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50

Drought Preparedness and Mitigation



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Drought Preparedness and Mitigation



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Preface

Drought is a slow setting disaster that ravages some part of the country or the other almost every year following deficiencies in rainfall or its erratic temporal and/or spatial distribution. In recent past, the impact of drought causing to water and food shortages and destruction of ecological system had been widespread and became a national concern during 1987-88, 2002-03 and 2009-10. Although relief measures undertaken by Central and State Governments, NGOs, community organisations, etc. are well established, the lessons learnt are often quickly forgotten once the drought is over. Drought preparedness and mitigation through proactive actions for managing available resources optimally are yet to be evolved. Farmers and water managers require tools and resources to protect crops and water systems and reduce the impact of drought.

With the increasing population and impending climate change and increasing water scarcity, drought mitigation and adaptation will have important roles to play in ensuring food and nutritional security and sustained better livelihood for millions of people. The lessons learnt from drought management in the past could be utilized in building up the necessary infrastructure, knowledge platform and evolving management systems for sustainable use of natural resources essential for drought mitigation and adaptation. It is against this background that this policy paper on drought preparedness and mitigation was conceived and prepared.

It is hoped that all stakeholders will find this document useful for augmenting our national efforts to manage drought. On behalf of the Academy, I express my gratitude to Dr. K.D. Sharma, Technical Expert (Water Management), National Rainfed Area Authority, New Delhi for his efforts in preparing it. Our thanks are also due to the “brain stormers” and the Editors.



(R B Singh)

President, NAAS

Drought Preparedness and Mitigation

PREAMBLE

Every year, drought occurs somewhere among the 15 agro-climatic zones that make India. In the drought-affected areas, the most damage is in the food and agriculture sector. For example, immediate crop and livestock losses mean strained economies, hunger and malnutrition for the vulnerable communities. Longer-term decline in productivity owing to diminished areas, reduced investments and slow recovery leads to poverty and chronic food insecurity. The risks associated with the complex drought-dryland problem may get worse owing to climate change. Thus global warming is expected to lead to more pronounced dry and wet weather. Indian summer monsoon precipitation could vary more and water availability may decline in arid and semi-arid regions. If this phenomenon continues, drought damage would increase.

Drought impact on economy, food and agriculture is especially severe because as much as 57 % of the India's agricultural land is rainfed with large portions in arid and semi-arid zones. In these dryland areas, delayed or reduced precipitation with longer dry spells exacerbate the growing water shortage faced by nearly 500 million of the Region's poorest inhabitants. Right now there is no clear solution in sight. Water scarcity and difficulty of finding cost-effective environment-friendly projects limit irrigation as a solution.

As per current theory the drought is identified as a phenomenon of temporary negative deviation in environmental moisture status. Because of the inherent variable character of monsoon rainfall there are often occasions when the actual rainfall is much below the 'normal' expected on a long-term basis. Thus, drought is a normal, recurrent feature of climate and occurs in all climatic regions and is usually characterized in terms of its spatial extent, intensity and duration. The drought is manifested in terms of crop failure and depletion in surface and groundwater resources/water bodies. The consequence is large-scale human migration and loss of livestock and human lives due to scarcity of water, food, feed and fodder.

The response to drought has varied within the country. On the whole, they may be characterized as *ad hoc*, short-term and superficial ranging from immediate food and feed relief, drinking water supply, temporary employment generation to distribution of

seeds and other inputs for the next crop. Such limited assistance has often been judged as **too little too late**. Typically, there is no strategy and long-term action plan for drought preparedness and mitigation. More often than not, drought mitigation and relief measures stop after a while and are forgotten until the next incident. Consequently droughts have exacerbated hunger, malnutrition and chronic food insecurity by degrading grazing lands, decimating livestock, depleting groundwater reserves, degrading marginal soils and devastating standing crops. More worrisome, they have reduced productivity and affected sustainable development.

The incidence and impact of droughts in the country's food and agriculture sector is increasing. But comprehensive long-term action plans to prepare for and mitigate droughts are lacking. Even when there is advance warning of droughts, most small farmers especially those in arid and semi-arid regions do not know what to do or do not have the resources to undertake mitigating measures or suffer owing to ineffective measures undertaken. Also, the farmers, businessman, corporate and governments have been reluctant to invest in rainfed drought-prone areas. Considering the increase in frequency of droughts in different parts of the country, what is urgently needed is a shift in public policy from drought management to drought preparedness and drought mitigation measures.

