Chapter 4

Drought

An Overview

Drought is an insidious natural hazard affecting a very large part of South Asian regions. While many definitions of drought exist, the importance of drought lies in its overall social, economic and environmental impacts. With the nonstructural nature of its damage and impact covering larger geographical areas, drought hits the largest number of people in South Asia. The agrarian economies of the South Asian countries are therefore more vulnerable. In fact, drought has been one of the primary reasons for widespread poverty and environmental degradation. Further, the latest IPPC report and other climate model predictions indicate that the global change is likely to increase the vulnerability of tropical countries to drought, more so in South Asia. [1, 2]

The South Asian regions have been among the perennially drought-prone regions of the world. Afghanistan, India, Pakistan and Sri Lanka have reported droughts at least once in three years in the past five decades, while Bangladesh and Nepal also suffer from drought frequently. What is of concern is its increasing frequency. Since the mid-1990s, prolonged and widespread droughts have occurred in consecutive years in Afghanistan, India and Pakistan while the frequency of droughts has also increased in Sri Lanka, Nepal and Bangladesh.[3]

The impact of droughts is more severe on the food and agricultural sector. The loss of crops and livelihood and its effect on the agrarian economy has severe consequences on the overall well being of the rural poor. The continued decline in productivity leads to diminished assets and reduced investments. The impact of drought has been severe in rain-fed areas with large portions of arid and semi-arid zones.

Drought, a creeping phenomenon, seldom results in structural damage, in contrast to floods and earthquakes. For these reasons, the quantification of impacts and the provision of relief are far more difficult tasks than in the case of other natural hazards. The non-structural characteristic of drought impacts has hindered the development of accurate, reliable, and timely estimates of severity and ultimately, the formulation of drought contingency plans by most of the governments.

Drought has been grouped as meteorological, hydrological, agricultural, and socioeconomic.[4,5,6] (Figure 4.1). The aggregate of all these finally leads to rural poverty and food insecurity. Drought has both natural as well as social components. The risk associated with drought is a product of both the region's exposure to the event (i.e. probability of occurrence at various severity levels) and the vulnerability of society to the event. Exposure to drought varies spatially. Vulnerability is determined by social factors such as population, demographic characteristics, technology, policy, and social behaviour. These factors change over time, and thus vulnerability is likely to increase or decrease in response to these changes. Subsequent droughts in the same region will have different effects,

even if they are identical in intensity, duration, and spatial characteristics, because societal characteristics will have changed. However, much can be done to lessen societal vulnerability to drought, especially in the context of South Asia.

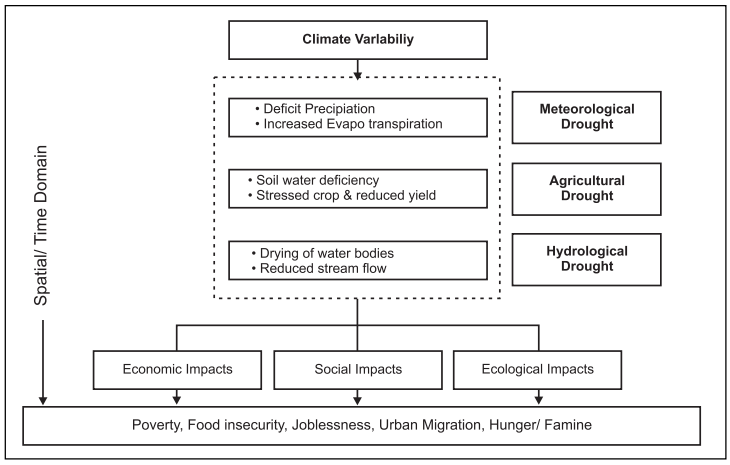

Figure 4.1: Natural and social dimensions of drought (Source: Wilhite[4])

Further, events of hazard have been ranked by Bryant[7] on the basis of their characteristics and impacts (Table 4.1). Key hazard characteristics used for this evaluation include an expression of the degree of severity, length of event, total areal extent, total loss of life, total economic loss, social effects, long-term impact, suddenness, and occurrence of associated hazards for thirty-one hazards. Because of the intensity, duration, and spatial extent of drought events and the magnitude of associated impacts, drought ranks very high. The total loss of life associated with drought may have been overestimated because it has included deaths associated with famine. Drought does disrupt food production systems but is only one of several potential natural triggers for famine; other social triggers, such as inequity and frustrations, further leading to social tension and extremism, have been more important factors in recent years.

