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Review and Analysis of Drought Monitoring, Declaration and Management in India

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International Water Management Institute

FUTURE HARVEST
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Acronyms and Abbreviations

ARWSP	Accelerated Rural Water Supply Programme
BDO	Block Development Officer
BPL	Below Poverty Line
CAZRI	Central Arid Zone Research Institute, Jodhpur (Rajasthan)
CM	Chief Minister (Head of a State)
CMG	Crisis Management Group
CRF	Calamity Relief Fund
CWWG	Crop Weather Watch Group
DDP	Desert Development Program
DG	Director General
DPAP	Drought-Prone Area Program
FWP	Food for Work Program
GIS	Geographic Information System
HLC	High-Level Committee
HPC	High-Power Committee
ICDS	Integrated Child Development Services
IMD	Indian Meteorological Department
INR	Indian Rupees
MoA	Ministry of Agriculture
MLA	Member of Legislative Assembly
MP	Member of Parliament
MoWR	Ministry of Water Resources
NCCF	National Calamity Contingency Fund
NCMC	National Calamity Management Committee
NIC	National Information Centre
NIDM	National Institute of Disaster Management
PDS	Public Distribution System
PHED	Public Health Engineering Department
PM	Prime Minister (Head of Indian Government)
PMGY	Prime Minister Gramin Yojna (Prime Minister Rural Schemes)
SDAA	Severely Drought Affected Areas
SLP	Special Leave Petition
SGRY	Sampooran Gramin Rozgar Yojna (Comprehensive Rural Employment Scheme)

Summary

Human and animal deaths, migration, economic losses and social effects were very common in Africa, Asia, America, Europe and Oceania during the twentieth century. Frequent droughts in Africa and Asia still result in misery, erode livelihoods, damage integrity of natural ecosystems and cause diseases or deaths due to poor-quality water and hunger. Ripple effects on secondary- or tertiary-level economy, political upheavals, social conflicts and out-migration are also tremendous outcomes of failed development. Frequency of epidemics decreased whereas relative occurrence of droughts increased during the twentieth century. The analysis also demonstrates that for a given level of drought, disaster risks are variable depending on the overall physical and socioeconomic vulnerability.

Data compiled from 107 countries revealed that, on a long-term average, 220 million persons are exposed to drought annually with maximum vulnerability in sub-Saharan Africa. The drought in 2002, one of the severest in the 130-year history of India affected 56% of the geographical area and the livelihoods of 300 million people in 18 states. About 150 million cattle were affected and the federal government allocated a financial relief of INR 200 billion (US$4.4 billion). The IT-enabled process of drought monitoring and declaration is, therefore, important to enhance preparedness, quick response, relief, recovery, and mitigation and management systems. Current management strategies of India have evolved out of the experience of 17 major droughts, 5 severe droughts and internalization of technological advances since 1871. Initially, the administration evolved famine codes, manuals and response procedures to minimize deaths from starvation. The 1965–1966 drought induced restructuring of the Indian strategy through a public distribution system to ensure physical availability of food. The 1972 drought prioritized economic access to food through employment generation for the drought-affected population. The experience of monitoring the 1979 drought underpinned robustness, resilience and stability of farming systems and livelihood opportunities. The 1987 drought enabled watershed management for mitigating the adverse impacts on livelihood, cattle and the wealth of trees. Isolated droughts in 2000 in vulnerable areas like Rajasthan, etc., consolidated the institutional and capacity-building infrastructure. The 2002 drought was unique since rains failed in the very beginning of the rainy season (July), the rainfall deficit was 51 percent, crops could not be sown and the existing formalities of monitoring and declaration were relaxed, revised or waived off. The severity of the 2002 drought also called for the setting up of special task forces, additional monitoring systems and responses. Important features of drought monitoring, declaration and management are summarized below.

- A multilevel institutionalized monitoring and early warning system both during normal and drought years and impact analyses for future guidance constitute the bedrock of the current comprehensive process-based management.

- The constitutional, legal and institutional framework of monitoring, declaration and management is undergoing rapid evolution for internalizing emerging technological and economic opportunities.

- Better governance reduced poverty to 15.28% in the frequently drought-affected State of Rajasthan as compared to 47.15% in the high rainfall State of Orissa and 42.6% in the least drought-affected State of Bihar.

- Different states have their own systems of drought management. A typical system consists of the Relief or Revenue Minister, Crop Weather Watch Group, Relief Commissioner, District Collector, Block Development Officer, and rainfall monitoring at *Tehsil/Mandal* level and village *Panchayats* (elected representatives).

- When droughts are severe like that of 2002, special task forces at the federal level and additional mechanisms at the state level reinforce the regular system of monitoring and management.

- Weather forecasts of the India Meteorological Department (predicting more than 19% deficiency in rainfall recorded at *tehsil*/district/state level), found that limited water flow or water availability in major reservoirs, and recommendations of the Crop Weather Water Group trigger the process of drought declaration.

- Drought declaration after estimation of agricultural losses is the sole responsibility of states whereas the federal government facilitates monitoring and management.

- Normally, agricultural losses are estimated by random crop-cutting experiments at the district level and droughts may be declared for the whole state or a part of it or even for a single district.

- Immediately after the receipt of declaration memoranda from states, central teams are constituted by the Central Relief Commissioner to verify the claims (generally overestimated) made by the state agencies.

- In the 2002 droughts, certain codes of estimating losses were waived off by the National Calamity Management Committee due to failure of rains in July itself, with a 51% deficit in rainfall in July and the inability to sow the crops.

- Impact of drought on crops, inputs support, energy availability, market responses, water availability, physical infrastructure, livestock, fodder availability and employment, etc., are monitored by the Central/State Relief Commissioners, and special groups/task forces.

- Estimations of sustained losses are inadequate for quantifying damages to perennial crops, orchards, trees, livestock fertility, wildlife, groundwater resources, biodiversity and aquaculture.

- The scope of estimating losses may be expanded to secondary and tertiary-level ripple effects on nonfarm livelihood opportunities, especially for the resource-poor population.

- Quantification of losses by the conventional revenue surveys has to wait for maturity of crops and delays the response. Modern methods of remote sensing, GIS, GPS, modeling and real-time communication can go a long way in hastening the responses.

- High-resolution spectral libraries and remote-sensing censors are evolving to improve precision and real timeliness of forewarning systems and estimation of losses.

- Long-term monitoring and evaluation of groundwater resources and their potential for drought mitigation should be prioritized.

- Impact monitoring and documentation of each drought are important to learn lessons for devising future strategies and process refinement.

- A global force of oceanic and terrestrial systems determines rainfall of a country. This calls for unrestricted sharing of data, experience and knowledge among the neighboring countries.

- India has adequate experience in managing medium and severe droughts. This could be shared with neighboring countries having similar agro-ecologies, socioeconomic conditions and livelihood opportunities.

- Some states of India, like Karnataka, have set up Drought Monitoring Centers with the latest art of technologies and real-time communication. This experience is valid for other drought-prone states and for other countries of the region.

- India has created a sufficient number of institutions, training materials, guides and manuals for capacity building and they may be quite useful for neighboring countries.

Introduction

Unlike earthquakes, floods and cyclones, drought occurrence is a gradual process with long-lasting effects. The droughts from 1980 to 2000 posed a threat to the food security and human mortality all round the world. On average, 28% of the geographical area of India is vulnerable to droughts. Meteorologically, ±19% deviation of rainfall from the long-term mean is considered normal in India. Deficiency in the range of 20 to 59% represents "moderate" drought and more than 60%, "severe" drought. From 1871 to 2002, India has witnessed 22 major droughts each in 1873, 1877, 1899, 1901, 1904, 1905, 1911, 1918, 1920, 1941, 1951, 1965, 1966, 1968, 1972, 1974, 1979, 1982, 1985, 1986, 1987, and 2002 and five of them were severe. Since disasters engulf vast regions and deprive large sections of the rural and vulnerable population of their normal means of livelihood, good governance is called for. Different countries and states have developed codes, manuals, procedures, processes and policies for monitoring and management of drought. Over the years, India has developed a fairly elaborate governance system of institutionalized drought monitoring, declaration and mitigation at different levels.

