



Government of India

Ministry of Agriculture

Department of Agriculture & Cooperation

(Drought Management Division)

**Report of the Workshop on
Setting up a “Mechanism for Continuous and
Integrated Drought management”**

21st September 2007, Friday

NASC, PUSA, NEW DELHI

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Report of the Workshop on Drought Management

1 Background

- 1.1 Drought, which is a slow developing natural disaster, has grave socio-economic impacts. Incidence of drought or deficit seasonal annual rainfall is part of the fluctuating climatic regime globally and particularly in monsoon season as the bulk of the annual rainfall occurs in the span of the summer monsoon season varying from 2 to 4 months.
- 1.2 India has witnessed drought in its rainy season from time immemorial and from the ancient period, policy was always in place to mitigate the adverse impacts of drought on availability of food. Even the local community and individual family mechanisms had traditionally evolved to support a community or a family from the misery of a drought situation. It was in the 19th century in the British period, when the incidence of regional / all India droughts increased in which socio – political conditions might have also contributed, that the British Government, with the recommendations of the three Famine Commissions during 1880-1901, put in place a policy to combat famine or scarcity conditions. The Government took upon itself the responsibility to save lives and reduce starvation deaths by offering gratuitous relief and providing short term employment on public works as far as possible near the habitat of the affected population. By the beginning of the 20th century, Famine Code was in place and efforts were made to undertake major irrigation works as well as use rail transportation on large scale to move food from surplus areas to scarcity areas. The mitigation efforts undertaken by the Government also began to be documented but the approach was mainly relief oriented. This policy also made the traditional community-based and family-based

resilient actions weak and the distressed population tended to depend more on gratuitous relief.

- 1.3 In the Post-Independent India period since 1947, the Government policy to tackle drought has considerably modified and it now rests upon Early Warning Preparedness, Crisis Management (Response), Mitigation and Long-term Drought Management measures in which inputs of science and technology play significant role. A number of long-term and short-term programmes for the rural India have evolved - some of them are the Drought Prone Areas Programme (DPAP), Desert Development Programme (DDP), Accelerated Rural Water Supply Programme (ARWSP), Pradhan Mantri Gramodaya Yojana (PMGY), Food for Work Programme (FWP), National Watershed Development Programme (NWDP), Rural Employment Guarantee Programme (REGP), Integrated Wasteland Development Programme (IWDP), Swarna-Jayanthi Grameen Rozgar Yojana (SGRY), Swarna-jayanthi Grameen Swarozgar Yojana (SGSY), Tube Wells, Food & Fodder Development Programmes etc. under different Ministries/Departments of the Central Government and the State Governments. Besides, banking and Cooperative Credit Societies sectors also provide help for making available financial credit to the farmers on easy terms. At the Ministry of Agriculture level, Crop Weather Watch Group at Central, State and even district-level functions which bring in data from monitoring mechanisms for rainfall, water resources, crop - growth etc. to provide weekly status. Decentralization of drought management and policy initiative by thinking in terms of micro level management is the new paradigm for effective drought management which is likely to benefit the distressed population. The worst effect of drought situation is

experienced at the local level and hence good governance demands that micro level management should be built within Drought Management Policy. In spite of all these mechanism and the lessons learnt from the post independent severe droughts of 1972, 1987 and 2002, the Indian agriculture and the economy has still not come out of the drought shocks. The GDP in a severe drought can go down by 2 percent, agricultural productions down by 2 percent, agricultural GDP down by 3 to 10 percent and they all in turn impact on other sectors like power generation, employment etc. which results in inflationary pressure. There is a need to critically assess our performance, particularly with regard to inputs of Science and Technology Organizations to Drought Management and formulate mechanism for keeping in place a Continuous and Integrated Drought Management Plan. In this context, the Second Administrative Reforms Commission in its 3rd Report on "Crisis Management" has recommended for setting up of a separate mechanism in the form of National Institute of Drought Management for enhancing drought monitoring, drought management and well focused research and development efforts for continuous and integrated drought management. Drought profile varies from year to year. Some droughts onset in early season (beginning of July) and others are felt in mid-season after sowing is complete (end of July to mid- August). The late drought begins in mid-August and lasts till September. Each type of drought has different implications on macro (India) and micro (district) levels and such impacts have not been fully investigated.

- 1.4 Since 1950, the definition of drought followed is based on percentage departure of rainfall from annual or seasonal rainfall without considering the natural variation of regional

rainfall. This needs change as not only water requirement for agriculture should be taken into account, but also the natural endowment of rainfall and its variability must also be given due weightage.