Table 4.1: Severity levels of natural disasters[7]

Overall Rank	Event	Degree of Severity	Length of event	Total arial Extent	Total loss of life	Total economic loss	Social effect	Long-term impact	Sudden-ness
1.	Drought	1	1	1	1	1	1	1	4
2.	Tropical Cyclone	1	2	2	2	2	2	1	5
3.	Regional Flood	2	2	2	1	1	1	2	4
4.	Earthquake	1	5	1	2	1	1	2	3
5.	Volcano	1	4	4	2	2	2	1	3
6.	Extra-tropical storm	1	3	2	2	2	2	2	5
7.	Tsunami	2	4	1	2	2	2	3	4
8.	Dust storm	3	3	2	5	4	5	4	1
9.	Landslide	4	2	2	4	4	4	5	2
10.	Tornado	2	5	3	4	4	4	5	2
11.	Snowstorm	4	3	3	5	4	4	5	2
12.	Flash Flood	3	5	4	4	4	4	5	1

Paradigms of Drought Management in South Asia

South Asia has witnessed some of the greatest famines, like the Bengal famine of the pre-Independence era. Since then, the continuing economic and social impacts of droughts have led all the affected governments to put in place effective policies. The present policies on drought management in the region have evolved over a period of time. The relief policy, broadly speaking, consisted of ad hoc measures during the initial period of drought management. A famine code was

provided for taking measures when a danger of large-scale human mortality was apprehended and aimed at preventing deaths on account of calamities. Later, famine-relief codes were replaced with scarcity relief measures with emphasis on reducing human distress and misery. The public distribution system was evolved in response to the droughts of the mid-1960s for building up a reliable food supply system. Later came employment-generation programmes, which led to the creation of durable and productive assets. Drought management policy seeks to provide social and economic goals and the egalitarian objective of the State. The objective was not only to prevent starvation death but also to halt physical deterioration and destitution of people and livestock. Thr existing drought management package consists of several programmes, which aim at mitigating the severity of drought. However, notwithstanding their welfare goals, these programmes in general suffer from poor infrastructure, technical content and low credit flow in the chronically drought-prone areas.

In South Asia, the practices of drought management in terms of policies, laws, use of technological inputs, etc. follow certain patterns but no universal model. In countries with a historical tradition of a highly centralized government, the drought management institutions and systems that have evolved typically are also highly centralized and dependent upon national government institutions and capabilities. In countries where there is a stronger tradition of local power, authority, and autonomy, drought management systems tend to be more locally driven, relying on support from higher levels of government.

An analysis of the policy perspectives being pursued in the region has brought the following strategies and trends into focus:

- Management of natural resources holds the key. Focus is placed on a community-centric, ecosystem-based approach of planning, implementation of plans and proactive mitigation measures, risk management, resources stewardship, environmental considerations, and public education. Integrating all these, a clear-cut national drought management policy with multi-sectroal linkages is necessary . Few countries currently have a national drought policy in place. Australia has set a good example by following such a comprehensive drought policy. China too has a drought management policy. Most of the countries in the region have a drought reduction strategy rather than a policy.
- Stronger linkages between agricultural meteorological networks and drought management functionaries on the ground are of great significance. This is essentially to aim at enhancing the effectiveness of observation networks, monitoring, prediction and information delivery, and to foster public understanding of and preparedness for drought.
- Encouraging the integration of comprehensive insurance and financial strategies into drought preparedness plans.
- Institutionazing a safety net of emergency relief that emphasizes sound stewardship of natural resources and self-help.
- The rank of priorities should follow thus: preference of preparedness over insurance, insurance over relief, and incentives over regulation.