Continent-wise details of drought impacts are given in table 1. As per UNDP (2004) relative drought vulnerability index (persons killed per million exposed) is highest in the Democratic People' Republic of Korea (16,847), followed by Mozambique (5422), Ethiopia (5189), Sudan (2881), Mauritiana (620), Chad (278), Somalia (29), Uganda (23), Papua New Guinea (11) and China (6). This index for India is relatively very low (0.58) due to the constantly evolving development and governance process in spite of greater frequency of droughts after 1965.

Table 1. Summarized effects of droughts sorted by continent from 1900 to 2004.

	No. of events	Killed	Homeless	Affected	DamageUS$ ('000)
Africa	459	1,046,394	48,000	314,238,582	4,472,093
Average per event		2,280	105	684,616	9,743
Americas	124	78	0	61,701,370	13,504,400
Average per event		1	0	497,592	108,907
Asia	164	7,761,408	20,000	1,789,441,014	14,810,976
Average per event		47,326	122	10,911,226	90,311
Europe	30	1,200,000	0	15,262,575	14,311,600
Average per event		40,000	0	508,753	477,053
Oceania	22	688	0	8,233,635	11,006,000
Average per event		31	0	374,256	500,273

There was hardly any starvation- or drought-related deaths after 1967 and especially during the severe drought of 2002 (table 2). India has a long history of drought mitigation and management. The great famine of 1876-1878 led to the constitution of the Famine Commission (1880), which recommended obligation of the sate to provide calamity relief. Presently, drought management is an adequately institutionalized system of monitoring, prevention, mitigation, preparedness, vulnerability mapping, declaration, relief and impact analysis. It is still evolving in response to accumulated experiences, new technologies, and socioeconomic and political aspirations.

Table 2. Occurrence, number of people affected and damages of droughts of India in 1900–2002.

Date	Location (state, regions or districts)	Numbers
July/2002	Uttar Pradesh, Madhya Pradesh, Rajasthan, Punjab, Haryana, Delhi, Karnataka, Kerala, Nagaland, Orissa, Chhattisgarh, Himachal Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu states	300,000,000 affected;damage: US$910,721,000
May/2001	New Delhi, Rajasthan, Gujarat, Orissa	20 deaths
November/2000	Mahasamund, Raipur, Kawardha, Rajnandgaon, Durg districts (Chhattisgarh region)	
April/2000	Gujarat, Rajasthan, Madhya Pradesh, Andhra Pradesh, Orissa, Maharashtra	90,000,000 affected; damage: US$588,000 ,000
March/1996	Rajasthan	
March/1993	Bihar, Orissa, Andhra Pradesh, Maharashtra, Gujarat, Madhya Pradesh, Uttar Pradesh, Karnataka	1,175,000 affected
July/1987	Orissa	110 deaths
1987	Gujarat, Rajasthan, Orissa, Madhya Pradesh, Andhra Pradesh, Maharashtra and 4 Union Territories	300 deaths 300,000,000 affected
11, April/1983	Kerala, Tamil Nadu, Rajasthan	100,000,000 affected
1973	Central	100,000,000 affected; damage:US$50,000,000
1972	Central	100,000,000 affected; damage:US$50,000,000
August/1964	Mysore	166,000,000 affected
1964	Rajasthan, center	500,000 affected
1942	Kolkatta, Bengal region	1,500,000 deaths
1900	Bengal	1,250,000 deaths

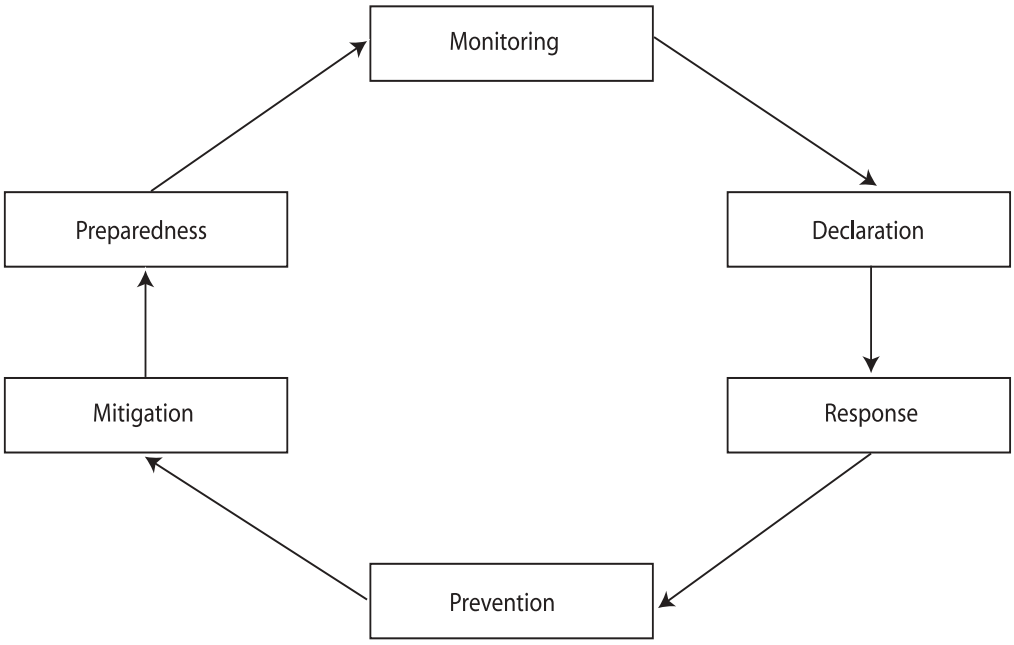
The subject of disaster management (including droughts) is not mentioned in any of the three lists in the 7th Schedule of the Indian Constitution. However, successive Quinquennial Finance Commissions since 1951 have provided budgetary arrangements for managing natural calamities with appropriate guidelines to ensure proper utilization of calamity-relief resources. A High Powered Committee (HPC 2002a) has recommended incorporating 'Disaster Management' (including drought) in the Seventh Schedule of the Constitution and these recommendations are under consideration by the government. HPC (2002b) also submitted a draft "National Calamity Management Act" and "Model State Disaster Management Act" for their enactment. The suggested framework is comprehensive since it includes natural calamities (droughts, floods, cyclones, hurricanes, hail storms, hot or cold waves, cloud bursts, avalanches, mud flows, earthquakes, disease/pests outbreaks), and industrial, biological and nuclear disasters.

This paper has attempted to describe the monitoring, declaration and impact management procedures at the state and national level, identify shortcomings in the existing mechanisms and suggest certain innovative improvements. The analysis has used information on the recent severe drought of 2002, particularly of the frequently affected Rajasthan State as a case study to support recommendations made in this report.

Drought Monitoring and Declaration Procedures

Monitoring and declaration are important components of the environmental management and governance system in India (figure 1). Monitoring of drought is the responsibility of both the state and federal governments with frequent exchange of information. A monitoring process is observed during normal times, the calamity period and the post-drought phase, with greater intensity during actual drought occurrence. Post-assessments of the severe 1987 and 2002 droughts were published, the latter in four volumes by the Ministry of Agriculture, Government of India (Anon. 2004).

Figure 1. A schematic description of a drought management cycle in India.



Monitoring and Early Warning at Federal Level

The Indian Meteorology Department (IMD) carries out the drought monitoring and forecasting function in the federal government whilst being a member and partner in information sharing with many national and international organizations. Over the years, IMD has evolved methodologies and parametric models to forecast the probable arrival and intensity of southwest and northeast monsoons on a broad regional scale.

IMD prepares aridity maps on a weekly basis and has a continuing updating mechanism for sharpening and adjusting such forecasts. It also compiles weekly rainfall summaries giving figures of precipitation at the district level. IMD also determines the occurrence of meteorological droughts, i.e., rainfall deficit exceeding 19% of the mean, using data from 2,800 rain gauge stations distributed across 36 meteorological subdivisions of the country. Reports and data emanating from the IMD form the bedrock of an early warning system. Weather data are also collected at tehsil and district level by revenue departments in all states. The Department of Science and Technology in

collaboration with ICAR has set up 89 centers for short- and medium-range monitoring and forecasting of the weather (Rathore 2002). Several forecasting and predicting models are being updated to improve their reliability. Forecasts of pest outbreak, disease occurrences, etc., are also being considered to add value to the weather-monitoring service for timely deployment of pesticides, fungicides, spraying machinery, etc.