IMPACT OF DROUGHTS

The usual impact of agricultural drought is in terms of loss of crops, malnutrition of human being and livestock, land degradation, loss of other economic activities, spread of diseases, and migration of people and livestock. Droughts result in crop losses of different magnitude, depending on their geographic incidence, intensity and duration. The droughts not only adversely affect the food security at the farm level but the national economy and overall food security as well. Predicted losses to agriculture in India were 50 % during the drought of 1957-58. The drought of 2002, registering the steepest fall of 29 million tonnes in food grains production, resulted in 25 % and 16 % reduction in rice and oilseed production, respectively and affected 150 million cattle due to lack of fodder and water. No other drought in the past had caused reduction in food grain production to this extent. Similarly, the food grain production was estimated to be less by 7 % compared to 2008-09, as a result of drought in the year 2008-09. During the 1987 drought in India, the productivity of pearl millet dropped by 78, 74 and 43 % in rainfall zones of < 300, 300-400 and > 400 mm, respectively. Similar reduction in the productivity of groundnut and millet in Andhra Pradesh during the drought have also been reported. For eastern India,

the loss in production of food grains due to drought averaged over 1970-96, has been estimated to be ₹ 1.8 billion year⁻¹, which is equivalent to 8 % of the value of food grain production in the region. The effect of drought was more pronounced on fodder availability as compared to that of food grains.

The duration of availability of water in surface water bodies reduces significantly during the drought year. They get dried up quickly even before the onset of summer. The groundwater table declines and the shallow wells dry up. Sometimes, the concentrations of toxic elements such as arsenic, fluoride and nitrate are increased. In deep wells, concentration of salts increases due to lowering of water table. The poor people suffer the most since they own shallow wells and cannot afford to deepen them.

Droughts affect the livestock in several ways. Reduced productivity and mortality are the direct effects. Driven by enhanced livestock pressure due to depletion of forage resources during drought, overgrazing and indiscriminate cutting of vegetation take place leading to land degradation. This is followed by first distress sale of cattle and even small ruminants. Migration is the next step extending the problems of uncontrolled and overgrazing, thus degrading land in other areas. There have been instances that large-scale mortality of livestock and mismanagement in disposal of their carcasses caused epidemic situations and environmental hazards. Decrease in size of herd (up to 52 %) was reported due to frequent occurrences of droughts.

Recurring droughts bring changes in the nature and extent of the socio-economic values and attitude of the people. Rise in prices, contraction of charity, diminution of credit and consequently enhancement of the rate of interest on loans, reduced grain trade, increase in petty crimes, unusual migration of the people along with their herds, etc. were some of the most common outcomes. The agricultural sector no longer could provide basic employment to rural workers thus resulting in migration/underemployment. Rural women were overburdened with additional work to earn through relief works. The infant mortality was high succumbing to host of diseases mostly due to poor quality drinking water. Taking infants to work/migration also led to increased child mortality. The mother and child had high morbidity due to low intake of calories, much below the energy spent for hard labor in relief works.

Apart from the natural causes (lack of rainfall) and the antecedent conditions (climatic characteristics, soil conditions, presence of groundwater, etc.), the interaction of the inhabitants (human and livestock) has profound impact on the growth of drought. It is not that only the farmers are adversely affected by drought but the entire society

suffers due to rise in prices and additional taxation, to meet the national needs for import of food. However, the farmer is the greatest sufferer for it is this sector of society, which bears the brunt in terms of loss in production. Hence, there is a need for action to protect farmers from devastation caused by the droughts, primarily through national and also regional and international interventions.

It must however be clearly understood that the impact of drought is not just a temporary adversity or a calamity. The relief measures, imports, foreign assistance and taxation on society to meet the food needs are merely the national attempts to address to the secondary impacts of drought. The basic adverse impact of drought is obviously the continuing land degradation or desertification in vulnerable areas, which if continued, can become irreversible in not too distant future. Obviously, there are many direct factors too, leading to land degradation. Yet since drought has a direct impact on agricultural production, any effort aimed at control of land degradation and protection of natural resources, would substantially mellow down the adverse impact of drought on agricultural productivity.

The scenario of drought discussed above thus, reflects the drought as a growing threat to the very fabric of the society and the environment. Therefore wide ranging policy, infrastructural and technological issues need to be looked into more seriously than ever in national, regional and global perspectives involving Governmental, Intergovernmental agencies and mechanisms. The National Agricultural Research System (NARS), international institutions, NGOs and private sector need to work together to realize the goal of a sustainable agricultural enterprise based on the most efficient use of the available natural resources i.e. land, water and vegetation in an integrated manner and in a farming systems perspective.