2 Workshop administration

- 2.1 As drought and its mitigation and management aspects come under the purview of Ministry of Agriculture, it was decided to organize a one day workshop on 21st September 2007 at NASC Pusa New Delhi, to discuss the setting up of a mechanism for continuous and integrated drought management. All major organizations dealing with Agriculture, Meteorology, Water Resources (including ground water resource), remote sensing as well as research institutes dealing with drought related studies were invited. Representative of International organizations like FAO, ADPC and some drought-prone State Governments were also invited. Out of 34 organizations invited, all except 4 viz., UNDP, Orissa Govt., Ministry of Home Affairs and D/o Women & Child Development participated in the workshop.
- 2.2 A background note detailing the objectives of the workshop was circulated to all the invitees.
- 2.3 The workshop was divided into three broad themes of drought management viz., (1) Policy Imperatives (2) Holistic Science and Technology inputs and (3) Integrating Social Perspectives. Distinguished Scientists, international and national experts on drought management, senior officers of the central and the State Governments participated in the workshop and gave their presentation/views in the Workshop. The list of participants is given at Annexure I. Detailed Agenda and schedule of the workshop is given in Annexure II of this report.

3 Sessional Proceedings

3.1 Policy Imperatives

3.1.1 Shri Mukesh Khullar, Joint Secretary (Drought Management), Department of Agriculture & Cooperation) welcomed the participants of the Workshop. He also appreciated the best efforts put up by the officers and staff of Drought Management Division in organizing the Workshop. In his welcome note he gave a brief background and structure of the Workshop. The necessity for establishment of a National level Drought Management Centre, which would encompass all aspects of drought management viz., prevention, preparedness, mitigation, monitoring etc., was highlighted by him. He emphasized the need for horizontal and vertical integration of various aspects of drought management across various levels of government by establishing mutually benefiting linkages of science, communities and administration. He also pointed out that the proposed Drought Centre would be a think tank on all aspects of drought and would act as a facilitative conduit for cross organizational working. A purely autonomous body under the Ministry of Agriculture, it would be a non-intrusive integrator that adds value to the outputs of the various stakeholders through a format in which outputs of the other stakeholders could enrich the service delivery to the communities, and evolve better designs of program and their implementation in order to strengthen various coping mechanisms practiced by the communities. The monitoring mechanism in the proposed centre would assess severity of drought, establish trigger points for related interventions and assess impact of conditions on communities through monitoring health, nutrition and livelihood profiles.

3.1.2 A presentation by Shri A.R. Subbiah, Director (Climate Resource Management), Asian Disaster Preparedness Centre (ADPC), Bangkok was made on climate information application for drought mitigation in Asia Specific Region. He gave a brief outlook of the experiences of ADPC in connecting science and society in Asia. He also depicted a few slides about the relevance of ADPC experience for drought management in India. A pictorial presentation of occurrence of drought / famine by countries between 1974- 2003 gave a view that the Asia Pacific region is most vulnerable to drought/famine, and 74% of population in Asia is affected by drought in comparison to other continents in the World. The graphical presentation of monsoon inter-seasonal variability in India between 1871-2002 indicated that the rainfall was below normal due to the impact of El Nino factor in 23 out of 27 times. He emphasized the need for Science based information that is understandable and usable by all users, policy and decision makers, and local institutions and at risk Communities. The projects undertaken by ADPC in Indonesia and Philippines, and in some other countries in Asia-Pacific, with the help of USAID, Governments and donor organizations, and their success were also highlighted. He added that the ADPC could:

- Facilitate development and application of tailor-made user friendly drought risk information by connecting science and society
- Facilitate development of end-to-end institutional system through pilot experiments
- Facilitate share of best practices-Global, Regional, National and Local stakeholders.

3.1.3 In his address to the participants Dr. P.K. Mishra, Secretary, Department of Agriculture and Cooperation set up the tone for the issues to be discussed in the Workshop. He mentioned that it was a new initiative although drought management was a century old issue in the country. Appreciating the need emphasized by Prof. V.K. Sharma, IIPA in having an institutional mechanism for holistic and integrated approach to drought management, he pointed out the recommendation of 2nd Administrative Reforms Commission for setting up of a National Institute of Drought Management. While listing the existing relief mechanism like CRF, NCCF and long-term existing measures like DPAP, DDP and IWDP, he mentioned that the droughts still occur year after year. He highlighted two points - one about the impact of long term programmes like DPAP etc. and the other about the objective drought monitoring. Citing his own experience in Gujarat, he pointed out that we realize the drought only after its onset by when the impact has already penetrated. The delay in anticipating drought in advance was mentioned and the extremely important need for monitoring drought in this context was stressed. He advocated for the probable use of science and technology in forecasting and collection of data on real time basis. He stated that the traditional coping mechanisms are much more realistic and suitable to the local situation, even as these are gradually disappearing. He advised the participants to look into the issues like advance identification of the occurrence of drought, traditional coping mechanism and the response to drought and real time monitoring of drought, which are required to be addressed. Citing the Nobel laureate Dr. Amartya Sen, he said that the impact of the Bengal famine in the late 19th Century was furious not because of the non-availability of food but due to lack of

entitlement to food or lack of purchasing power of the affected people. This social aspect is the important point in policy formulation for conditions like drought. About the possible organizational structure he suggested to explore various possibilities and also take into consideration the need for addressing social aspects of drought, integration of available knowledge institutes to have a realistic approach for developing and designing policy that would respond to the situation, more consistently and effectively. He requested the participants to make the workshop extremely useful and meaningful, not limited to the academic analysis. He also sought the guidance from the workshop in preparing a road-map for creating a new institutional structure for drought monitoring and management in the country.