In order to internalize information, data and early warnings of the IMD into tangible practical action, an institutional interministerial mechanism of Crop Weather Watch Group (CWWG) has existed within the Federal Ministry of Agriculture since 1979, which is a nodal agency of India in all matters of drought. This Group meets every Monday during the rainy season (June to September) and the frequency of their meetings is increasing during drought occurrence. The composition of the group and its specific areas of responsibility are given in table 3.

Table 3. Composition and role of CWWG of the Ministry of Agriculture, Government of India.

Partners	Tasks
Additional Secretary, Ministry of Agriculture	Chairperson of the Group; promotes overall coordination
Economic & Statistical Adviser, MoA	Report behavior of agro-climatic and market indicators
India Meteorological Department	Rainfall forecast and progress of monsoonal conditions
Central Water Commission	Water-availability monitoring in major reservoirs
Plant Protection Division	Watch pests and diseases outbreak
Crop Specialists	Crop conditions and production
Agricultural input supply divisions	Supply and demand of agricultural inputs
Agricultural extension specialists	Report on field-level farm operations
Ministry of Power	Manage electrical power for groundwater extraction
Indian Council of Agricultural Research	Technical input and contingency planning
National Center for Medium Range Weather Forecast	Provide medium-term forecasts

This group evaluates information and data furnished by the IMD and other scientific and technical bodies with a view to determine the likely impacts of meteorological events and other environmental parameters on agriculture. The deliberations of the Group and exchange of information with a similar kind of group at state level serve as the *"triggering mechanism"* to activate drought-response systems. The monitoring and information-management system of the CWWG group is summarized in table 4.

Drought Declaration

Drought declaration is the primary responsibility of the states while the central government only aids or facilitates financial and institutional processes. Forecasting of arrival dates of monsoons and rainfall deviations with respect to normal by IMD and monitoring at state level initiate the process of drought declaration. States also monitor rainfall at mandal or tehsil level and gather information from remote-sensing agencies. The Karnataka State has a Drought Monitoring Centre, which monitors rainfall, water-reservoir levels and other relevant parameters on a daily basis in the rainy season. Abnormal deviations beyond definite limits are generally highlighted by mass/electronic media, political processes get activated and humanitarian considerations become

Table 4. Details of CWWG monitoring and information management.

Parameters	National-level agencies	State-level agencies	District-level agencies	Field-level agencies	Communication mode
A. Meteorological					
Delay in the onset ofmonsoon	W	W	D	D	Wireless/Fax/Telephone/e-mail
Dry spell during sowing	W	W	D	D	Wireless/Fax/Telephone/e-mail
Dry spells during critical crop-growth periods	W	W	D	D	Wireless/Fax/Telephone/e-mail
B. Hydrological					
Water availability inReservoirs	W	W	D	D	Wireless/Fax/Telephone/ e-mail/Written reports
Water availability in tanks/lakes	F	F	F	W	Written reports
Stream flow	F	F	F	W	Written reports
Groundwater level	S	S	S	S	Written reports
Soil moisture deficit	F	F	F	F	Written reports
C. Agricultural					
Delay in sowing	W	W	W	W	Wireless/Fax/Telephone/e-mail
Sown area	W	W	W	W	Wireless/Fax/Telephone/e-mail
Crop vigor	F	F	F	W	Written reports
Change in croppingpattern	W	W	W	W	Wireless/Fax/Telephone/e-mail
Supply and demand of agricultural inputs		W	W	W	W Wireless/Fax/Telephone/ NICNET

D = Daily; W= Weekly; F= Fortnightly; M= Monthly; S = Seasonal (Pre- and Post-rains)

uppermost. Meteorologically, ±19% deviation of rainfall from the long-term mean is considered normal in India. Rainfall deficiency in the range of 20 to 59% represents a "moderate" drought. Negative deviation of more than 60% represents a "severe" drought. During the 2002 drought, annual rainfall deficit was within normal limits, but failure of rains in July in 18 out of 26 states was absolutely unique. This triggered the mechanisms of multi-sectoral or interministerial CWWGs at the federal/state level with vigorous day-to-day consultation and monitoring.

States have set rules and guidelines of appraising agricultural losses for declaring hydrological drought as agricultural drought for the whole or part of a district/state. The system of estimating agricultural losses varies from state to state. An example—the *Annawari* procedure of estimating losses used in Gujarat—is prescribed in Gujarat Relief Manual under the Gujarat Land Revenues Rules. The procedure allows losses to be assessed in terms of scores (1 to 12 scores). The assessment is carried out for each village by the *Annawari* Committee, which includes a Chairperson (a Circle Inspector or Deputy *Mamlatdar* or Extension Officer or *Gram Sewak,*) and Members (*Talati, Sarpanch*, Chairperson of Cooperative Society and a farmers' representative). The committee estimates yield from three plots representing good, medium and poor crop conditions in a village, by actual harvesting. The *Annawari* score is calculated as

Annawari score = (12 * Observed yield) / (Standard yield of the village)

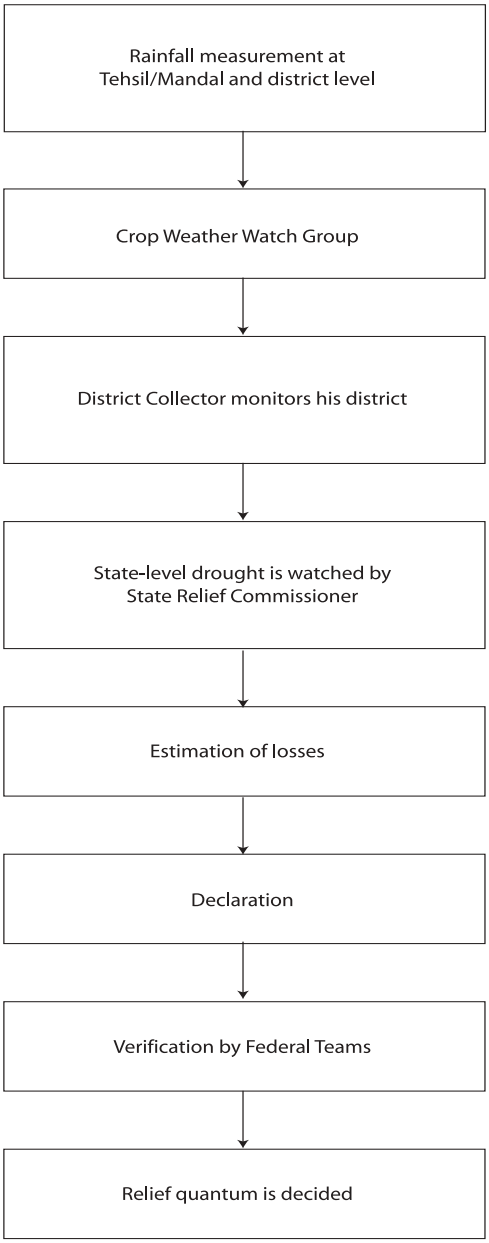
The score of less than 4 is considered to be the indication of a *severe drought*. *Moderate drought* is indicated by the score between 4 and 6 points. The estimated *Annawari* is published by the *Mamlatdar* and invites objections, if any, from the villagers within 15 days. After the objection period is over the *Mamlatdar* submits the report to the Subdivisional Magistrate, who sends the evaluation to the District Collector to finalize the decision.

In Maharashtra, a similar system is called the *Paisewari* system. It works on a scale of 1 to 100 scores, and if a village gets less than 50 scores, it is declared drought-affected. The State of Andhra Pradesh also supplements estimates of losses by remote sensing. In a predominantly rain-fed state like Chattisgarh, rainfall deficit itself is the criterion for declaring drought without actual estimation of agricultural losses.

