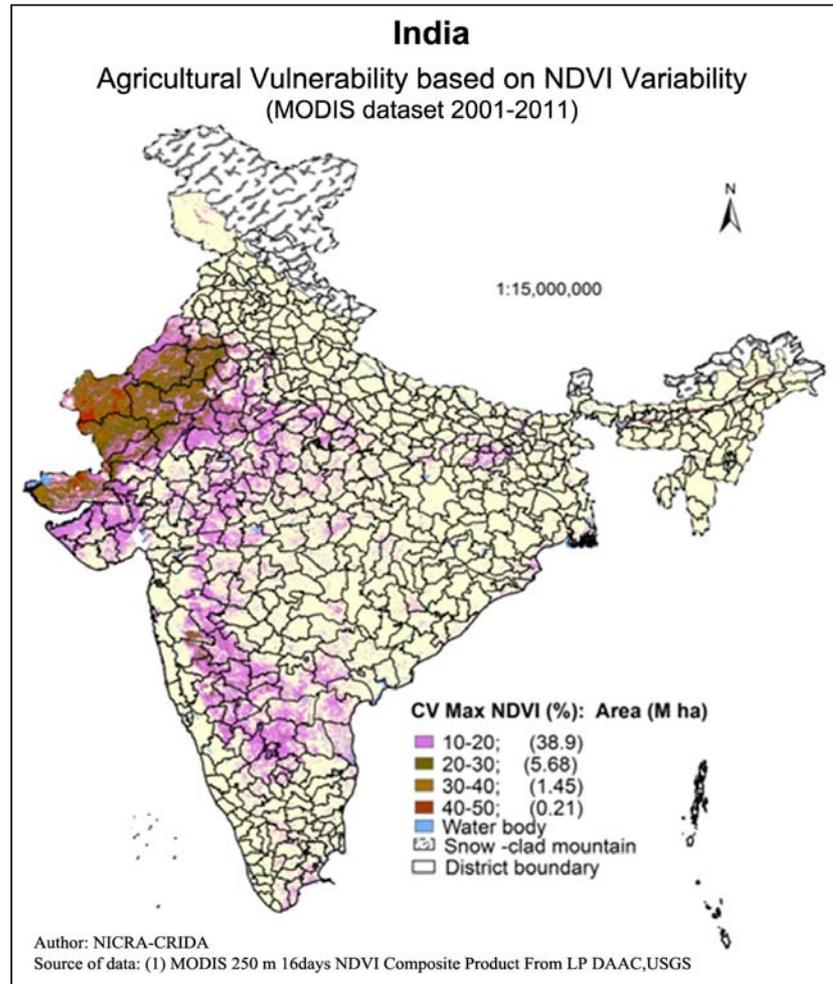


Fig.1: Extent of agricultural vulnerable region at district-level identified from MODIS

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. ■

- Dr. Kausalya Ramachandran, Shubhasmita Sahani, V. Praveen Kumar, DVS Sarma, Central Research Institute for Dry land Agriculture, Hyderabad

# Droughts in India: Types of Occurrence

Drought is one of the most frequently occurring natural hazard in India. Drought differs from other hazards as it is a slow onset phenomenon of ecological challenge that affects people more than any other natural hazard by causing serious economic, social and environmental losses in both developing and developed countries. Drought affects all parts of our environment as well as our communities. Like other hazards the impacts of drought can be reduced through mitigation and preparedness. Analysis of incidence of droughts over the last two centuries in India does not show any increase in the incidence of droughts in recent years. However, their severity appears to have increased. Since 2001, the country has experienced three major droughts, in the years 2002, 2004 and 2009<sup>1</sup>, severely affecting the various sectors and overall economic development of the country. India in 2002 experienced its worst drought in 20 years.<sup>2</sup> With its increased occurrence and expanded coverage in the recent years, about one third of the country is either drought prone or under desert areas. These areas are lagging behind in agriculture and also in overall economic growth.

There is no universally accepted definition of drought. It is generally considered that droughts are the result of acute water shortage due to lack of rains over extended periods of time affecting various human activities and lead to problems like widespread crop failure, ground water resources, depletion in lakes and reservoirs, shortage of drinking water and, reduced fodder

availability etc covering larger area and for longer period of time.