3.1.4 Dr. Mohan Kanda, Member, National Disaster Management Authority (NDMA), the Chief Guest gave his Address with anecdotes on the issue of managing a disaster. Having vast experience in the field of management and his long association with rural affairs, he flagged various points that are required to be kept in mind before formulation of a new set up for drought management. He emphasized the need for achieving the objective of three complicated words continuous, integrated and management through a fine chemistry which could work in such a way that we reach our milestone easily. Some of his observations are:

- While setting up a new organization we would face teething problems, not unexpected, not unusual, but to be faced and dealt with;
- Understand the difference between catastrophe and calamity. The mishandling of calamity could lead to catastrophe.

- Efficient management of drought is the major issue that faces politics, and it is good that it is at centre stage of discussion.
- Management is precisely what response is not. Management is basically a pre-event activity which focuses on how to anticipate, prepare and act. Whereas the response is a post-event act.
- Work like a Team and not as a Group. In group a well rehearsed or well prepared kind of action is not very often in evidence.
- It has to be seen how the word integrated gets translated in this context into action, in the kind of chemistry proposed for the future. The scientific and technical products of IMD have to be mixed up with the product matrix of agriculture for having a desired product of monitoring and forecast, i.e. the right use of agrometeorology with ICT tools.
- While saying continuous, we should understand the difference between the discrete and continuous. Thus, the issue of monitoring is not so simple. We must obviously have to know as to what to see, where, and at which time; and what is good and what is bad.
- Understand the crisis of managing food grain shortage, onion shortage, and the import of wheat etc and difficulty of coordination between Department of Agriculture & Cooperation and Department of Food and Public Distribution. The issue is whether drought is a consumer problem or a farmer problem; whether it is a production problem or an income problem. Availability is one thing and the accessibility is another thing.

- It has to be sincerely accepted and seen whether the scientific institutions and the long-term programmes have been able to achieve their desired results.
- Let our long and short term programmes be demand driven.
- The important thing is that for an organizational mechanism, defining the destination should be the first objective. In defining destination do not say that every time, one has to take a specified approach but look at some fresh point at matrices.
- Also, do not go into the details of compartmental operational destination issues, administrative issues, legal issues, financial issues etc. Define the goal.
- Don't get into the business of norms and components, as the guidelines won't work because everyone would follow it as a holy book. Let us do whatever is required to be done.
- Once we are able to define our destination, then break it into parts and finally choose from it the number of things that appear having some priority, vital, essential and desirable.
- Let us do with something which is doable, which gives you encouragement and satisfaction in the short run.

3.1.5 Shri Naved Masood, Principal Secretary, Government of Manipur, who was earlier Joint Secretary (Drought Management) in the Department of Agriculture & Cooperation, gave his wrap up message. He spelt out the success of the Department of Agriculture & cooperation in handling the acute drought in 2002. He mentioned that we have to work out ways and means of looking at the long-term interventions while planning short term relief measures. Declaration of

Drought is another issue. We have to differentiate between the ordinary and the extra-ordinary drought, because not having a clear definition for drought of acute, very acute and ordinary case, may cause serious management problems. He advocated that there should be a definite role for NDMA/ other agencies in relation to declaration of drought. He emphasized the need for involvement of local people and universities necessary for integration of drought related information. He wished the participants to suggest how long-term interventions with better management could work in an enabling mechanism that is proposed to be set up.

3.1.6 The inaugural session on policy imperatives gave an inference that it was the right time to evolve a comprehensive drought management policy that dovetails short term measures into long term ones, has a sound objective drought forecasting, declaration and mitigation mechanism for actively involving the affected communities and recognizing their traditional coping measures. The policy should be regularly monitored for needed improvements through inputs from holistic studies undertaken on all aspects of drought management. From the policy imperatives perspective to guide the formulation of such a comprehensive policy that is continuously to be monitored for improvements, it is necessary to create an independent organization that gives an exclusive attention to the drought management and facilitates collaborative working of different organizations so as to get the needed information at one point for a holistic analysis.