To be more specific, the following approaches have gained importance in the region:

Multi-sectoral Linkages: The focus is on integration of disaster management programmes with other sectoral issues such as poverty alleviation and natural resourcesetc. Especially, poverty reduction and drought management are moving towards having stronger linkages with other sectoral issues. However, there have been relatively few examples of effective, systematic and long-term integration between drought mitigation and poverty reduction programmes. In different social, political, economic and hazard-specific contexts, this trend is also being promoted by international financial agencies like the Asian Development Bank (ADB), World Bank and international donors.

Regulatory Framework: Efforts are on to: enact a comprehensive Disaster Management Act; bring out an appropriate building code; set up the techno-legal regime to reduce the people's vulnerability; develop policy guidelines at the national, state, sector and sub-sector levels; evolve land use/cropping systems in harmony with agro-ecological conditions.

Risk Financing and Insurance: There is focus now on promoting risk sharing and transfer mechanisms (insurance/re-insurance schemes) for natural disaster mitigation, enhanced financial support to the vulnerability reduction funds. Some of the concepts in this regard include risk pool and risk management strategies for poor households, credit markets, support-led interventions for vulnerability reduction and mitigation, financial resources for mitigation and investment, natural disaster insurance – especially agricultural/crop insurance for drought and a group-based insurance programme.[10]

Community-based Drought Management: This directly involves vulnerable people themselves in the planning and implementation of mitigation measures. This bottom-up approach has received wide acceptance because considered communities are the best judges for their own vulnerability and can make best decisions regarding their well being. The aim is to reduce vulnerability and strengthen people's capacity to cope with drought.

Incidence of South Asian Drought in 2007

A simple global analysis of EMDAT data highlights the frequency as well as severity of drought since 1980 (Figure 4.2). The EMDAT data clearly shows that the year 2007 has not been significant as far as the incidence of drought is concerned. However, further analysis reveals the incidence of milder drought in Eastern Africa, Southern Africa, South America and Eastern Europe (Figure 4.3). At this scale, the incidence of drought in South Asia has also not been found significant.

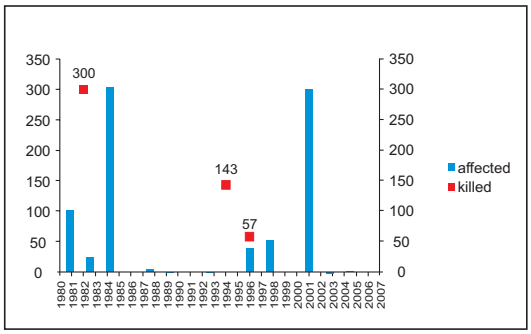

Figure 4.2: A time series global analysis of incidence of drought (Data source: EMDAT)

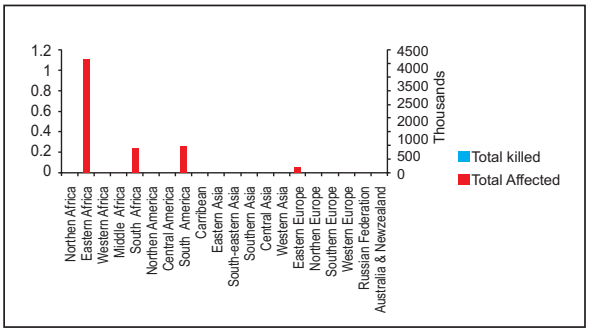

Figure 4.3 Incidence of global drought in year 2007 (Data source: EMDAT)