FREQUENCY OF DROUGHTS

A study of moderate and severe droughts that occurred in India indicates that, except for a very few small pockets in the North-eastern India and Kerala, there were no areas, which have not been affected by drought at one time or the other. While the entire country could thus be considered as drought-prone, there are certain areas, which are chronically subjected to such condition and merit the appellation 'drought-prone' (Table 1). Technical Committee on Drought Prone Area Programme and Desert Development Programme identified about 120 million ha of the country's area, covering 185 districts (1173 development blocks) in 13 states as drought-prone. Based on the historical records, about 130 droughts/famines have been reported in one or other part of the country between 1291 and 2009. During

the 20th century alone, droughts of varied intensities occurred during 28 years in India. Since the mid-nineties, prolonged and wide spread droughts in consecutive years have occurred in the country.

Table 1. Probability of occurrence of drought in different meteorological subdivisions of India

Meteorological subdivision	Frequency of deficit rainfall (75 % of normal or less)
Assam	Once in 15 years
West Bengal, Madhya Pradesh, Konkan, Bihar and Orissa	Once in 5 years
South interior Karnataka, Eastern Uttar Pradesh and Vidarbha	Once in 4 years
Gujarat, East Rajasthan, Western Uttar Pradesh	Once in 3 years
Tamil Nadu, Jammu and Kashmir and Telangana	Once in 2.5 years
West Rajasthan	Once in 2 years

DROUGHT MANAGEMENT STRATEGY IN VOUGE

Drought management is currently addressed through the following mechanisms and sectors:

Governmental

- ◆ Policy issues, national, regional, and district level
- ◆ Agriculture and rural development infrastructure
- ◆ Input supply, marketing and farm advisory services

Non-Governmental

- ◆ NGOs
- ◆ Rural institutions
- ◆ Private sector
- ◆ Philanthropic organizations
- ◆ Community codes (tribes, herders)
- ◆ International aid agencies

Research and Development Initiatives

- ◆ Weather forecasts, early warning, vulnerability and preparedness measures
- ◆ Best practices for rainwater and soil management through linking on-station and on-farm research
- ◆ Contingency crop planning/mid season corrections
- ◆ Alternate and diversified land use systems

Research and development initiatives especially in areas like understanding the monsoon behaviour, agrometeorology, arid/dryland farming systems and hydrology have since contributed substantially to the knowledge base on drought management. These advancements have contributed to the development of useful technological options and also infused dynamism in agricultural production strategies and development of appropriate farming systems. These efforts thus enable the farmers to tide over difficulties created by the drought situations. However, the technology adoption by small holders who constitute the bulk of stakeholders in drought-prone areas has not been to the desired extent. This deficit is not only due to inherent difficulties in developing appropriate technologies for extremely complex rainfed–drought-prone environment, but also due to the poor socio-economic conditions of the farmers and lack of adequate development infrastructure. Of late, the drought management approach has shifted significantly in the region from crisis response to risk management through early warning systems, advance planning for emergency response and better preparedness. This paradigm shift in R&D strategy has since made some impact, yet the sustainability in rainfed areas is yet to be realized. The quality of life of small holders in rainfed areas therefore is yet to attain the desirable standards of living to reduce the gap with high productivity zones i.e. the irrigated areas. This is a national priority.

In India, major research efforts on improving the productivity of rainfed areas with focus on reducing the adverse effects of drought have been underway for the last 2-3 decades. Package of practices involving appropriate crops, improved varieties, tillage and seeding practices, soil and rainwater conservation/harvesting, use of fertilizers, weed control, alternate land use systems and plant protection have been developed through intensive and location specific research efforts. However, except for improved crop varieties, other components of the technology – particularly those aimed at conservation of natural resources (soil and water) have not been adopted by the farmers, more so the small holders who dominate the agriculture sector in

rainfed areas. The integrated watershed management programme which forms the central strategy for the national programme of development of drought-prone areas in India, initiated in mid-seventies has not made desired impact in terms of replicability of pilot projects despite the huge investment of public funds during the last two decades and only 35 % of the projects performed better than average. Among other reasons, the following factors have been responsible for this setback:

- ◆ Technology bias on biophysical issues – lack of appreciation of farmers conditions, their priorities and resources
- ◆ Top down extension strategy and weak institution and capacity building
- ◆ Lack of on-farm research for participatory technology development (PTD) in rainwater harvesting and watershed management
- ◆ Greater reliance on crops – lack of appreciation of farming system perspective and production system diversification and livelihood activities for landless and asset-less
- ◆ Inadequate rural infrastructure
- ◆ Poor management of developed natural resources especially water for productive purpose