3.2 Holistic Science & Technology inputs

3.2.1 The second session was on “Holistic Science & Technology inputs for objective Drought Monitoring” which was chaired by distinguished Scientist from ICAR, Dr. Nawab Ali, Deputy Director General (NRM & IC). He shared his experience and knowledge with the participants while moderating the presentations from different organizations. *Indian Meteorological Department on forecasting droughts*

3.2.2 Dr. Jayanta Sarkar, Director from IMD Pune gave a detailed presentation on the subject - better forecasting is the key for the objective drought monitoring. He gave details of classification of droughts and the role of IMD in drought monitoring. He further stated that IMD has been delineating sub-division wise drought since 1875. He said that in our country, a year is considered to be a DROUGHT YEAR in case the area affected by moderate and severe drought, either individually or together, is 20-40% of the total area of the country and seasonal rainfall deficiency during southwest monsoon season for the country as a whole is atleast 10% or more. As per IMD Technical Circular No. 2/2007, when the spatial coverage of drought is more than 40% it will be called as ALL INDIA SEVERE DROUGHT YEAR. He further mentioned that the DROUGHT EARLY WARNING SYSTEM IN INDIA could also include early information on monsoon break situations of the duration of more than 2 weeks causing plant water stress leading to low productivity of crops, besides long range forecasting of monsoon rainfall. IMD is having future plan of presenting drought information in Agro Advisory Service (AAS) Bulletins with a goal to enable and persuade farmers and other concerned organizations to take action to maximize

the probability of successful production in agriculture, forestry and fisheries and/or minimize the potential damage to established crops, forests and other assets. The ultimate objective is to enable governments and organizations to develop a pro-active response to droughts. According to the IMD the COMPONENTS OF DROUGHT INFORMATION for a comprehensive picture of droughts in a given region are timing of drought, drought intensity, drought duration, spatial extent of a specific drought episode, risk analysis of the phenomenon and its likely impact on agricultural production.

3.2.2 As the drought information is primarily meant to assist the farming community in making operational decisions regarding managing their farming systems, it is important to provide a short analysis of the risk of an ongoing drought phenomenon and how it is likely to impact agricultural activities. Close interaction with the extension agencies active in a region could be helpful in this regard. Planning agencies also should be informed about the important aspects of ongoing droughts and their likely impacts to assist them in making appropriate adjustments in their regional/national plans.

3.2.3 He asserted that it is possible to provide drought information that enables action to maximize the probability of successful crop production and minimize the potential damage to established crops and other assets. To this end, information should be provided on the timing, intensity and duration and the spatial extent of droughts. An equally important element of drought early warning systems is the timely and effective delivery of this information to decision makers. To provide effective drought information there should be improved

collaboration among scientists and managers to enhance the effectiveness of observation networks, drought monitoring, prediction, information delivery and applied research. Such collaboration could help foster public understanding of and preparedness for drought.

Central Arid Zone Research Institute on use of drought indices

3.2.4 Dr. K.P.R. Vittal, Director, Central Arid Zone Research Institute (CAZRI), Jodhpur gave his presentation on Indicators of drought monitoring. He gave the details of Physical, Biological and Social Indicators of drought and occurrence of drought in dry lands / arid zone. He gave the merits and demerits of different set of indicators.

3.2.5 The Meteorological drought indices are:-Deciles of Precipitation (DI) a simple method of calculation with precipitation data but too simplistic to inform about gravity of the problem in different sectors. Precipitation Departure from Normal simplicity makes this index popular in India, but the average precipitation is not always the same as median precipitation. Also distribution or time-scale of rainfall is not specified. Palmer Drought Severity Index (PDSI) quantifies abnormality of weather in a region, including historical past and well used for spatio-temporal variability of drought, but the index values did not often match the situation in India. Standardized Precipitation Index (SPI) has advantage of computing for different time scales, providing early warning of drought in helping to assess drought severity and fewer complexes than PDSI. But it has the disadvantage of groundwater, stream flow and reservoir storage reflects on long-term precipitation anomalies. So, SPI is calculated for 3, 6, 12, 24 and 48 month time scales.

- 3.2.6 The Hydrological drought indices are:- Groundwater and Reservoir Level - Standardized water level Index (SWI) which is computed for different time scales can provide early warning of water shortage and can help in assessing hydrological drought severity. Surface Water Supply Index (SWSI) designed for river basins with a component of mountain snow input. It integrates reservoir storage, stream flow and snow and rain into a single index. But, it is unique to each basin or region, so difficult to compare across basins or regions. Changes in water management in a basin, necessitates redevelopment of the algorithm. Extreme events cause a problem if events surpass historical time series. Reclamation Drought Index (RDI) is calculated at river basis level and is similar to SPI, PDSI and SWSI. It builds a temperature-based demand component and duration into the index. It can account for both climate and water supply factors. But, it is unique to each river basin, so inter-basin comparison is limited.
- 3.2.7 The Agricultural drought indices are: - Aridity Anomaly Index (AAI) indicates water-deficit conditions in a region. Crop-water requirements are not considered. It is percent departure of the anomaly value from the normal. IMD uses this index. However, it is simple but water balance calculations do not properly account for rainfall-runoff before the stored moisture is estimated.
- 3.2.8 Moisture Adequacy Index (MAI) CAZRI developed this index for quantification of agricultural drought. Moisture is measured by the actual evaporation over potential evapotranspiration (in %) during different phonological stages of crop. It has a merit of Water balance calculation taking into account soil characteristic, crop growth period and water requirement of major crops. Drought is specified crop-wise

on a real-time basis. But, the calculations are data-intensive, and hence difficult to implement under data-scarce conditions. On the basis of this CAZRI developed a Agricultural Drought Code based on MAI.