## Types of droughts

There are mainly seven types of droughts seen in India. These are mentioned below:

1. **Meteorological Drought:** Meteorological drought is absence of rainfall from the normal. It is the least severe form of drought and is often identified by sunny days and hot weather.
2. **Hydrological Drought:** Hydrological drought often leads to reduction of natural stream flows or groundwater levels, stored water supplies. Its main impact is on water resource systems. A meteorological drought often leads to hydrological drought. There are two types of hydrological droughts namely surface water drought and ground water drought.
3. **Agricultural Drought:** This form of drought occurs when moisture level in soils is insufficient to maintain average crop yields. Initial consequences are in the reduced seasonal output of crops

and other related production. An extreme agricultural drought can lead to a famine, which is a prolonged shortage of food in a restricted region causing widespread disease and death from starvation.

4. **Soil Moisture Drought:** This is a situation of inadequate soil moisture particularly in rainfed areas which may not support crop growth. This happens in the event of a meteorological drought when the water supply to soil is less and water loss by evaporation is more.
5. **Socioeconomic Drought:** Socioeconomic drought correlates the supply and demand of goods and services. When the supply of some goods or services such as water and electricity are weather dependant then drought may cause shortages in supply of these economic goods.
6. **Famine:** A famine occurs when large scale collapse of access to food occurs which, without intervention, can lead to mass starvation.
7. **Ecological Drought:** It happens when the productivity of a natural ecosystem fails significantly as a consequence of distress induced environmental damage.

- Droughts are one of the most frequent natural hazards in India.
- Since 2001, the country has experienced three major spells of drought that have severely affected its economic development.
- To alleviate the situation mitigation and preparedness activities against the impacts of droughts need to be part of risk reduction and development strategies.

To conclude droughts in all forms of their existence affect the living population in multiple ways and also consume huge amount of compensatory actions from different stakeholders involved. Since climate change is increasing in both intensity and visibility, a weather extreme like drought occupies a major position in any risk reduction or development planning. ■

- Sonali Das, AIDMI

1 [http://envfor.nic.in/sites/default/files/India\\_Country%20Report%20Hanoi.pdf](http://envfor.nic.in/sites/default/files/India_Country%20Report%20Hanoi.pdf)

2 [http://www.ksdma.co.in/guidelines/NDMA\\_Droughtguidelines.pdf](http://www.ksdma.co.in/guidelines/NDMA_Droughtguidelines.pdf)

## While Building Shields against Drought in Kerala

Even though the hilly Karuvarakundu Grama Panchayath of Malappuram district already has 66% of water security coverage along with 2 rivers running through this, wells at household and community levels, small water supply schemes by district Panchayath with average rain fall of 2852.2 mm annually, the high runoff by geography of it, the people experienced themselves was in the beginning of drought. That realization lead to Jananidhi which is the prestigious programme of Kerala Rural Water Supply and Sanitation Agency, which provides sufficient quality and quantity of water to each and every beneficiary households (through household connections) belonging to that Panchayath.

To document the women efforts to meet water demands of the family, a survey had been conducted among the beneficiaries at planning phase. Major finding was the women do not get remarkable supports from men in collecting water, due to livelihood. Among the 3221 beneficiaries 12 families spend 3-4 hrs/day for collection and move up to average distance of 1 km to nearest water sources during summer; other seasons it is below 100m. The most unfortunate thing ever noted is the insufficient yield; they forced to search different sources around there to depend up on in alternative time periods.

- Despite having plenty of water, the geographic run off resulted in drought like conditions in Karuvarakundu Grama Panchayat of Mallapuram district in Kerala.
- To contract this threat, project Jalnidhi was started which covered 3221 beneficiaries under its ambit.
- However, some challenges such as the sustainability of this intervention still remain to tackled.



Reaching the 'S'miles: The household water connection placed by Jananidhi project at beneficiary's kitchen side.

As a unique case in the GP, the settlement shift in summer season of a tribal colony was disclosed. During the summer the nearest water point extends about 3 km to the deep forest, so they managed to locate temporary shelters over there and collect honey and other forest resources. There is the only place where the gender equity and responsibility sharing found in water collection.

With a filtering and prioritization process on beneficiary households as women headed, found that during summer season they forced to spend up to 3 hrs/ day for water collection little girls and boys also participated in the mission. 90% of the households used to bring water only for cooking purposes; hygienic demands were met at surrounding of the source. Those who work as house maids shared struggles of water collection which forcefully rescheduled working hours and being as the earning members victimized to loss of income several times.