Drought Management Strategies

Having gone through the unnerving experience of suffering many widespread droughts due to high variability of rainfall in time and space, a fairly organized drought management system has been evolved in the last 150 years in India (Figure 1). The problems caused by drought were faced with fair amount of competence and dedication. However, the approach was essentially that of starting *ad hoc* relief works, as per famine code, to provide employment to the distressed population rather than having the long-term perspective for improving the conditions in the region and to reduce the probability of drought. This approach did not prove effective in mitigating the drought conditions. It was only since 1970s, with the launch of Drought Prone Area Programme (DPAP), and subsequent watershed development projects that a long-term view was taken for evolving technological, socio-economic, institutional and organizational innovations, which were accepted as the strategy for integrated development of drought-prone areas. This policy improvement has paid rich dividends while dealing with the infamous droughts of 1987, 1999-2000 and 2009.

Successfully Managing Drought during 2002

In terms of magnitude, the drought of the year 2002 ranked 5th amongst the severest droughts India faced since 1875. The intensity of aridness in July at 51 % rainfall deficiency surpassed all previous droughts. The impact of drought spread over 56 % of the landmass threatening livelihood of about 300 million people in 18 States.

In the era of economic liberalization, the policy makers and planners both in the Central and State Governments formulated and implemented appropriate strategies to manage 2002 drought, taking into account the prevailing policy environment, resource availability and institutional systems across the country. Emergence of Panchyati Raj Institutions and Self Help groups at the local level were also of immense value to undertake community-based drought relief operations. Resource transfer from the Centre to the States was of the order of Rs. 130 billion for direct relief measures including 8.7 million tonnes of food grains for relief employment. Another Rs. 70 billion were spent towards the debt servicing liability and crop insurance claims of the affected farmers. More than 1.4 billion man-days were generated benefiting over 20 million rural households. Emergency measures for supply of water by rail and road enabled over 90 million people to receive potable water during the period of utmost distress. Resource transfer of this magnitude had very gratifying impact.

At present, the main objectives of drought management strategy are:

- ◆ Distribution of essential commodities such as water, fodder and food at subsidized rates.
- ◆ Optimum utilization of resources in the affected areas with emphasis on primary resources viz. soil, water, vegetation, livestock, manpower, etc. Relief works undertaken for providing employment to drought stricken population mainly for drought proofing.
- ◆ Improvement in terms of living conditions of the rural poor who suffer the most due to scarcity and drought in particular, and the community in general by creating direct and indirect employment and taking up short duration programmes of development.



Fig. 1. An approach to manage drought being followed by the Ministry of Agriculture, Government of India

While drought management programmes have been in existence for a long time, they have not been effective due to many reasons. Individual departments with a narrow focus usually run most of these programmes in isolation, with allocations thinly scattered over a large area. There is no sustained dialogue with the people about the benefits of these programmes and the need for their participation and ownership. As these programmes are fragmented in their implementation, the accountability mechanisms are very weak and all programmes experience serious lacunae. Thus, there is a need to revise the strategy for implementing drought management programmes in an integrated manner on a mission basis, which can be implemented in the identified areas with active participation of the people.

RECOMMENDATIONS

Research

- ♦ The importance of prioritizing areas and people for resource allocation is to be highlighted. Within the selected areas, issues for R & D and drought-combating actions should also be prioritized.

Laws/Regulations for Delaying Summer Rice Transplanting

Due to subsidized power and compulsion of engaging immigrated labour. the rice transplanting date was advanced to May in Punjab and Haryana. The water requirement of rice transplanted on May 20 is 76 cm, on June 10 is 60 cm and on June 30 is 52 cm i.e. 1 % less per day over May transplantation.

In order to conserve groundwater, the Haryana Vidhan Sabha passed the Haryana Preservation of Sub-Soil Water Bill, 2009, prohibiting transplanting of rice before June 15 of the year or such date as may be notified by the State Government. Similarly, in March 2009 the Punjab Legislative Assembly passed the Punjab Preservation of Sub-Soil Water Act, 2009, to replace the ordinance already issued to ban rice transplanting before June 10. The Punjab State Electricity Board was also advised to supply power to tube-wells only after June 10. The procurement of rice in the market also deferred to ensure transplanting at desired dates only. This timely action of Haryana and Punjab will not only save the groundwater in these States but also set an example for other States.