- 3.2.9 Crop Water Stress Index (CWSI) values are a daily integration of plant-available soil water, evaporative demand and plant phenological stage, susceptibility and are defined for the growth season. SPAW model is used for simulation of soil water and calculation of effective rainfall for plant transpiration. It has the merit that the estimates using dynamic simulation models are reasonably good, but SPAW model needs calibration for each crop and region and hence has a limitation for use. The comparative performance of different models in drought prone Jodhpur district indicated that the SPAW model is more efficient.
- 3.2.10 Drought related indices from remote sensing: NDVI, EVI, VCI, TVI etc. The merits of calculation are simple, daily satellite data available, several sensor wavelengths and calculation options now available. The demerits are – persistent cloud cover during monsoon, misrepresentation in sparsely vegetated areas, often lagging actual occurrence by weeks to month, does not yet reliably quantify biomass, crop condition, grain yield or even plant density. CAZRI's experience is that the modified MSAVI drawn from PD-54(Australia) Index is better than NDVI.
- 3.2.11 CAZRI has noted that the traditional wisdom in drought management is getting eroded due to over-dependence on drought relief. They have given the minimum data-layers for a DSS on drought vulnerability & monitoring in Arid Areas which are climate, land resources and socio-economic. They gave following six-step approach for a bare drought monitoring plan:-

- Step 1: Collection of rainfall and temperature data from different locations (In collaboration with IMD and State agencies)
- Step 2: Calculation of temporal and spatial availability of soil moisture in a GIS environment using pre-calibrated dynamic simulation models for all major crops taking into consideration water requirement and soil characteristics.
- Step 3: To find out threshold limits for each crop as a warning as no drought or mild, moderate and severe drought conditions for each location.
- Step 4: Taking medium range forecasting, preparation of early drought warning bulletins on drought status and disseminate to drought managers.
- Step 5: Preparation of Agro-advisory bulletins based on drought conditions and contingency plans in case of late onset of monsoon.
- Step 6: Dissemination of Agro-advisory bulletins to farmers through local media and get feed back.

3.2.12 CAZRI informed that they have a dedicated Drought Monitoring Cell for undertaking their research work in arid zone areas.

National Remote Sensing Agency on remote sensing tools

3.2.13 Dr. C.S. Murthy, Principal Investigator (Drought) from NRSA, Hyderabad who is working in RS & GIS applications area gave his presentation on remote sensing tools for objectivity. He explained about the on going National Agricultural Drought Assessment and Monitoring system (NADAMS). He gave the detailed account of Earth Observation Systems and Geo-spatial Information Technology association with the system. They have also developed a Drought vulnerability mapping for country as a whole with space and ground inputs. In his presentation

he explained the standard criteria required for operation of drought assessment and declaration for drought in the country, and the institutional linkages with the knowledge centre. He also explained about the criteria in US Drought Monitor at University of Nebraska. Automatic Weather Stations (AWS) are being established in selected locations in Andhra Pradesh, Karnataka and Maharashtra by NRSA in their task for drought assessment.

Potential of using Information and Communication Technology

3.2.14 The next two presentations were on ICT tools as glue for holistic approach by NIC and IBM. Dr. M. Moni, DDG, NIC gave a detailed presentation about the role of Agricultural Informatics Division in the NIC. He explained how NIC is meeting the peoples' needs and the Rural India's Stakeholding. He gave his presentation on the Inter-Sectoral approach requirement for Agricultural Informatics & Communication, models of e-Government (i.e. digital Government), Geometry of information flows, needed domestic strategy for sustainable rural livelihoods, NICNET services in districts, DISNIC programme, fusion of technology framework, and undergoing pilot demonstration projects. He suggested an ICT framework for the proposed centre having components of data-base system, watershed based development, decision support system, development of workflow systems, low cost automatic weather stations, networking of stakeholders, ICT infrastructure at grass root level, Enterprise Architecture framework Process re-engineering and Monitoring and Evaluation system for effective agricultural monitoring to mitigation. He concluded that the idea of establishing of a 'Centre for continuous and integrated drought monitoring' is laudable.

He offered that on demand the NIC could design and activate the information infrastructure for the proposed centre.

- 3.2.15 The presentation of IBM followed the NIC's presentation. Dr. Rajendra Gupta, Lead Solution Architect in IBM explained key objectives and goals, business view, enterprise view, process view, technical view and architectural view of the proposed Drought Information Network. He also offered that the IBM could provide on demand operating environment through the IBM Software shared components where the real-time access to critical drought indicators could optimize business results and rapid reaction to events.