An unforgettable day: three Muslim housewives came to office and said

the water supply to their houses stopped by the rehabilitation works by Jananidhi project; all other water sources were also failed. All the male members of the family go to work every day and there will not be sufficient water for the women who used to stay in home all the time, they couldn't take a bath for these three days and they were not hygienic to fulfill the religious customs.

When comparing this data and issues with other states of India, it seems

negligible. But the concern is high. The Gods Own Country - 'Keralam' having 44 rivers, thousands of its various orders and tributaries, average rainfall of 3107 mm annually, lots of fresh water sources and household level wells. We announced Palakkadu, Idukki, Wayanadu, Thiruvananthapuram, and Kollam the high ranges and coastal ones are highly exposed to water scarcity annually. In addition to this, the geography contributes huge runoff water to Arabian Sea

threatens of drought. The fights while tankers supplying water were once a usual scene in rural summer, but things are improving now a women group themselves repaired a failed well which was abandoned by men and succeeded, all these are promising steps by the government to retain the normal availability of water to generations. ■

- Asha Kiran,  
Team Leader, Jananidhi Project,  
Shreyas Social Service Centre  
Karuvarakundu, Malappuram, Kerala

## RISK REDUCTION

# Drought and Persons with Disabilities: What is The Connection? Exclusion or Inclusion?

Drought is an extended period when a region receives a deficiency in water supply, whether atmospheric, surface or ground water. Persons with Disabilities (PwDs), remain invisible while we discuss about disaster response, relief and rehabilitation, especially during a disaster like Drought. Like other disasters, drought too; has direct and indirect impact on the life

- Since droughts are insidious in nature, not much thought has been devoted to the welfare of people with disabilities (PwDs) during droughts.
- As large-scale migration is the most widespread response to droughts, the migration of PwDs poses a serious threat to their well being.
- Since PwDs are highly dependent on family support, separation from their families due to drought induced migration might prove fatal for them.
- The solution lies in devising PwD sensitive relief and rehabilitation strategies and tools that can lead to a more inclusive disaster risk management.



of a PwD, but less perceived and discussed. Drought has potential to act as a catalyst for more exclusion or inclusion of PwDs at family and community level.

As witnessed, in many of the Drought affected areas, the first and foremost response from the affected people is migration to other places. As Drought affects a large population or geographic areas, families of PwDs are bound to migrate to distant places to meet their basic needs for survival i.e. drinking water and livelihood. "Migration" for PwDs to such places always remains a challenge; both for themselves as

well as their family members. These phenomena results in leaving PwDs back at their home places. Further, the impact of Drought continues for months, Drought compels PwDs to live without their families for long period of time.

Needless to state that families being the first and most important support system for PwDs, such forced exclusion from families lead to many complications for PwDs. The foremost is limited access to safe and adequate drinking water. In Drought situations, especially in absence of family support, PwDs access to these basic needs for living and living

healthy life gets affected to a great extent. PwDs are last to receive the Drought relief facilities; mainly due to lack of adequate and sensitised relief plans. Thus, they are the first to succumb to deteriorated health and in many cases to death. Thus, water security for PwDs in drought situation is the biggest challenge.

During droughts another struggle for survival is to access food security. And for that one need to get engaged in income generating activities. In a typical Drought relief programs, the income generation activities require more of physical work such as construction of water harvesting structures. Thus, there are very few, rather almost negligible choices for work for PwDs in Drought relief operations. The dream of PwDs friendly relief work and their participation in such special income generation activities is yet to materialise in Indian context. Thus, such exclusion from work and be an economic contributor to self and

"In situations of risk, natural disasters and armed conflict, the emergency services must be accessible to persons with disabilities, or their lives cannot be saved or their well-being protected. Accessibility has to be incorporated as priority in the post- disaster reconstruction efforts. Therefore, disaster risk reduction must be accessible and disability inclusive."

*Statement of disability inclusion, UN CRPD Committee, General Comment 2, Paragraph 36.*

family, reduces PwDs belief of self-worth.