- ◆ Only when farmers, scientists and extension workers operate as a team could new technologies suitable for local conditions emerge in drought-prone areas. The R & D institutions must undertake more on-farm research, with the full participation of farmers in indigenous knowledge assessment and adoption, resource appraisal, problem identification and programme implementation.
- ◆ Old and newly emerging technologies for drought preparedness and mitigation include contingency crop planning, *in situ* rainwater harvesting, village and farm ponds, underground cisterns, crops, varieties and cropping systems, crop combinations, weed management, planting density, soil and crop management, integrated nutrient management, alternative land-use systems and others.
- ◆ The existing response programmes for drought-prone areas tend to be limited in scope and depth. They typically focus on immediate needs such as drinking water, food, crop and livestock loss prevention, and short-term employment. The assistance given is generally inadequate and understandably, limited to accessible people and areas. New approaches, strategies and methods to protect farming systems, resources and livelihood in drought-prone areas are urged.

- ◆ Government and concerned institutions must accord high priority to R & D of drought-resistant technologies and practices.
- ◆ Early warning, and continuous monitoring and decision support systems are integral components of a programme to protect farmers' livelihoods. Only if these components are effective, farming adjustments and corrections be made in time; and optimal decisions taken to maximize returns/minimize losses, especially with mid-season and terminal droughts. Drought management and a decision support system based on RS & GIS inputs, crop growth models, drought mitigation technologies, market forecasts and resource information are to be evolved.

Integrating Advances in RS, GIS, Modeling and Mobile Telephony

Continuous advancement in Remote Sensing (RS) has improved timely, accurate and synoptic coverage of crops and also assessing crop vigour at a range of spatial scales. RS data on crop environment, crop distribution, phenology and leaf area index can be coupled to crop simulation models in a number of ways to estimate crop yield and yield loss. Crop simulation models (CSM) that have been successful in field-scale applications are being adapted in a GIS framework to model and monitor crop growth with RS inputs. An integration of five technologies, viz., crop simulation models, RS, GIS, GPS and mobile telephone-enabled services provide an excellent opportunity for monitoring and modeling crops at a range of spatial scales.

- ◆ Additional work for a number of areas on a priority basis namely, identification of researchable issues in each agro-ecological zone, early warning and decision support systems, soil quality enhancement, agro-bio-diversity issues, farming systems, participatory technology development and technology assessment and refinement in drought mitigation needs to be supported.
- ◆ Various drought indices should be researched and promoted so that data from regular observations can be used to more effectively warn of drought dynamics. Research should develop and apply ways to monitor and predict, through remote sensing, direct measurement and simulation models the current and future water conditions of the soil-plant-atmospheric continuum.
- ◆ A comprehensive resource analysis and study of land use in drought-prone areas may be undertaken with consideration of water resources, potential

productivity of crops, environmental problems, land use patterns, cropping systems, water and forest resources, livestock and fodder resources.

- ◆ Climate-soil-production systems need to be critically evaluated from a sustainable resource management context in drought-prone environments. To help manage agriculture and coordinate the relationship between development and environment, research should be conducted on:
 - Soil degradation
 - Water erosion control
 - Improving rainwater productivity
 - Cropping patterns
 - Tillage systems
 - Water management
 - Use of drought resistant crops
 - Soil moisture conservation practices and runoff techniques among farmers.
- ◆ R&D, while being wherever appropriate systems-focused and strongly interdisciplinary, should use participative processes to take advantage of the wisdom of farmers and their traditional practices. Research should also focus on the integration of the technical and socio-economic aspects.
- ◆ The key to successful farming in drought-prone areas is not 'farming land' rather it is 'farming water'. Simple tools to calculate the farm or field water balance, and the on-farm level of efficiency of water or rainfall use in terms of crop yield- generated should be developed for use in action-learning processes with dryland and irrigation farmers.
- ◆ The potential for so-called inferior but drought-hardy species such as *Prosopis* and *Opuntia* to provide raw materials for employment generation activities, along with post-harvest processing technologies, should be investigated and promoted.
- ◆ Drought-tolerant breeds of livestock and varieties of crops must be explored to help build drought tolerance and resilience of farming systems.