Sessional interventions and conclusions

- 3.2.16 The Session drew good interventions from scientists from CRIDA, DST, Water Resources, IITM, NCMRWF, Delhi School of Economics and State Government officials.
- 3.2.17 Dr. P. Sanjeeva Rao, Scientist, Earth Sciences Division of Department of Science and Technology (DST) informed that the DST has brought a vision document for R&D on "Integrated and holistic approach to Agro-meteorology" during the next two decades which is prepared for a holistic Indian Climate Research Programme. The document also spelt about the action need to be taken to tackle agricultural drought. Para 8.4.3.3 of the document inter alia indicates the need for creation of nodal research centre for agricultural drought monitoring which could initially be in the identified drought prone areas and gradually extended to other regions. The action proposed in the document conforms to the view for the need to establish a separate set up for dealing with drought. It also

shows that sincere efforts to deal with the drought are being handled in different departments, without any holistic attempt to integrate the individual efforts. The relevant extracts of the document relating to drought is placed in the list of papers presented in the workshop.

- 3.2.18 Prof. C.S. Ramachandran, Delhi School of Economics pointed out that the weather stations are based on convenience of the IMD and not scientifically located. He suggested for improvement in weather data collection, number of vulnerable people, number of livestock affected etc. He emphasized a post-facto index for ensuring uniform drought relief distribution.
- 3.2.19 Shri G.B. Pant, former Director, IITM stated that there is a climate scale anomaly and we do not know the frequency of monsoon going failure. We need good quality data.
- 3.2.20 Shri R.K. Jain, Sr. Joint Commissioner M/o Water Resources pointed that the hydrological data can be integrated into the system for drought forecast / monitoring and explained how the Ministry of Water Resources deal with long term programmes on water management basically aimed at drought reduction.
- 3.2.21 Dr. Y. Ramakrishna, Director, CRIDA while pointing out the WRF model and Ryle's model sought the way for bringing it to regional level. He said that the capacity in the soil is not dependent only on rainfall (although an important factor) but also on other factors. We should have global outlook in our perspectives in so far as crop weather outlook and drought related issues are concerned. He suggested for involvement of local / district level partnership at local universities level. In 600 districts, he said that we can engage 6000 people by giving major role to State Agriculture Universities in our Drought Monitoring System.

While welcoming the proposed new initiatives, he emphasized for a consortium basis attempt for the new set up.

- 3.2.22 Dr. A.K. Bohra, Adviser & Head, NCMRWF informed that there are 107 agro-climatic zones in the country and they give medium range forecast including agricultural weather outlook for an area of 50 km radius. The information is given 7 days in advance and also arranged to reach at local level. He also welcomed the new initiative of the Department and extended the support of NCMRWF.
- 3.2.23 Shri S.M. Jaamdar, Principal Secretary and Relief Commissioner, Government of Karnataka regretted allotment of lesser time for the State Governments in the Workshop. While explaining the success of Karnataka in Drought Monitoring through establishment of a separate Drought Monitoring Cell, he said that the Automatic Telemetric Stations, costing roughly around Rs. 20,000/- each, are giving valuable inputs to them. They have invested Rs.3 crores in their project. He supported the proposed National institutional framework as a body meant for knowledge dissemination and custodian of all field level feedback.
- 3.2.24 Dr. B.K. Singh, a scientist from private sector in agriculture, while pointing out their success in a limited way, pointed out the limited resources with the private sector for taking up their research at larger level. He supported the views of Karnataka Government and suggested that we should use cheaper mode for collecting data by using cell phone, etc, and the focus of FAO based IPC techniques for getting information as soon as possible. But the farmer should be placed in the focus and engaged

in consultation in our major link, which is ultimately neglected in all our programmes.

- 3.2.25 Shri Jitendra Kumar, NCFC , DAC informed about the Government's new initiative for Extended Weather Forecast System.
- 3.2.26 Rapporteur of the workshop, Dr. D.R. Sikka also dwelt upon the issues raised by the speakers and gave his intervention by way of suggestions.
- 3.2.27 Chairperson of the session Dr. Nawab Ali summarized the presentations and concluded that science and technology institutions need to get together to evolve a format for sharing real time information amongst themselves. Through sharing of such information the effectiveness of the information product individually developed by each of the agencies should enhance. There is an urgent need to assist the policy making and its implementation thereafter through objective definition of drought, and monitoring its severity in the context of various planned relief measures. He also gave his experience in ICAR in Natural Resource Management and the role of Karnataka Government in objective drought monitoring using modern scientific tools.

3.3 Integrating Social Perspectives

3.3.1 The post-lunch session was dedicated to Integrating Social Perspectives and the best practices in drought management. Shri Prem Narain, Joint Secretary (NRM, RFS & M&T) in the Department of Agriculture & Cooperation chaired the session. He explained the need for integration of social perspectives with Science and Technology for objective drought management in the country.