While the drought situation was not significant in most of the South Asian countries and there were enhanced agricultural production (in India, Pakistan, etc.) during the kharif seasons, specifics with regards to the 2007 drought in some of the affected countries are listed below:

Bangladesh

The northwestern part of Bangladesh has been less vegetative, having a lower soil moisture regime. The western part of the country receives less rainfall averaging some 1,400 mm as against the national average of about 2,150 mm. As a consequence, susceptibility to and severity of drought in the western districts have been much higher than elsewhere. Based on the characteristics of moisture retention capacity, infiltration, etc. high prevalence of drought has been observed in the western districts of Rajshahi, Chapai Nawabgonj, Bogra, Pabna, Dinajpur, Rangpur and Kustia. Drought of different intensities in Kharif, Rabi and pre-kharif seasons causes damage to 2.32 m ha of T. Aman and 1.20 m ha of Rabi crops annually. Yield reductions due to drought vary from 45 to 60% in T. aman and 50-70% in Rabi crops in very severe drought situations. In the severe drought year of 1979, the shortfall was about 0.7 million tonnes. During 1981 and 1982, drought affected the production of monsoon crop (Aman) and the shortfalls from the trend were 0.5 and 0.3 Mmt, respectively. Drought affected the northwestern part of the country in 2006 and crop production was reduced by 25-30%.[8] In 2007 however, the impact of drought was not significant.

India

The Southwest Monsoon (June to September), which is directly linked to the drought situation, was quite normal in 2007 and thus the drought impact in India was not significant.

The highlights of IMD reports pertaining to the Southwest Monsoon 2007 are as follows:

- For the country as a whole, the seasonal rainfall from 1 June to 30 September 2007 was 105% of its long period average (LPA).
- Seasonal rainfall was excess by 26% over South Peninsula. It was deficient (15% below (LPA) over Northwest (NW) India, 8% above LPA over Central India and 4% above LPA over Northeast (NE) India.
- Out of the 36 meteorological sub-divisions, the seasonal (June-September) rainfall was excess in 13 and normal in 17 sub-divisions. However, it was deficient in 6 sub-divisions.
- Out of 513 meteorological districts for which data were available, 72% of the meteorological districts received excess/normal rainfall and the remaining 28% received deficient/scanty rainfall during the season. As many as 77 districts (15%) experienced moderate drought and 30 districts (6%) experienced severe drought at the end of the season.
- Five sub-divisions (viz. west Uttar Pradesh, Haryana, Chandigarh and Delhi, Punjab, Himachal Pradesh and east Madhya Pradesh) experienced moderate drought conditions (rainfall deficiency of 26% to 50%) at the end of the season.
- IMD's long range forecasts for July rainfall over the country as a whole and the 2007 seasonal rainfall over NW India and NE India proved to be accurate. However, the 2007 monsoon seasonal rainfall over the country as a whole was more than the predicted value.

Figure 4.4: Progress of weekly cumulative rainfall – 2007
(Source: IMD Annual Report 2007)

Besides IMD, India has put in place a National Agricultural Drought Assessment & Monitoring System (NADAMS) project with the National Remote Sensing Agency (NRSA) for in-season drought monitoring in the vast geographical areas of semi-arid/arid regions. The NADAMS, which involves the analysis of satellite data and integration with ground information, provided in-season assessment of the prevalence, severity and persistence of 2007 agricultural drought at state/district (Figure 4.5) and sub-district level in India. Out of 13 states, drought assessment at district/state level was carried out with coarse resolution NOAA AVHRR data in 9 states and detailed assessment at district/sub-district level using higher resolution IRS AWiFS/WiFS images was carried out in 4 states namely, Andhra Pradesh, Karnataka, Haryana (Figure 4.6) and Maharashtra. The monthly agricultural drought reports were sent to the Ministry of Agriculture (Govt. of India) and relief and agriculture departments by the first week of the succeeding month. The agricultural drought information was used as inputs in the review meetings of agricultural situation by state agriculture departments, preparation of contingency plans and for relief claims and relief management. IMD inputs in conjunction with NADAMS products have been providing more objective and 'actionable' information related to the drought situation in the country.