Important phases of the declaration process are illustrated in figure 2. Once drought has been notified by the state, it is mandatory for the center to depute a team of experts to verify losses claimed by the state. The states also submit memoranda for financial assistance from the federal government, which are generally exaggerated and are invariably verified by the central teams later on. However, declaration by the states sets into motion several response mechanisms at various levels of management. Normally, such declaration is made by the states after assessing losses by crop-cutting experiments or satellite tracking. Multivariate crop production predicting models, based on climatic parameters, are also available in India and have been successfully validated.

However, the drought of 2002 was very different since crops could not be sown due to -51% rainfall deficiency in July, and the procedure of estimating losses by crop cutting was meaningless (Rathore 2002). The normal practice of the past was waived off and most of the states adopted the unusual approach of declaring drought on the basis of 'eye-estimation.' If the states are unable to manage drought out of the already parked CRF, they submit memorandum of additional assistance from NCCF, which is meant for 'severe drought' but recoverable from the states later on. Chronological details of declaring droughts and submission of memoranda by states along with visits of central teams during the severe drought of 2002 are described in annex 1. Some of the states went on updating the list of drought-affected districts according to the progress of rainfall. A few states submitted memoranda first and made declaration later on but additional assistance was generally released after all steps were followed.

Figure 2. A flow chart of drought declaration process in Indian states.



Monitoring and Management of Drought Impacts

Established Institutional Arrangements at Federal and State Levels

The federal government provides financial assistance regularly in accordance with relief norms laid down by the Finance Commissions. The Calamity Relief Fund (CRF) is released by the center to the states in two installments, one in May and the other in October every year.

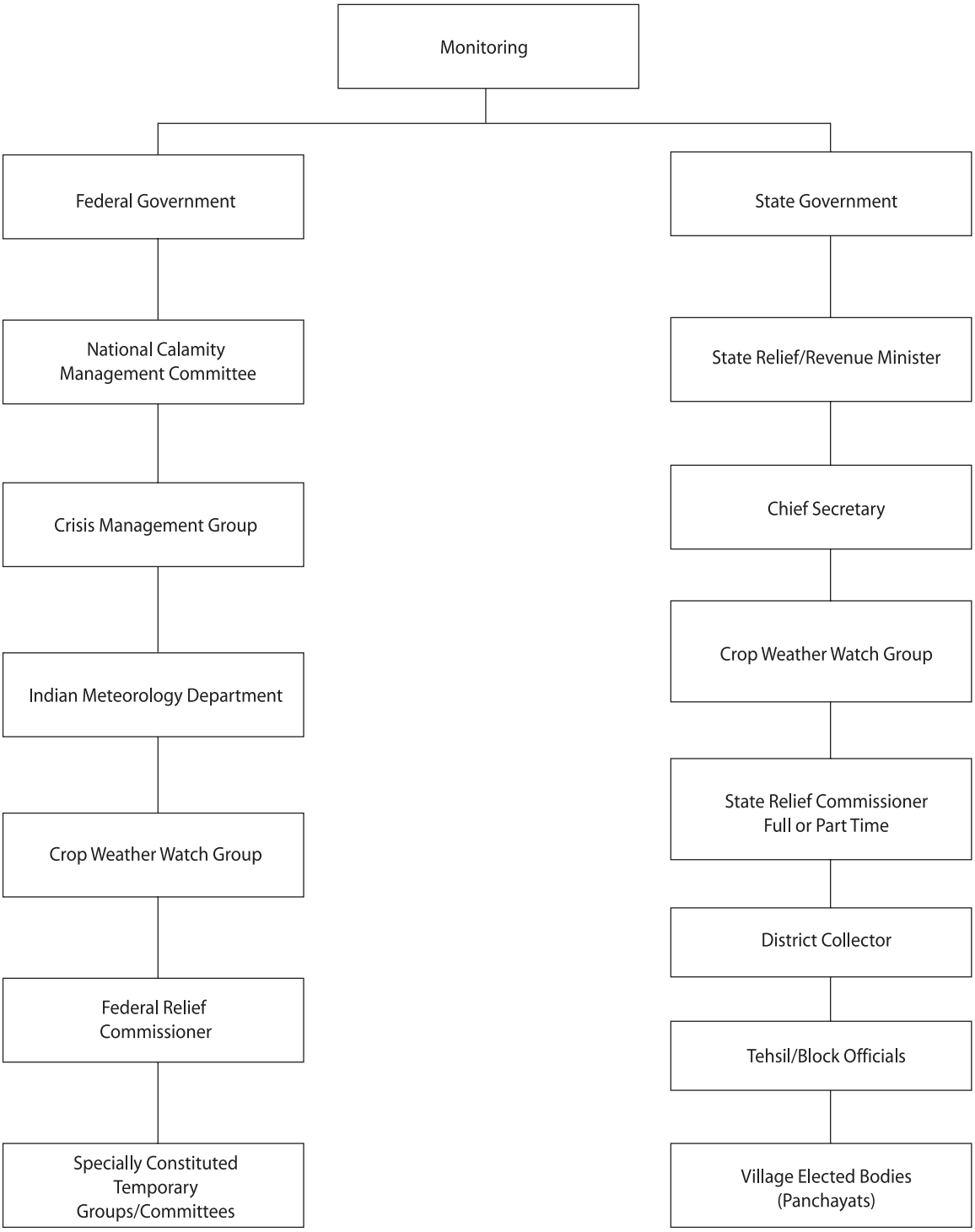
Institutionally, the primary responsibility of responding on behalf of the federal government rests with the Department of Agriculture and Co-operation in the Ministry of Agriculture. One of the Additional Secretaries in the Department is permanently designated as the "Relief Commissioner" to coordinate drought monitoring and management over the country. At one higher level, there is a "Crisis Management Group" (CMG) within the Ministry of Agriculture under the Chairmanship of the Drought Relief Commissioner with representatives of related ministries and organizations whose involvement is necessary. The group meets as often as required depending upon the contingency. It also takes stock of the situation as contained in the monitoring of relief operations as per parameters of annex 2.

Above the CMG is the National Calamity Management Committee, which operates in respect of all calamities (including drought) under the chairmanship of the Cabinet Secretary with the secretaries of the ministries and heads of agencies as members concerned with calamity-afflicted areas. An approximate flow chart of drought management in India is shown in figure 3. Normally, any major calamity-related issues require a decision of the Cabinet. However, during a major drought, more specific apex-level ad hoc fora, like task forces, are created to facilitate quick responses. Informally, the Prime Minister of India and even its President would enquire about the management of a severe drought.

Institutionally, either an independent relief minister or the revenue minister discharges additional responsibilities of the relief system. Most states have a dedicated Relief Commissioner heading the Relief Department while in a few states some officers are charged with the additional responsibility of the Relief Commissioner (figure 3). Irrespective of local variations, in the event of a major calamity, the overall coordination of monitoring and management is under the guidance of the Chief Secretary of the State.

At the district level, the Collector is in overall charge of all matters concerning monitoring, declaration and governance and is assisted by officials of revenue and other departments. In some states, officials of the Relief Department are posted at the district level and they work under the control of the District Collector. Relief is normally routed through the Revenue Department and arguments are being put forth to shift it to the Rural Development Department to enhance the preparedness, preventive measures and mitigation.

Figure 3. Components of drought monitoring and management in India.



Note: The federal and state governments have their own independent monitoring system and output is shared at Federal and State Relief Commissioner level.

Special Arrangements at the Federal Level during the Severe Drought of 2002

In the 2002 severe drought year, the onset, progress and intensity of the southwest monsoon were normal during the entire month of June. Some anomalies appeared in the first week of July and the monitoring mechanism was very quick in issuing a warning on July 16th. Following this alert, the Union Agriculture Minister convened a meeting of State Agricultural Ministers, Relief Commissioners, etc., on July 24 (within 8 days) and shared the broad strategy of managing the situation through a contingent planning and an initiation of relief process.