However, droughts can also be utilised as an opportunity for facilitating inclusion of PwDs beyond drought relief actions and pave way for inclusive development actions and ensure their human rights. The 'Sphere Standards' identify those persons with disabilities who

experience many of the socioeconomic factors and barriers which contribute to their vulnerability in disasters. And thus, in community focused infrastructure, specific care should be taken to make it accessible for PwDs by incorporating universal standards for barrier free environment. Let me give an example. Can't we think of a water harvesting structure which is accessible for person with loco motor disability by adding a ramp? Or changing the shape of water tap which can easily be held by a person with Cerebral Palsy? Or can't we think and enforce specific types of supportive work earmarked exclusively for PwDs in Drought relief? These are simple, real-world and yet most effective measures; both from the perspective of making PwDs independent and providing them opportunity for inclusion. During and after droughts too! ■

- **Arvind Patel**, Managing Director, SoCH Development Support

## ECOSYSTEMS AND DROUGHTS

# Water Deficit Himalaya

It is a Himalayan irony that in spite of being called water bank of India, its community acutely suffers them both drinking and irrigation water crisis. In fact settlement in mountain had always been alongside the water source viz spring shallow well, creeks etc. All these structures used to address local water needs specially drinking. Excess of the same was used for irrigation. Otherwise, major source of irrigation

is monsoon in mountain area and about 90% region is rainfed. Unfortunately erratic monsoons have been hampering crops and cropping pattern in recent part.

Mountains are suffering from the drought for the last several years for one major reason. Since catchment zone of water sources are deforested, spring and other water resources have severely suffered. The discharge

in majority of cases has gone down. In an average 40% springs have dried up in mountain areas. Other 35% are at verge of disappearance while another 25% have lost water discharge at significant levels. This is the case of major water bodies of the mountain.

Similarly small streams which get water from catchment have also lost water discharge. This was the major source of irrigated land which is hardly 9% in mountain. Most of the banks of minor or major rivers don't have any access to this water simply because of lack of pumping means and as well as other mechanisms.

This a regular feature now in Himalayan mountain states. Poor



Dr. Anil Prakash Joshi

- Despite being considered as the water bank of India, the risk of drought looms large over the Himalayas.
- Erratic monsoons and deforestation in the catchment zone of the rivers of the region are culpable for the drought like situations in the mountains.
- The government needs to take up concerted action against this risk to provide the community of the mountains a stable supply of drinking and irrigation water.

catchment zones have largely reduced all kind of water availability here. This situation had come since the beginning of the century and likely to be more grim in future as catchment zones are also growing poor and poor by green cover.

Such pathetic state further worsens by erratic monsoon behavior. Since 90% agriculture is fed with monsoon rains, its queer behavior has adversely impacted overall agriculture productivity.

Since a significant part of the mountain is under variety of orchards, timely rain and temperature decides flowering and fruiting. Any disturbance in the cycle affects production. In last two decades, orchard area has been increased but inadequate ecological input has lowered the productivity. Water is one crucial element and soil is the second important. Both of these components have suffered in the past two decades. Drought followed with torrential erratic rains on deforested catchment doesn't only take away important soil but also in absence of adequate green cover water percolation also becomes poor. Both of these conditions have created



Women carry water daily for a distance of 2 kilometers.

drought like situation in Himalayan villages, which may continue in future too. In fact Himalayan community exclusively depends upon subsistence agriculture. In lack of any other alternative, changing climatic conditions directly hit community needs.

The Himalayan ecosystem has been suffering constantly with drought. This has triggered migration from many villages on to areas where

immediate and important needs are met out. This is likely to be main feature of mountain areas in future too.

Government understanding towards the issue is very poor and thus bleak future is ahead for this community. A serious and timely action is important to ensure water availability to these communities. Routine approach of department to supply water to deficit villages from water rich other areas are leading water conflict in villages. Another effort of Government to supply water to scarce villages through lorry is expensive and non feasible. This is ridiculous that villages around Tehri dam have their water coming in lorry. A region which is full of water is deprived of the same is a question that need to be answered by planners. It is because of poor planning and inadequate attention to mountain dwellers. If water rich Himalaya cannot give water to its community what is going to be fate of water deficit areas of the Nation. A serious debate is required on the water policy of the country. ■

- **Dr. Anil P. Joshi**, Himalayan Environmental Studies and Conservation Organization (HESCO), Dehradun, Uttarakhand

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