IPC framework of FAO

3.3.2 Mr. Luca Alinovi, FAO gave a presentation on IPC for real time impact assessment. FAO had undertaken a programme in South Africa and Kenya with the ultimate objective of Integrated Food Security & Humanitarian Phase Classification (IPC). He advocated that we need a “**common currency**” for describing nature & severity of crisis. He circulated the Technical Manual prepared by FAO for understanding the Food Security Analysis of FAO in Somalia. He admitted that the situation in African continent or Somalia is not similar to that in India and other Asia-Pacific countries. But, the tool developed by FAO could be a model source with suitable adjustments for any nation in the world. The system would lead to need based, strategic and timely approach to crisis. The strategic response framework to the different classified phases was explained by him. The Phase Classification was 1) Generally Food Secure 2) Chronically Food Insecure 3) Acute Food and Livelihood Crisis 4) Humanitarian Emergency 5) Famine / Humanitarian Catastrophe. The early warning levels in the phases were duly defined and illustrated. The components of IPC supporting tools include Reference Table, Analysis Templates, Cartographic protocols, Standardized population tables etc. IPC is a distinct stage in the analysis response continuum. IPC -

- enables a composite analytical statement on food security and humanitarian situations
- is for current situation analysis and early warning
- draws together multiple indicators of human welfare and livelihoods
- for consistent and meaningful analysis.
- ⇒ A method—it draws from multiple methods
- ⇒ An information system—it is a complimentary 'add-on'
- ⇒ Response analysis—this is the next step, which is based on sound situation analysis

3.3.3 The presentation from FAO was an eye-opener for the participants as to how a deliverable mechanism to address the need of drought affected society could be framed with all inclusive parameters and tools. In view of the paucity of time in the workshop, it was decided to have a separate discussion with FAO and Department of Science and Technology (DST) to share the information between each other on 25th September 2007 in the presence of Secretary (A&C). Accordingly, the presentations of FAO on IPC and presentation of DST on Crop Yield and Crop Health Project were shared on 25th September 2007. After a detailed discussion, following conclusions were reached:

- ❖ FAO's IPC framework could act as an integrating mechanism to mainstream the social perspective of the drought in terms of severity of impact of the drought to be classified, on the basis of socio economic parameters, in various phases as per the framework. Appropriate responses for the drought affected population could be planned in time to mitigate the effects of the drought condition.
- ❖ FAO indicated its willingness to enter into a strategic partnership with India extending full support to the concept of establishing an independent Drought Management Centre. The

detailed modalities of this support would be communicated by FAO in consultation with donors like DFID, USAID etc.

- ❖ It would be better to take up immediately, implementation of IPC framework in some identified blocks of the country. Based on such pilot test, implementation would be scaled up, over a period of time, to all the drought affected areas.
- ❖ In the same identified blocks, Science and Technology Department would monitor the physical Meteorological conditions as also the crop health condition to suggest the severity of the drought conditions through an index that takes inputs from various other scientific agencies like IMD, Central Groundwater Board, Central Water Commission and other related State agencies.
- ❖ Whereas Department of Science & Technology will provide the diagnostic tools for looking at the physical factors affecting the area and population. FAO's IPC framework would look at the human factors in terms of diagnosing the socio-economic conditions of the affected population. In this way, a holistic view of the drought at the block (sub-district) level in the country would become feasible. The needed mitigating interventions by way of area treatment and also through strengthening the coping mechanism of the community could be monitored.

Health and Nutrition monitoring

3.3.4 Dr. R.C. Sharma, Director, Desert Medicine Research Centre, Jodhpur, a research institute of Indian Council for Medicinal Research (ICMR) gave his presentation on monitoring nutrition status in desert areas. He explained that the parameters for monitoring nutrition status in desert areas could be made applicable to the drought affected areas also. He also gave details of micro nutrient deficiency disorders, nutritional status and

morbidity among pregnant and lactating women, children and other vulnerable sections. He said that the assessment of impact of relief especially the food for work programme during drought 2002, by National Institute of Nutrition (NIN) indicated that it was positive and reduced the vulnerability of drought affected populations to a large extent. He extended all possible cooperation from ICMR in the proposed establishment for drought management centre.

Drought Area Development Initiatives

3.3.5 Shri R.K. Srivastava,, Additional Inspector General (Forests), (D/o Land Resources) gave the details of on-going area development programmes viz. IWDP, DPAP and DDP which are aimed at long-term mitigation of drought. The funding of DPAP is 75% Central share and 25% State share and the unit cost is Rs.6000/ha. The micro watershed size is 500 ha. The status of DPAP indicated that as on 14.9.2007, Rs.2508.50 crores funds were released from Central share. At present, 27439 projects were sanctioned to cover an area 137.20 lakh ha, with a total cost of Rs.9874.92 crores. He gave the details of success stories and advocated that "watershed villages" were seen to have developed sufficient drought Sustenance capacity.