Development

- ◆ As drought is a slow-onset disaster, strengthening of monitoring and early warning systems are central to drought management. Drought preparedness and mitigation measures follow these initial steps in drought management.
- ◆ Interventions in emergencies in terms of a sequence of events, referred to as a disaster cycle, with distinct phases, could be distinctly identified for planning and executing different actions. The eight type of actions or phases of the emergency sequence are: (1) prevention, (2) preparedness, (3) early warning, (4) impact and needs assessment immediately following a disaster, (5) relief, when immediate humanitarian assistance is required, (6) rehabilitation, when the first attempts to rebuild the rural livelihood system take place, (7) reconstruction, when the destroyed infrastructure is replaced and investment can take place, and (8) sustainable recovery, when conditions permit to return to a development process (Table 2). Reasonable drought relief is being provided in India followed by a fair assessment of impact and needs. Limited efforts towards drought early warning have been made by the Indian Meteorological Department in the last decade.
- ◆ As per the current system, the expenditure on relief measures takes precedence over mitigation, placing enormous burden on the State budget and relegating the development plans. An emphasis on mitigation measures would reduce the incidence and severity of drought, improve crop production and save resources spent recurrently on relief.
- ◆ The existing response programmes for drought-prone areas tend to be limited in scope and depth. They typically focus on immediate needs such as drinking water, food, crop and livestock loss prevention, and short-term employment. The assistance given is generally inadequate and understandably, limited to accessible peoples and areas. New approaches, strategies and methods to include farming systems, resources and livelihood in drought-prone areas are urged.
- ◆ From the economic perspective, integrated watershed management coupled with enterprise diversification based on carrying capacity and product value addition should be the main thrust. This line of action would ensure optimum resource-use, sustainability and income maximization.
- ◆ Measures to enhance perennial component of vegetation in arid and semi-arid farm lands including agro-forestry, agri-horti, etc. must be incorporated.

Weather Index-based Crop Insurance

Several weather-based insurance schemes piloted in India since 2003 are presently being offered by both the public and private sector insurance companies including AIC, ICICI Lombard, IFCCO-Tokio, etc. for different crops in selected areas of the country. Weather-based index measures a specific weather variable and pays indemnities based on the realization of the index such as rainfall (that proxies the loss in yield owing to the adverse weather incidence) rather than based on estimates of actual yield losses experienced by the insured. The insurance product specifies a threshold that establishes the range of values over which indemnity payments are made. It operates on the concept of 'Area Approach' i.e., for the purpose of compensation, and this 'Reference Unit Area (RUA)' deemed to be a homogeneous unit of insurance and is linked to a Reference Weather Station (RWS) for processing claims.

One of the key advantages of the weather-index based crop insurance is the use of independently verified, objectively measured and publicly available weather data as trigger events to 'proxy' for crop yields in compensating the farmers for deemed crop losses. This not only makes the indemnity payouts faster, but also the insurance is more transparent, less costly due to reduced transaction costs of yield estimation and field visits, and less susceptible to moral hazard. There are some weaknesses and limitations also that limit the scaling up. First, the concern of high basis risk due to wide variability of index value within the Reference Unit Area of a representative weather station, arising from insufficient network and spread of weather stations. Therefore, for effective delivery, scaling up network of rain gauge stations will need to be expanded to cover every village *Panchayat*. Second challenge is to design a crop and/or area specific proxy weather risk triggers (index) with predictive capability to realistically measure crop losses, and this requires well researched and calibrated threshold levels of triggers considering critical crop growth stages. Third, there is inconvenience of buying weather insurance due to lack of understanding of highly technical and complicated claim structure by farmers. Their successful introduction would require a significant educational effort.

Some of the above issues of yield-based insurance have now been addressed in the **Modified National Agricultural Insurance Scheme (MANIS)** on a pilot basis for two years. The scheme covers food crops, cereals, millets and pulses, oilseeds and annual commercial horticultural crops; loanee farmers (compulsory) and non loanee farmers (voluntary); indemnity amount (maximum 25 %) for prevented sowing /planting risk with the village *panchayat* as unit area of insurance and the threshold yield-based on average yield of preceding 10 years data excluding years of calamity.

- ◆ Establishment of water (especially for human and livestock), seed, fodder and feed bank for meeting immediate demand assumes higher priority in drought prone areas. Seeds of all annual and perennial crops, shrubs, trees and other industrial crops as per contingency plan of each State/region should be available in sufficient quantity in these banks. These seed banks may be updated periodically since they may be used occasionally and private sector may not be interested in such a risky business.
- ◆ Coarse cereals may be included in PDS and procurement at the MSP should be ensured to promote cultivation of traditional rainfed crops in these areas.
- ◆ Conservation agriculture and rainfed farming systems need to be prioritized, encouraged and incentivized in developing rainfed areas. Mechanization is highly essential due to exigency of completion of farming operations within limited period in drought affected areas. In view of predominance of small and marginal poor farmers, renting or custom hiring services may be created.
- ◆ It may be made mandatory that harvested rain water and augmented ground water resources should be used through micro-irrigation and other efficient water saving techniques for enhancing productivity of scarce water.
- ◆ The forest management policy need to be re-visited for the fringe forests located within a radius of 3 km from the village boundaries to ensure synergy between the conservation of forest and livelihood needs of the local people. Special efforts are needed to re-orient the management of these forests for recharging and rain water harvesting for drinking, agriculture and other local needs which will benefit the forests to regenerate and create a win-win situation.