The triggering of an early warning on July 16 and the subsequent meeting of the Agriculture and Relief Ministers of the affected states on July 24 assessed that a large number of states were heading towards a drought of unprecedented severity since failure of rains in July was one of the rarest phenomena. Consequently, the following special mechanisms were put in place:

Task force. In order to enable adequate monitoring and quick response, the Prime Minister constituted a 'Task Force on Drought Management' under the chairpersonship of the Deputy Prime Minister. The other members of the Task Force were the Union Ministers of Agriculture, Finance, Food, Rural Development and the Deputy Chairperson, Planning Commission. The essential mandate of the Task Force was to take policy decisions for a quick response. The Task Force, in addition, also acted as the apex forum for reviewing the progress of relief operations. The NCMC occasionally deliberated on issues referred to it by the Task Force. Some of the important policy measures taken by the Task Force are quite indicative of the kind of monitoring and response system of the 2002 severe drought. They included, amongst others, advanced release of the second installment of the central share of the National Calamity Contingency Fund for affected states, requests to the state governments to draw up contingency plans for alternative crops, drinking water supply and provision of fodder, the issue of ICAR guidelines for short-duration drought-tolerant contingency crops, direction to railways to commence free transportation of water, fodder and cattle grade food grain to the affected states (particularly Rajasthan), the issue of guidelines to states to regulate outflow of water from major reservoirs and to conserve water, etc.

High-level committee. It consisted of the Deputy Prime Minister, the Finance and Agriculture Ministers and the Deputy Chairman, Planning Commission for sanctioning assistance from NCCF.

Special empowerment. In order to cut down delays, the Task Force was suitably empowered under Rule-12 of the Government of India (Transaction of Business) rules whereby, subject to the approval of the Prime Minster, its decisions were deemed to be the decisions of the Union Cabinet.

Grievances redress. The Task Force, particularly the Chairperson and the Union Agriculture Minister also provided an interactive forum for exchange of ideas and hearing of grievances of the affected states.

Special monitoring systems. In addition to permanent monitoring by the Union Ministry of Agriculture, some additional institutional mechanisms were established in various related ministries to cater to specific problems and needs of the state vis-à-vis drought management. Some of them are mentioned below:

- A Task Force on Water Management was constituted under the Chairpersonship of Secretary (Water Resources) for coordinating measures for water conservation.

- A system of periodic review of movement of food grains under the Chairpersonship of the Food Secretary with membership of Railways and Agriculture Ministry was set up.

- The practice of having area officers in the Department of Agriculture & Co-operation and the Department of Animal Husbandry & Dairying was activated for keeping constant vigil and liaison with drought-affected states.

- A number of centrally sponsored schemes like the Integrated Child Development Scheme and Accelerated Rural Water Supply Program and many others allowed part of their budget to be deployed for drought mitigation in the relevant sectors.

Progressive monitoring by the central government and corresponding responses are summarized in annex 3. Day-to-day monitoring and quick responses ensured the success in managing the drought of an unprecedented magnitude (annex 4).

Special Arrangements in Rajasthan during 2002–2003

The response system, which operated in Rajasthan during the recent drought, included several components.

Committee of directions (COD). At the apex level, a committee or the highest decision-making body for drought-related measures comprised the Chief Minister, nine cabinet ministers, Chief Secretary and the Relief Secretary. On average, the committee met twice a month during the 2002 drought to monitor the progress of relief.

Crop Weather Watch Group (CWWG). Rajasthan has a permanent setup of a CWWG under the chairpersonship of the Relief Secretary with membership of the Director, Agriculture, Director, IMD, Hydrologist of the Irrigation Department, and representatives of the Public Health Engineering Department & Groundwater Department. This group met every Monday during the monsoonal season and relayed an early warning of drought conditions periodically so as to ensure requisite response measures in advance.

Task forces. The following Task Forces were set up under the Chairpersonship of the officers mentioned below. They met twice a month in 2002 and monitored the progress in their respective responsibilities.

- The Chief Secretary: drinking water and relief work

- The Principal Secretary: fodder for livestock

- Additional Chief Secretary and Development Commissioner: nutrition and health

- Chief Managing Director, Rajasthan Electricity Distribution Board, Ltd.: energy

District and subdivisional relief committees. At the district level, there was a District Relief Committee chaired by the minister-in-charge of the district and co-chaired by the collector of the district and comprising both officials and nonofficials including local members of parliament, legislative assembly and representatives of the *Panchayati Raj* (elected representatives) institutions. Representatives of NGOs and social workers were also coopted as members on this committee. This committee sanctioned relief measures and closely monitored their implementation. There was also a committee comprising both officials and nonofficials at the block level steered by the Subdivisional Officer, followed by a Committee at the village *Panchayat* (elected body) level, chaired by the *Sarpanch* (Village Head of the *Panchayat)*.

Functional hierarchy. The functional/operational level hierarchy is Relief Commissioner, Divisional Commissioner/Collector of the district, Subdivisional Officer, *Tehsildar*, other revenue staff and other departments contributing on a need basis. The following special arrangements were also made in Rajasthan due to severity of the drought (2002):

- By a special order, the state government empowered the collectors to take disciplinary action or to impose penalty against offices of other departments for dereliction of duty regarding relief operations. Thus the entire district machinery was placed directly under the effective control of the collector during the relief operations.

- For each district, a Minister in-charge was appointed to direct, supervise, review relief activities and assist the district administration in problem-solving. The Minister-in-charge was also required to submit a report as per the prescribed checklist to the Chief Minister.

- The Rajasthan Government also appointed one Secretary to the state government in charge of a drought-affected district who was expected to visit the district under his charge once a fortnight, and submit a report in the prescribed format covering all aspects of drought monitoring.

- For each village, a village-level functionary was made responsible for drought-relief activities and reported to the block control room in case of any deficiency or difficulty in relief measures.

Control rooms. Control rooms managed by senior officials were set up at state, district and block levels, which continuously functioned during the drought period. Control rooms received periodical information on various relief activities from the field which was passed on to the concerned Task Force. The approach was to detect early signals of any emerging distress and initiate proactive action to avert any crisis.

The chronological sequence of events and actions taken in Rajasthan during the drought of 2002–2003 is given in annex 5. As a result of adequate monitoring and quick response there was hardly any starvation, death or abnormal out-migration of human beings and livestock. Distribution of relief material was equitable with a laudable human face, checks and balances. The Supreme Court of India intervened and ensured adequate financial support to the Rajasthan State from the federal government. Special arrangements were made for livestock, drinking water, child care, nutrition and women's health (annex 6).

Analysis and Discussion

India has institutionalized a system of drought monitoring, early warning, forecasting and impact analysis both at the federal and state level with frequent exchange of information between the two levels. Drought declaration is the responsibility of the individual states while the federal government only facilitates the process. Declaration procedures, institutions, codes, practices and manuals for drought management vary from state to state and they determine quickness of responses and efficiency of the mechanisms. Droughts are very frequent in Rajasthan and 2002 was the fifth drought year in succession in certain areas of the state. Drought management in Rajasthan was relatively better institutionalized and response was fairly quick and efficient as compared to other states. Special mechanism for distributing food grains (constituting 68% of the total relief) and cash disbursement prevented starvation deaths and out-migration of human beings and livestock by monitoring regular supply of essential goods. Transparency in operations, involvement of NGOs, voluntary organizations, *Panchayats* and people's participation in monitoring and governance removed many bottlenecks. The central government agreed to waive off the normal procedure of drought declaration in 2002 since crops could not be sown or failed after sowing due to severity of the drought. Greater use of information technologies, pressure groups and mass media immediately created public awareness. If we examine the monitoring and information system of table 4, chronology of responses at national level (annex 3) and in Rajasthan (annex 4), it becomes evident, that actions and decisions are taken almost on a daily basis. Relief activities were rather advanced by 6 months and provisions of the manual were bypassed. The management system was very objective and innovatively flexible. There were no drought-related starvation deaths. At the same time, there is scope for improvement on several accounts. A list of the shortcomings in the process is given below:

1. Till recently, drought monitoring and management were considered an ad hoc and empirical famine intervention for providing instant relief to prevent starvation and the same attitude is still prevalent in some of the states. The concept of an institutionalized process of monitoring, real-time communication, vulnerability mapping, prevention, mitigation and quick responses are regionally variable. The use of modern tools and procedures of monitoring, automatic triggering, impact analysis, documentation and capacity building are inadequate. Officials were drawn temporarily from different departments or sources when the calamity struck without preparedness and trained/responsive personnel in many cases. Codes and manuals of different states did not visualize several unprecedented manifestations of droughts. Many a time, there was a normal onset of rains, crops were sown and investments made by farmers, followed by sudden withdrawal resulting in drying up of water resources, withering of crops and natural vegetation. Sometimes, rains recovered in the latter part after a short spell of drought and damage was reduced. There was a third situation as in 2002 when the onset was delayed too much with scanty rainfall in July, crops could not be sown and the normal declaration procedure was modified. In a fourth situation rains came very late, the growing period was curtailed and appropriate resources for cultivating short-duration drought-tolerant varieties for contingency cropping were inadequate. Codes, manuals, and declaration and monitoring procedures did not account for the abovementioned contingencies and their permutation and combinations.