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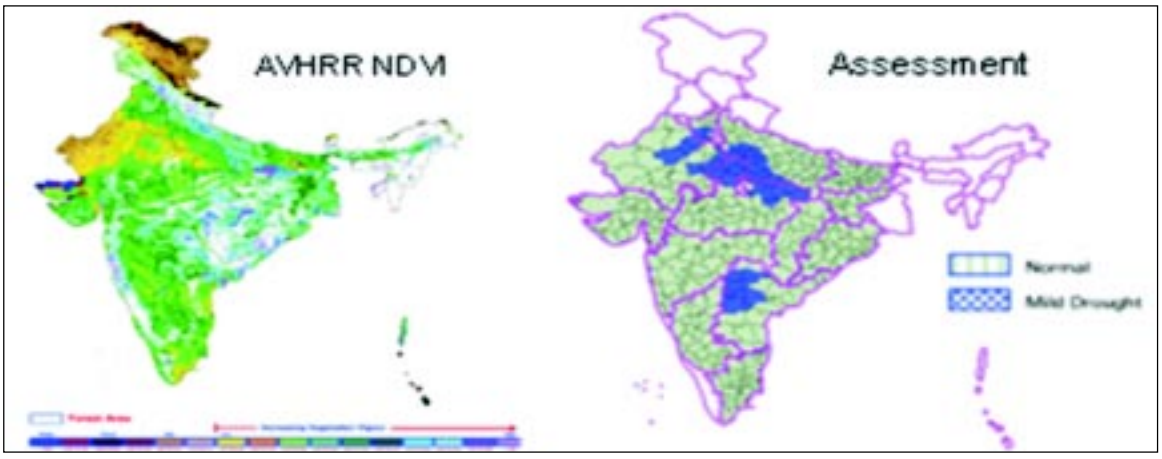

Figure 4.5: District-level Agricultural Drought Assessment (NRSA Annual Report 2007: www.nrsa.gov.in)

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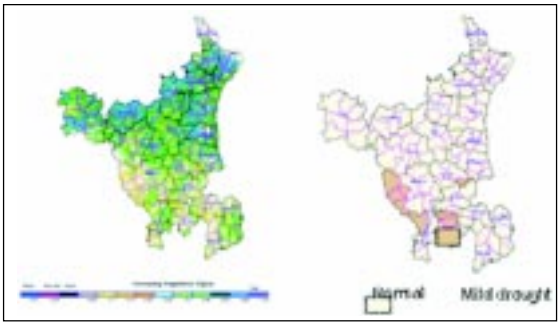

Figure 4.6: Block-level Agricultural Drought Assessment with AWiFS data – Haryana state, Oct 2007 (NRSA Annual Report 2007: www.nrsa.gov.in))

The agricultural production during the drought season is considered to be an indicator of drought severity. As per the Department of Agriculture & Cooperation (DAC), Govt of India estimates, the coverage during Kharif 2007 was higher than the previous year in rice, maize, cotton, sugarcane, while it was similar or slightly less in case of jowar, bajra, jute and mesta, which indicates virtually no impact of drought. In fact, the total foodgrain production during Kharif 2007-08 was about 115.88 million tonnes against a target of 114.20 million tonnes and achievement of 110.57 million tonnes during 2006-07. The production of rice during Kharif 2007-08 was realized at 81.52 million tonnes, which was higher than 80.17 million tonnes achieved during 2006-07. A record production of cotton to the tune of 233.81 lakh bales was realized during 2007-08 as against the previous record production of 226.32 lakh bales achieved during 2006-07.[9] It is important to highlight that all these crops were grown in drought-prone areas.