Policy

- ◆ The urgency of drought combating action, at the outset, varies in time and with the area. Also, many public and private agencies deal with the problem. In such circumstances, efforts are often sporadic and fragmented and they lead to nowhere. The importance of continuous integrated actions is emphasized. Establishment of task forces/partnerships/consortia of all public and private stakeholders to solve the drought problems is called for.
- ◆ A regional strategic drought preparedness project may be established. This project would have several elements and support individual regions in their drought preparedness initiatives and activities. Initially it could take the form of a collaborative partnership network with one or more coordinating nodes. The future shape would depend on subsequent policy decisions. The elements could include:

- a. coordinating emergency stocks of food and other drought reserves and their maintenance,
 - b. information flow for drought early warning and monitoring,
 - c. information flow for drought preparedness and response (eg, new climate research findings, new land and water management practices, new drought-tolerant breeds and varieties, social and community processes to help communities prepare for drought, what to do when drought is forecast, and ways to purify drinking water),
 - d. monitoring of regional drought severity and extent to assess climate change impacts,
 - e. focusing priorities for research and development agencies,
 - f. capacity-building for a strategic approach to drought preparedness and response,
 - g. focusing priorities for emergency relief agencies, and
 - h. making sure drought is not forgotten as soon as rains arrive.
- ◆ The national, State and regional policies may provide for conservative management and maintenance of all reserves developed as a part of drought preparedness initiatives, whether they be reserves of food, surface water or groundwater, seeds or fodder.
 - ◆ At the national level, policies may be enacted to support a National Drought Mitigation Plan (NDMP), involving all the ministries and concerned organizations such as NGOs. As a focal point, a central nodal agency will coordinate and maintain the NDMP.
 - ◆ Drought support policies, appropriate in the particular circumstances, should encourage self-reliance by farmers. In other words, drought preparedness including safety nets, insurance, etc. should be factored into their normal farm management plans and activities.
 - ◆ Need for evolving scientific but practical crop zoning concept suitably linked with marketability to adjust demand of water to the availability for its efficient utilization. Cultivation of high water demanding crops should be discouraged in water scarce areas and some regulatory measures may be evolved for rational use of water in such areas.
 - ◆ Authorities may be encouraged to develop/improve drought declaration/revocation processes and to share the information on these processes, recognizing that

Table 2. Proposed measures under operational strategies for disaster management

Prevention	Preparedness	Early Warning	Impact and need assessment	Relief	Rehabilitation, reconstruction and sustainable recovery
* Introducing Food Insecurity and Vulnerability Information Mapping Systems (FIVIMS)	* Promote appropriate database for preparedness and planning	* FIVIMS	* Establishing methods for community and government impact and needs assessment	* Improving collaboration of all players at local, national, regional and global levels	* Integrating all actions with the development process
* Strengthening guidelines for agricultural vulnerability reduction	* Support disaster preparedness planning in farming systems	* Establishing/ strengthening national Early Warning Systems (EWS)	* Improving comprehensiveness, timeliness and accuracy	* Increasing cost-effectiveness of distribution mechanisms	* Building physical and institutional infrastructure
* Encouraging hazard resistant and protective structures	* Strengthen national and local level FIVIMS	* Establishing/ strengthening agro-meteorology units	* Promoting community and government participation	* Mobilizing resources (foods, inputs, funds and support)	* Raising R & D for resilient farming systems
* Promoting land and water use planning and zoning	* Create mechanism for disaster management	* Upgrading crop assessment and forecasting methods	* Linking national, regional and local assessments	* Instituting nutrition surveillance	* Strengthening agricultural micro-credit systems
* Developing community decision-making and action	* Support nutritional information and health care	* Linking national, regional and global EWS		* Building systems for monitoring and evaluation	* Improving access to land and other means of production

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Prevention	Preparedness	Early Warning	Impact and need assessment	Relief	Rehabilitation, reconstruction and sustainable recovery
* Building community self-reliance	* Develop mechanism for loss and damage compensation	* Improving two-way farmer-EWS information flow			* Raising farm and off-farm incomes of the poor
* Improving disaster proof farming systems including:	* Stock emergency food, feed, fodder and agricultural inputs				
- Crop diversification	* Encourage agriculture-related employment projects				
- Integrated farming systems					
- Contingency crop planning	* Work towards effective involvement of local communities				
- Disaster mitigation practices					
- Hazard resistant practices					
- Pilot projects					

although they are commonly based on threshold criteria for rainfall deficits and other relevant factors, they may be location-specific and operate differently at different levels, and wherever possible they have local community involvement through processes that help maintain morale in the face of drought.