2. Crop-cutting surveys have been prescribed to estimate losses by the states for declaring drought. Naturally, the states have to wait till maturity of the crops, which delayed the responses. In 2002, crops could not be sown due to failure of onset of rains and surveys became redundant. States requested the center to waive off crop-cutting experiments that were replaced with "eye estimation," which also delayed responses and management interventions. Automatic triggering from the bottom upward was lacking.

3. Losses suffered by biodiversity, livestock fertility, orchards, perennial crops and plantations extend over years after the drought and are not adequately accounted for in the drought-declaration process. Sometimes, there could be permanent damage to heavy investments made in such enterprises of long-gestation periods. In 2002, higher drought compensation for perennial crops was quite innovative, which demands its institutionalization.

4. Livestock is an important livelihood source, especially in frequently drought-afflicted agro-ecologies like Rajasthan. The 2002 drought occurred in neighboring states also and they imposed a ban on interstate migration of animals, which restricted drought-escaping opportunities. Many states, excepting Punjab and Haryana, banned even the movement of fodder to other states. Resolving of such contingencies or conflicts should be part of good governance.

5. Monitoring of common property resources like fishery, forestry, groundwater and biodiversity is inadequately integrated into a drought-proofing process.

6. Distribution of food grains constituted 68% of the total relief in 2002 as compared to 5% during the severe 1987 drought. Transportation of a significant amount of grains by the railway and road network in a short period was a constraint for quick-relief response. Surprisingly, food grains are generally stored in food-surplus states, which would never require them. It is better to transport and store food grains and other nonfood grain commodities in vulnerable regions after harvesting during normal years.

7. Food grains were made available by the Department of Food to the Relief Commissioners of the state and transported by railways. Sometimes, the coordination of three agencies could not deliver grains within the stipulated 45 days in many cases. The recipient or consumers generally contested the quality of grains, which is a unique concern of the transparent-monitoring system.

8. Planting of trees, bushes and agro-forestry systems for robust livelihoods was not prioritized in the management process.

9. Drought-tolerant short-duration crops are planted occasionally during scarcity years only. Monitoring of seed availability, viability and periodic replacement are not in place.

10. There is a lot of politics in drought monitoring, estimation of losses and declaration, especially when different political parties are in power at the states and federal level. States generally inflate their claims by including infrastructural creation in their memoranda. A quick and transparent system of RS/GIS/GPS and modeling may be used in the management.

11. Irrigated areas in a drought year also suffer losses due to excessive consumption of energy, diesel and groundwater, which is not monitored properly and accounted for in estimation of losses.

12. The pre-monsoonal IMD predictions do not give a site- and time-specific forecast, which negates targeted preparedness.

13. Drought-preventive and -mitigation measures were taken up in India through the Drought-Prone Area Program since 1973–1974 and the Desert Development Program since 1977 with massive investments. Instead of the drought-relief expenditure falling down it has rather gone up over the years in India and globally. Effectiveness of mitigation approaches requires reassessment and refinement in the strategy.

14. Excessive depletion of groundwater resources during drought years and externalities of their recharging cost are inadequately analyzed.

Recommendations

1. The probabilities of drought occurrence in different states/districts in India may be calculated on the basis of climatic records, which have been available for a relatively long period. Maps/ methods of showing, in quantitative terms, the vulnerability of different regions to climatic droughts should be prepared for strategic drought management.

2. Prevention, mitigation, preparedness, institutional infrastructure, capacity building and logistic of relief material for a quick response should be planned and reserved according to the vulnerability level of the regions.

3. Traditional, time-consuming and restrictive revenue procedures of crop cutting for estimating losses may be replaced with remote sensing, GIS, modeling and real-time information-exchange systems. Normalized vegetation indices can be standardized during normal years for different periods of rainfall for deployment of remote sensing for quicker response.

4. Climate is a larger global system and driving forces originate somewhere else, especially in the oceans. Improvement in monitoring of space, ocean and land-based parameters for forecasting at the short-, medium- and long-term calls for greater international cooperation and partnership.

5. Decision support systems for estimating losses to crops, orchards, trees, grasslands, biodiversity, livestock, fisheries, groundwater resources, etc., may be calibrated for different vulnerable regions and livelihood opportunities.

6. Outsourcing of non-rainfall-dependent income from nonagricultural occupations (handicrafts, mining, etc.) in vulnerable areas is an indigenous coping strategy of Rajasthan and its monitoring for resilient drought proofing could be a sound strategy of mitigation.

7. There should be greater emphasis on monitoring and drought management during normal years than during the actual drought periods.

8. Banks for food, water, fodder, feed and seeds of short-duration drought-tolerant crops/varieties for contingence cropping may be set up in vulnerable areas.

9. Drought-mitigation strategies may be built upon the traditional systems of drought management/ coping mechanisms.

Lessons for Neighboring Countries

Ecological, cultural and socioeconomic conditions of India are similar to those of Pakistan, Afghanistan, other neighboring countries and Africa. Synergies' complementarities or multiplier effects of partnership can be internalized by the exchange of experience, information, data and satellite information. Important points of consideration are summarized to manage regionally shared calamities, which do not recognize international boundaries (droughts, floods, airborne/bird-carried diseases, etc.).

1. Modeling and probabilistic analyses of climatic data for refining vulnerability mapping, analysis of diseases/pest outbreaks, warning system and drought-declaration process of India are quite advanced and may be adapted to conditions of other countries of the region.

2. Replacement of traditional, time-consuming, biased and outdated methods of estimating agricultural losses of the Revenue Department with the parameterized, quick, unbiased and technology-driven procedures of remote sensing, GIS, GPS and modeling are quite relevent for the larger region.

3. The scope of drought monitoring and impact assessment needs to be expanded by including losses to livestock, orchards, trees, groundwater resources, biodiversity and secondary or tertiary-level economic activities.

4. Real-time exchange of information for harnessing a quick response by using space-borne dependable information and communication technologies is required.

5. A comprehensive, decentralized, institutionalized and participatory system of drought management needs to be established.

6. India has experienced many successes and failures of monitoring, preventive, anticipatory and drought-proofing technologies that may be shared with the neighbors.

7. Innovative and robust farming systems least-affected by climatic variations and rainfall-independent livelihood outsourcing can also be shared.

8. Budgetary provisions of CRF and NCCF and linking drought management with other development schemes of India are unique for adaptation to local policies of any country.

9. Partnership with charitable organizations, NGOs, voluntary organizations, etc., is quite effective during calamities and may be scaled up in the region.

ANNEXES

Annex 1

Chronological details of declaration of drought by the states and initial response of federal governments during the severe drought of 2002 due to failure of rains in July in India.