Setting up the National Rainfed Area Authority (NRAA) for Drought Mitigation

Since 1947, the Government policy to tackle drought has seen several paradigms. A number of long-term and short-term programmes, viz. the Drought-Prone Areas Programme (DPAP), Desert Development Programme (DDP), Accelerated Rural Water Supply Programme (ARWSP), Pradhan Mantri Gramodaya Yojana (PMGY), Food for Work Programme (FWP), National Watershed Development Programme (NWDP), Rural Employment Guarantee Programme (REGP), Integrated Wasteland Development Programme (IWDP), Swarna-Jayanthi Grameen Rozgar Yojana (SGRY), Swarna-jayanthi Grameen Swarozgar Yojana (SGSY), Tube Wells, Food & Fodder Development Programmes, etc. under different Ministries/Departments of the Central Government and the State Governments were evolved. Further, Banking and Cooperative Credit Societies sectors were enabled to provide help for making available financial credit to the farmers on easy terms. At the Ministry of Agriculture level, Crop Weather Watch Group at Central, State and even district-level functions which bring in data from monitoring mechanisms for rainfall, water resources, crop growth, etc. to provide weekly status. Decentralization of drought management and policy initiative in terms of micro-level management is the new paradigm for effective drought management, which is likely to benefit the distressed population. The worst effect of drought situation is

experienced at the local level, hence good governance demands that micro-level management should be built within the Drought Management Policy. In spite of all these mechanisms and the lessons learnt from the post-Independenc severe droughts of 1972, 1987 and 2002, Indian agriculture and economy have still not come out of the shock of drought. The GDP in a severe drought was seen going down by 2 per cent, agricultural productions down by 2 per cent, agricultural GDP down by 3 to 10 per cent, and all of these, in turn, impact on other sectors like power generation, employment, etc. which results in inflationary pressure.

In this background, a need was felt to have convergence and synergy among the various programmes to ensure 'inclusive growth' in perennially drought-prone rainfed areas. In fact, rainfed areas of 85 million hectare out of the 142 million hectare of net cultivated area, were considered as having high untapped productivity and income potential. An insight into the rainfed regions reveals a grim picture of poverty, water scarcity, rapid depletion of ground water table and fragile ecosystems. The challenge in rainfed areas, therefore, is to improve rural livelihoods through participatory watershed development with focus on integrated farming systems for enhancing income, productivity and livelihood security in a sustainable manner. The National Rainfed Area Authority (NRAA) was set up in 2006 -07 as an inter-sectoral and inter-ministerial programme, keeping in mind the need to give a special thrust to these regions. The watershed approach has been accepted as a major theme for the development of rainfed areas with a view to conserving natural resources of water, soil and vegetation by mobilizing social capital.

The NRAA has been mandated with the following objectives:

- To prepare a perspective plan, outlining the national strategy and road map for holistic and sustainable development of rainfed farming areas.
- To evolve common guidelines for all schemes of different Ministries, including Externally Aided Projects (EAPs) for development of Rainfed/ Dry land Farming Systems.
- To coordinate and bring convergence within and among agricultural and wasteland development programmes being implemented in the rainfed areas of the country.
- To identify rainfed areas in different States, which need priority attention and prepare watershed development programmes for integrated natural resource management, in consultation with States, focusing on multidimensional crop, livestock, horticulture, agri-pasture integrated systems and programmes for landless farming communities.
- To identify gaps in input supply, credit availability, dissemination of appropriate technology and other requirements relevant for development of rainfed areas.
- To guide the implementing agencies on priority setting and monitor the specific interventions required.
- To develop plans/programmes for capacity building of Centre/State Government functionaries in rainfed areas.
- To suggest modalities to strengthen National and Statelevel institutions concerned with rainfed/dryland areas, and establish institutional linkages with prioritized watersheds.
- To monitor disbursement of rural credit/insurance cover/safety net programmes developed for rainfed areas.