- ◆ At national and State levels, policies are required for ensuring adequate reserves of food and drinking water as well as seeds of suitable varieties and livestock fodder, suitably located or able to make available in a timeframe.
- ◆ Financial support must be provided for strategically planning and implementing water conservation programmes as a part of ongoing budgetary arrangements for drought mitigation programmes.
- ◆ Policies at all levels should encourage the uptake of more water efficient technologies such as drip irrigation and rehabilitation of traditional water storages.
- ◆ Legal framework may be evolved to enable share croppers and to actual land tillers become eligible for loans, compensation, loan waivers, subsidies, insurance and other such government assistance.
- ◆ Policies at all levels should recognize that social interactions are important to maintain morale and social capital in the event of drought. Land care (local people acting to resolve local problems) movement is a powerful agent for building social capital in rural communities to cope with weather adversities such as drought.
- ◆ Drought information network/databank to provide the data and interpretation on future drought occurrence, probabilistic forecast, location, intensity, duration and impacts on different sectors may be established.
- ◆ Extension and awareness activities should reinforce awareness that droughts recur and the focus should be more on sustainable natural resource management as a part of drought preparedness drills.
- ◆ Creating public awareness about the drought and educating on efficient use of water through information media is necessary.
- ◆ Information provided by the Agromet Weather Advisories and Remote Sensing Agencies should help the farmers as decision support systems to reduce the drought vulnerability.

- ◆ A systems approach stressing comprehensive and integrated actions needs to be adopted through a network of pilot projects in the country. The pilot projects which cover all aspects of drought management.
- ◆ Legislation may be adopted on cropping patterns as an agenda for governance and insurance cover.
- ◆ Figure 2 outlines an example of drought response, preparedness and mitigation policy for consideration of the planners and decision makers in the country.

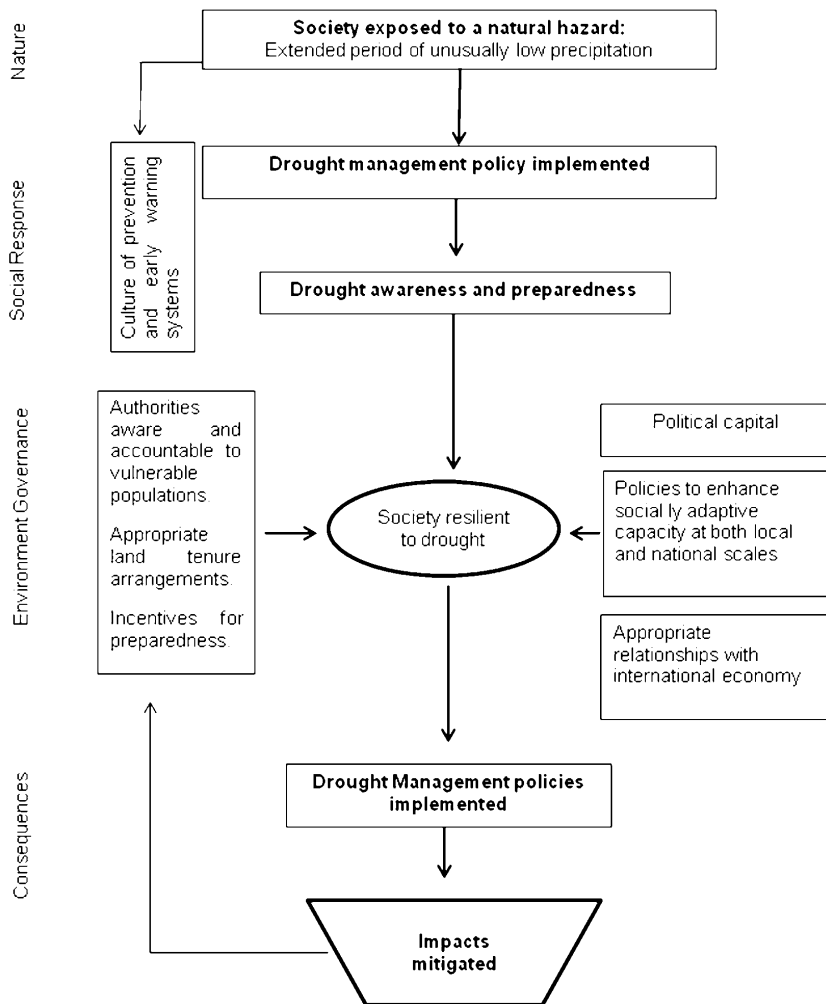


Fig. 2. An outline of drought response, preparedness and mitigation policy

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