No.	Name of the state	No. of affected districts	Date of declaration	Date of memorandom received	Date of visit of the federal team
1.	Andhra Pradesh	22	01.08.2002 08.10.2002	26.08.2002	08–12.09.2002
2.	Chhattisgarh	16	27.07.2002	07.08.2002	12–14.09.2002
3.	Gujarat	14	24.10.2002	20.01.2003	16–18.09.2003
4.	Haryana	19	08.08.2002	06.09.2002	26–28.09.2002
5.	Himachal Pradesh	12	01.08.2002	19.08.2002	28.09.2002
6.	Jharkhand	22	07.08.2002	05.08.2002	18–20.09.2002
7.	Karnataka	24	18.07.2002 25.07.2002 01.08.2002 08.08.2002	26.07.2002	03–05.09.2002
8.	Kerala	11	19.08.2002 05.11.2002 06.11.2002	21.08.2002	08–12.12.2002
9.	Madhya Pradesh	33	12.08.2002 28.08.2002 25.11.2002	29.07.2002	02–05.09.2002
10.	Maharashtra	33	05.08.2002	06.08.2002	17–19.10.2002
11.	Orissa	30	10.08.2002	05.08.2002	16–19.09.2002
12.	Punjab	17	17.08.2002	19.09.2002	9–11.10.2002
13.	Rajasthan	32	29.07.2002	03.08.2002	1–4.09.2002
14.	Tamil Nadu	28	24.01.2003	06.08.2002	23–26.09.2002
15.	Uttaranchal	13	06.08.2002 07.08.2002 08.08.2002	05.08.2002	6–9.09.2002
16.	Uttar Pradesh	70	19,20,22,23, 24,25,27, 29,30,31 July 01,06,07,08 August	05.08.2002	04–07.09.2002
	Total	396			

Note: West Bengal declared 3 districts as drought-affected but no memorandum seeking central assistance was submitted by the state government.

Annex 2

Parameters monitored by the Crisis Management Group.

Monitoring parameter	National level	State level	District level	Field level	Communication mode
A. Crop security					
Demand and supply of agricultural inputs	W	W	W	W	Fax, wireless, telephone, e-mail
Emergency seed production program	F	F	F	F	Written reports
Water budgeting	F	F	F	F	Written reports
Demand and supply of power and diesel	W	W	W	D	Fax, wireless, energy, telephone, e-mail
B. Food security					
Distribution of food through PDS*	W	W	W	W	Written reports and mass media
Prices of essential commodities	W	W	W	W	Written reports and mass media
Number of relief works	F	W	D	D	Telegrams, fax, postal, e-mail
Number of people on relief works	F	W	D	D	By post, telegrams, fax,written reports
Rural employment program	F	W	W	W	Written reports
Wage levels	F	F	W	W	Written reports
Migration of people	F	F	W	W	Rapid assessment report
C. Nutrition security					
Number of Integrated Child Development Services Centers	W	W	W	W	Written reports
Number of people served by ICDS**	W	W	W	W	Written reports
Number of people on mid-day meal program	W	W	W	W	Written reports
Supplementary nutrition program	W	W	W	W	Written reports
D. Health					
Waterborne diseases	W	W	W	W	Written reports
Malnutrition	W	W	W	W	Written reports
Drinking water	W	W	W	W	Written reports
Drilling rigs movement	W	W	W	W	Written reports
E. Social security					
Old age pension	W	W	W	W	Written reports
Gratuitous relief	W	W	W	W	Written reports
F. Livestock security					
Fodder prices	W	W	W	W	Written reports
Fodder distribution through depot	W	W	W	W	Written reports

D – Daily; W – Weekly; F – Fortnightly.

*PDS = Public Distribution System; **ICDS = Integrated Child Development Services.

Annex 3

Monitoring and key responses to the severe drought of 2002 in India at the national level.

Dates	Weather behavior/event	Policy responses
July 15 2002	Rainfall activity in June was satisfactory. However, the vigor of the monsoon dissipated in the last week of June. The monsoon failed to advance and cover large parts of northwest India. Absence of low-pressure conditions in the first fortnight of July caused anxiety.	Crop Weather Watch Group provided information on weather behavior and its impact on agriculture to the Agriculture Secretary. The progress of agricultural operations was seriously affected. The situation was comparable to those of 1992 and 1995 when the monsoon was deficient till mid-July.
July 16 2002	DG, IMD indicated the formation of a low-pressure area and the possible resumption of monsoonal activity from July 19 onwards.	Agriculture Minister reviewed the situation with Secretary, Agriculture, DG, ICAR and DG, IMD and senior officers of the Ministry of Agriculture.
July 17 2002	25 out of 36 meteorological subdivisions received deficient rains.	Cabinet Secretary reviewed the situation.
July 19 2002	Scattered rains in Orissa and central parts of India. Previous week's low-pressure area over northwest; Bay of Bengal of Orissa coast moved inland and weakened over east Madhya Pradesh and the neighborhood. Thereafter, the seasonal trough shifted northwards close to the Himalayan foothills. The southwest monsoon advanced further as a weak current into the remaining parts of West U.P., and some more parts of Rajasthan, Haryana.	The monsoon was perceived to be comparable to that of the 1987 drought and an action plan was triggered accordingly.
July 20 2002	The rain-bearing system dissipated. Dry spells continued in northwest India.	Agriculture Minister fixed the meeting with Agriculture Ministers of 12 states on 24.07.2000.
July 24 2002	Conference of agriculture ministers of states and federal government.	Reviewed the drought and announced policy intervention.
July 27 2002	Dry spell continued in northwest and central and most parts of peninsular India. 75% of the districts received deficient or scanty rainfall.	A National Task Force for Drought under the chairmanship of Deputy Prime Minister constituted to lay down policies and issue guidelines.
August 05–11 2002	Monsoonal trough was at the normal position. Model predicted its continuation for the following 5 days.	The central government released the first installment of calamity relief funds to affected states amounting to INR 5,510.4 million (US$122.5 million) in August.
August 12–19 2002	Monsoonal activity picked up. It rained in Maharashtra, Gujarat and parts of peninsular India. Orissa, central India and Bihar experienced floods. Northwest India continued to be under long dry spells.	The state governments submitted a memorandum seeking central assistance under the Calamity Relief Fund.

August 20–27 2002	Vigorous rainfall activity all over India except in west Rajasthan.	
Sept. 01–15 2002	Rainfall continued except in west Rajasthan.	Central teams constituted to assess drought impacts of 2002.
Sept. 16–30 2002	The monsoon withdrew in most parts of central and northwest India. Peninsular and eastern India continued to receive rains.	Central team visited affected states to make on-the-spot assessment of losses.
Oct. 01–31 2002	Northeast monsoon was normal in Kerala, Tamil Nadu and parts of Andhra Pradesh.	Central teams submitted the report.
Nov. 01–30 2002	Northeast monsoon continued and, except in a few districts, rainfall during this period was normal.	The National Task Force considered the report of the central team and decided to release central assistance. State governments alleged inadequate central assistance.
Dec. 01–31 2002	Winter-season rainfall was satisfactory in many states.	Due to recovery of rainfall beyond July, most of the drought-affected areas were free from droughts. Rajasthan, south interior Karnataka, Rayalseema of Andhra Pradesh and Tamil Nadu continued to experience droughts.
Jan. 01–31 2003	Winter-season rainfall was deficient.	The Central Government deputed central teams to assess the drought situation in the context of winter (rabi season).
Feb. 01–28 2003	A severe cold wave was experienced in north India, which damaged young orchards, sensitive crops and the freshwater inland fishery.	The Central team submitted report to the National Task Force. The team recommended central assistance to Rajasthan only.
March 01–31 2003	Additional relief.	The National Task Force approved special assistance to Rajasthan.
April 01–30 2003	Rajasthan High Court on a Special Leave Petition ordered fresh survey by a team with membership from independent experts.	Central Government honored directive of the High Court of Rajasthan.
May 01–31 2003	The central team visited Rajasthan and submitted report to National Task Force.	Special assistance to Rajasthan was approved.
June 01 2003 and after	India expected normal monsoon.	

Annex 4

Nation-wide statistics of the 2002 drought impacts in India.

1. Water storage in 70 major reservoirs was 33% less than the average of previous 10 years.

2. An area of 21.53 million hectares was not sown and 47 million hectares of sown crops were damaged by drought with a shortfall of 29 million tons of food grain production.

3. Around 150 million cattle were affected due to lack of fodder and water. Milk procurement declined by 22% in Rajasthan, by 8% in Madhya Pradesh and by 7% in Tamil Nadu.