- To set the research agenda including a critical appraisal of ongoing programmes and promote diffusion of required knowledge for integrated farming in rainfed areas to district and lower-level authorities.
- To evaluate the effectiveness of completed watersheds and concurrent evaluation of ongoing programmes.

Institutionalization of mandates is attempted through convergence and synergy among the ongoing initiatives as listed above.

A good practice: Technology absorption for watershed development and drought mitigation

Lack of technology absorption was considered to be a constraining factor for drought mitigation through watershed development. With the formation of the National Rainfed Area Authority pooling together the inter-sectoral/Inter-Ministerial (Rural, Agriculture and Ministry of Environment & Forest) activities, institutionalization of advanced technologies, viz. remote sensing/GIS has taken place in the following ways:

Integration of remote sensing/GIS in Detailed Project Report (DPR)preparation

In the revised guidelines of watershed development, Govt. of India has been made/made it mandatory to use remote products for DPR preparation by Govt. agencies as well as community-based organizations.

Integration of remote-sensing products for Monitoring and Evaluation of watershed development The experiences of National Watershed Development Programme for Rainfed Areas (NWDPRA) of Ministry of Agriculture helped in integration of remote-sensing products in monitoring and evaluation of watersheds under NRAA.

Integration of remote-sensing products for watershed development programmes is expected to strengthen implementation of flagship programmes like National Rural Employment Guarantee Act (NREGA), an important task under the National Rainfed Authority.

Making remote-sensing products mandatory would lead to sanctioning and implementation of all these activities based on these technological inputs and thus open the door for their greater utilization in rural development – a unique way of institutionalisation. One example is illustrated below:

"India lives in villages, particularly where there are large tracts of arid and semi-arid areas with poor farmers battling with low productivity and sub-standard living conditions. Most of these farmers depend heavily on rainfall for agricultural production and sustenance. An innovative program of participatory watershed development project (Sujala in Karanataka State in Southern part of India) is implemented in five drought-prone districts covering an area of around 0.5 Mha, and benefiting more than 400,000 households. Remote sensing and GIS products have been operationally used in Sujala project from the early stages of watershed prioritization, database and query system development to project action plan generation. The unique feature of the project is the way remote sensing, GIS and

the Management Information System (MIS) are dynamically linked with the impact assessment both in terms of development of natural resources as well as socio-economic indicators. The approach of integrating these tools and techniques has been participatory through community themselves.

The mid-term assessment on the impact of the Sujala Watershed Development Project carried out has indicated very encouraging trends. The average crop yields have increased by 24 pe rcent over the baseline. The average ground water level has increased by 3 to 5 feet. A shift to agro-forestry and horticulture, and reduction in non-arable lands has also been observed. Annual household income from employment, income-generating activities and improvements in agricultural productivity has increased by 30 per cent from a baseline. The 'extra mile' was prototyping a system ensuring greater transparency, social mobilization, inclusive growth and capacity building at the grass roots.[10]"

Pakistan

Almost all the semi-arid and arid areas of Pakistan have been experiencing drought with varied intensity. Pakistan experienced one of the worst droughts during 1998–2001. The severity of drought reached its climax in low rainfall zones, including most of Balochistan, southern parts of Sindh and southeastern parts of Punjab. The rainfall during these periods over Pakistan was much below the normal and largely below normal in some parts of the country. In Sindh and Balochistan provinces, some of the areas almost didn't get rain at all. This deficiency of rainfall caused severe drought conditions, crop failure, and shortage of water in rivers and reservoirs and depletion of underground water. In Pakistan, government officials estimate that nearly 3 million people - mostly villagers - faced starvation in 2000. More than 100 people died as a result of the drought, most because of dehydration.[11]

In 2007 however, Pakistan did not experience any significant drought event; rather, the agricultural production during the drought season increased considerably.

Sri Lanka

In 2004, Sri Lanka was in the grip of a severe and prolonged drought causing tremendous hardships to people and their livelihood due to the continuous drought prevailing in the districts of Hambantota, Anuradhapura, Monaragala, Badulla, Kurunegala Puttalam and Mannar. Due to the unfavourable changes in the weather patterns during the period September to December 2003, many parts of Sri Lanka received exceptionally low rainfall. Rainfall recorded in December at the Meteorological stations was the lowest ever recorded for the monthin 125 years (www.ndmc.gov.lk/images/drought%202004.pdf).

In 2007, drought was not reported in a significant way.

Is a Regional Early Warning System for South Asian Drought feasible?

With the common agro-ecological systems of arid and semi-arid regions, coastal, flood and mountain plains, theoretically there is always a possibility to have a viable Regional Warning System for South Asian drought. The operational constraints in realizing such feasibility are summarized below:

Data Networks. In many countries, the density of meteorological and hydrological stations is insufficient to provide adequate coverage for drought monitoring. A wide range of data is necessary to adequately monitor climate and water supply status (i.e. precipitation, temperature, stream flow, ground water and reservoir levels, soil moisture, snow pack). These data are often not available at the density required for accurate assessments. Data quality (i.e. missing data) and length of record also represent critical deficiencies in data networks for many locations in South Asia.

Data Sharing. Meteorological and hydrological data often are not widely shared between agencies of government. This restricts early assessment of drought and other climate conditions and retards its use in drought preparedness, mitigation, and response. In some countries, the high cost of data acquisition from meteorological services restricts the flow of information for timely assessments and for use in research.

Early Warning System Products. Data and information products produced by early warning systems often are not user friendly. Many products are too complicated and do not provide the type of information needed by users to make decisions. Users are seldom trained on how to apply this information in the decision-making process or consulted before product development.

Drought Forecasts. Long-term drought forecasts (a season or more in advance) are not reliable in most instances. Drought forecasts often do not provide the specificity of information needed by farmers and others (e.g. the beginning and end of the rainy season, distribution of rainfall within the growing season) to be useful for operational decisions. Greater investments in research to improve the reliability of seasonal forecasts would provide significant economic benefits to society if these forecasts were expressed in user-friendly terms and users were trained in how these forecasts can be applied to reduce climate risks.

Drought Monitoring Tools. Tools for detecting the early onset (and end) of drought are inadequate. Triggers for specific mitigation and response actions are often unreliable because of the inadequacy of detection tools and inadequate linkages between indices and impacts. Integrated assessment products are preferred, but few attempts have been made to integrate meteorological and hydrological information into a single product for purposes of detecting and tracking drought conditions and development. Remote-sensing products offer considerable advantages and should be an integral part of drought early warning systems.

Integrated Drought/Climate Monitoring. It is critical that an integrated approach to climate monitoring be employed to obtain a comprehensive assessment of the status of climate and water supply. Too often, drought severity is expressed only in terms of precipitation departures from normal, neglecting information about soil moisture, reservoir and ground water levels, streamflow, snow pack, and vegetation health.

Impact Assessment Methodology. One of the missing links in early warning systems is the connection between climate/drought indices and impacts. The lack of effective impact assessment methodologies has hindered the activation of mitigation and response programmes and reliable assessments of drought-related impacts. Impact assessment methodologies need to be improved

in order to help document the magnitude of drought impacts and the benefits of mitigation over response.

Delivery systems. Data and information on emerging drought conditions, seasonal forecasts, and other products often are not delivered to users in a timely manner. This characteristic significantly limits the usefulness of these products for most users. It is critical that delivery systems are improved and that they be location appropriate. For example, the Internet provides the timeliest and cost-effective method of information delivery in many settings but is inappropriate in most developing countries.

Global Early Warning System. Because of the many definitions and characteristics of drought, no historical drought database exists. Similarly, no global drought assessment product illustrating current and emerging drought conditions is available to governments, international organizations, donors, and NGOs.

Regional cooperation may lead to address some of the operational constraints, as listed above.

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