4. A population of over 300 million in 180 million hectares (56% of total geographical area) was affected.

5. There was a loss of 1,250 million person-days of employment.

6. Agricultural GDP was reduced by 3.1% due to agricultural income loss of INR390 billion (US$8.7 billion).

7. Irrigation cost of tube wells increased by INR2,000 (US$44.4) per hectare in Punjab state.

8. The federal government provided a total relief of INR200 billion (US$4.4 billion).

9. The groundwater table in drought-affected areas declined by 2 to 4 meters below the normal levels.

10. About 1.5 billion liters of drinking water per day were transported by tankers and railways during the drought period.

Annex 5

Chronological sequence of events and responses of the Rajasthan State during the 2002 drought.

2nd Week of July

- The District Collectors were directed to assess the situation and send report to the Relief Department on the crop condition and other losses/damages.
- The Agriculture Department was also called upon to implement a Crop Contingency Plan in view of the delayed monsoon.

3rd Week of July

- The District Collectors were asked to report on the impact of the dry spell on agriculture.

4th Week of July

- The Collectors reported emerging distress conditions to the state government.

Last Week of July

- All 32 districts of Rajasthan were notified as drought-affected on 29 July 2003.
- Recovery of land revenue was suspended and the process of conversion of short-term crop loans to the medium term was initiated.
- The Chief Minister (CM) requested the Government of India to allocate food grains for employment generation through the 'Food for Work' program and provide support for procurement and transportation of fodder and water.

1st Week of August

- A COD headed by the Chief Minister was set up.
- Five Task Forces on Relief Works, Drinking Water, Health and Nutrition, Fodder and Energy were set up.
- A Minister-in-charge for each district for drought-relief activities appointed.
- Officers of the level of Secretary to the Government appointed officer-in-charge for each district.
- State-level 'Drought Action Plan' prepared by the Relief Department.

- The CM along with the Leader of Opposition in Lok Sabha met the Prime Minister (PM), discussed the drought situation and requested for central assistance.

- The state government submitted a memorandum of INR61.2 billion (US$1.36 billion) including 5.6 million metric tons of food grains to the Government of India on 03.08.2003 for assistance under National Calamity Contingency Fund.

2nd Week of August

- The state government issued detailed guidelines to the collectors about relief works, fodder transportation, cattle camps (*gaushalas*), transportation of water and gratuitous relief.

- The CM reviewed the situation with the ministers-in-charge and secretaries- in-charge of each district.

- COD met to discuss the management strategy.

- Meeting of the Divisional Commissioners and District Collectors held on 14.08.2002 to discuss the situation and the immediate needs.

3rd Week of August

- The Drought Code envisaged relief activities in February 2003 which were advanced by 6 months due to severity of the calamity.

4th Week of August

- Assessment of crop damages completed one month ahead of scheduled date by collectors.

- Revolving funds made available to each collector for emergency supply of water, medicines and self-employment.

- Relief Minister and Finance Minister of State met Union Finance Minister for allocation of food grains.

1st Week of September

- Central Study Team visited the state for verification of damage assessment.

- The CM, Rajasthan met the Deputy Prime Minister, Food Minister, Rural Development Minister, Government of India and the Vice President of India for central assistance.

2nd Week of September

- Relief Minister and Finance Minister met the Deputy Prime Minister for central assistance.

3rd Week of September

- The Task Force under the Deputy Prime Minister considered report of the Central Study Team but did not allocate additional funds. CM wrote to the PM and others for release of more assistance.

- CM held an all-party meeting and meeting of the MPs of all the parties at Jaipur and argued for additional assistance.

4th Week of September

- Anticipating the uncertainty of central assistance and the challenges of meeting the grave situation, the COD took the following decisions on 23.09.2002:

- Laborers will be deployed on relief work on 10-day rotations.

- Construction of houses, *tankas* (storage tanks), wells, etc., by individual beneficiaries by providing 75% of wage in food grains by the government and the remaining expenditure to be borne by the individual beneficiaries.

- Installing of tube wells on priority for watering cattle.

1st & 2nd Weeks of October

- The CM met the President of India and apprised him of the prevailing drought situation.

- A special relief package was declared for 74 severely drought-affected blocks of Rajasthan.

November 2002

- Relief activities scaled up to the employment of 1.11 million laborers, 3,074 fodder depots, and drinking water supply to 2,380 villages and gratuitous relief to 222,703 persons.

- The CM met the PM, Union Finance Minister and the Vice President of India for central assistance.

December 2002

- The President of India undertook a 2-day visit to drought-affected areas of Udaipur, Barmer and Jaisalmer districts and relief activities were scaled up.

January 2003

- The Federal Team visited Rajasthan again and reassessed the requirement from March to June, 2003.

February to March 2003

- The Government of India allocated 2.1 million tons of food grains under SGRY up to July 2003 and INR 6,200 million (US$138.2 million) assistance from NCCF. The State of Rajasthan considered the relief inadequate and took up the matter with the Central Government.

- The PM had a meeting with the CM and MPs of the State in Delhi to discuss the issues relating to drought.

April 2003

- The Rajasthan High Court issued an order to the Central Government to constitute a composite team for reassessing needs of assistance to drought-hit people.

- On the recommendation of the Composite Team, the Government of India sanctioned an additional assistance of INR1,000 million (US$22.2 million) and 0.2 million metric tons of food grains.

May 2003

- The employment program expanded progressively to engage 3.57 million laborers per month.

June to 15th July 2003

- The employment program further expanded to engage 3.8 million laborers during June, 2003.

- The next rainy season was set in time.

Annex 6

Statistics of the 2002 drought impacts and responses in the State of Rajasthan

Cropping. Against 13 million hectares in normal years only a 6.9 million hectare (47%) area was sown in the rainy season of 2002 and that too withered later on. During the winter season of 2002, compared to the normally sown area of 7 million hectares, only 3 million hectares (43%) were sown due to lesser availability of soil moisture and irrigation water. Contingency cropping was more effective for winter season crops since the sufficient response period was not available during the rainy season (*kharif*). The water table declined by 4 m in many groundwater-irrigated regions.

Agricultural support. A range of contingency measures were provided, including crop loans to farmers amounting to US$243 million, long-term loans amounting US$12.4 million to diversify agricultural activities, issue of credit cards to 1.69 million farmers, conversion of short-term crop loans (about US$170 million) into medium-term loans as a relief measure in drought-affected villages, distribution of 0.204 million metric tons of certified seeds to farmers for contingency cropping of short-duration-tolerant varieties.

Energy support. Supply of diesel was maintained and farmers were provided electricity for 6 to 8 hours a day to save the standing crops even by purchasing power at a higher cost from the neighboring states.

Market support. Pledged loan scheme for providing 75% loan to the pledged agriculture produce to agricultural markets was introduced.

Physical infrastructure. From July 2002 to June 2003, 240,703 hand pumps were repaired. Also, 22,258 new hand pumps were installed, 2,250 new tube wells commissioned and 24,895 traditional sources of water revived.

Transportation of water. To transport water to 10,530 settlements and 74 towns, 27,000 water tankers were engaged. Altogether, 2.8 billion liters of water were transported to 11 towns and 128 villages through 102,009 railway wagons.

Social impact. The sick, destitute and infirm persons were provided gratuitous relief at the rate of 50 kilograms of food grains and cash of INR50 (about US$1) per month. And a 434.4 million person-day employment was generated with peak time labor engagement of 7.5 million per month. Besides, 48.9 million person-days were generated under the Comprehensive Rural Employment scheme. Food was provided to 44.8 million of the vulnerable population through the Food for Work and Public Distribution Schemes.

Livestock. In Rajasthan, 45.2 million cattle were affected by the 2002 drought and a deficiency of about 6 million metric tons of fodder was established. 5,582 fodder depots distributed 2 million metric tons of fodder at subsidized rates and cooperative banks distributed loans of about US$222.2 million to farmers for purchase of fodder. Free veterinary care was provided by the Department of Animal Husbandry in these camps. Owners of 0.7 million cattle were provided feed subsidy at INR5 per head per day, etc. As a result of the above measures, the cattle mortality remained within the normal limit of 12–14%.

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