Initiatives of Rajasthan Government

3.3.6 A detailed presentation on the drought management in the State of Rajasthan was given by Shri Sita Ram Gupta, OSD & Deputy Secretary, Government of Rajasthan. He gave the details of their new drought manual which was revised recently with detailed operational procedures required for handling drought in their State. He said that the drought management is as old as since 1844 when "Girdavari" system was established by Maharajas in the State. The methods for detection of drought and the traditional coping mechanisms were explained by him. He

explained the new initiatives of the Government of Rajasthan like Food Stamp Yojana, involvement of NGOs and Voluntary organisations, involvement of public at large, Panchayati Raj Institutions, Social security measures to SC/ST, BPL and other vulnerable sections, Drought mitigation strategies with special emphasis on water management, irrigation, cattle conservation, drinking water, use of foodgrains and fodder stocks, traditional coping mechanisms, etc. Drought being a nature endowed common phenomenon in Rajasthan their elaborate efforts could be a common guide for all the States in the Country with suitable modification.

Initiatives of Karnataka Government

3.3.7 Karnataka State Government was represented by Dr. S.M. Jaamdaar, Principal Secretary and Dr. V.S. Prakash, Director, Drought Monitoring Cell (a society established in the State under Societies Act). They gave the details of their efforts in networking information through common and cheap mode of telephonic network and automated weather stations at Tehsil / Village level.

Presentation by Gujarat Government

3.3.8 Dr. Anshu Bharadwaj, Asstt. Professor from Gujarat Institute of Disaster Management, an organisation under GSDMA gave details of the Gujarat efforts and the positive developments in the State.

Floor interventions

3.3.9 Interventions from the floor suggested creation of a tripartite mechanism among scientific community, policy makers and citizen especially drought prone society in the proposed set-up. Prof. Santosh Kumar (NIDM) advocated for risk reduction measures based on estimated losses and not on estimated damages. Shri Jitendra Kumar, Additional Statistical Adviser National Crop Forecasting Centre in his intervening remarks to query about developing a sampling methodology for district level estimation of

crop yield, said that already 5 lakh crop cutting experiments/year is going on. He also explained that they were exploring further possibility with the use of advanced S&T tools in their estimation methods.

Sessional Conclusions

Chairperson of the session, Shri Prem Narain summed up the discussions in his concluding remarks stating that the felt need expressed by all the participants was to find ways to evolve a mechanism that ensures participation of the communities and the local administration in the efforts of the Government to reduce the rigors of the drought. He opined that the presentations by different institutions show that each organization aims to reach out to the communities in an adequate manner. However, considering that there was a big variation in the domain covered by them individually there was some kind of deficit felt in associating the communities holistically. Some of the local initiatives effectively been demonstrated by the State Governments need to be replicated and made more all encompassing.

3.4 Conclusions

- 3.4.1 The concluding session was chaired by Ms. Charusheela Sohoni, Secretary, D/o Animal Husbandry, Dairying and Fisheries. She shared her experiences in managing drought as collector of Aurangabad (Maharashtra) in 1972. She advocated that the livestock is another sector which should be looked into while holistic management of drought is planned. With increase in population and industrialization and availability of a fewer Wastelands in the country, pressure on land and farming has increased manifolds in recent past. She said that rural population's livelihood is dependant on livestock. For sustainable livelihood, she asked for examining the possibility of assessing of requirements of fodder and water in a given place based on the number of people and cattle residing in that area. The effect of climate change on livestock, fisheries and poultry is another issue that needs to be looked into.
- 3.4.2 Dr. J.S. Samra, CEO, National Rainfed Areas Authority (NRAA) advocated for inclusion of the proposed set up under the umbrella of NRAA, which also has risk management component in its domain of work. He lamented the inadequate staff and support mechanism of NRAA as attached office of the Government and said that the same issues would have to be faced by the new set up. Instead, it was better to house the drought centre in NRAA. He mentioned about new progressive manuals, advance warning system, change of relief strategy, and reduces vulnerability and mitigation measures. He wanted a predictive approach, i.e. weather based insurance system. He stated that there is no method to assess losses of hidden factors like livestock etc. In sectors like horticulture the

impact is visible in next seasons and not during the current season. In Punjab, the deficit rainfall is a boon as the Kharif paddy will not be affected by pest and diseases. The production increases by 10-15% but there will be loss due to increased use of diesel for exploiting potential ground water. The estimation of losses through predictive methods, standardised cardinal points etc was suggested by him.

3.4.3 Dr. D.R. Sikka as rapporteur of the workshop stated that the objectives of the workshop are fully met in terms of the full scale participation by all the stakeholders. He noted that barring the views of NRAA, there was unanimity that drought management would gain considerably in terms of policy development, objective drought monitoring using S&T inputs and close association of the affected communities and the local administration, if there was a central institution separately created to give exclusive attention to drought in all its dimensions. He mentioned that the task of creating new institution could be relatively easy but sustaining the efforts would require the cooperation of all the stakeholders to make it a success.

3.4.4 Mr. C.M. Sharma Deputy Secretary in the Drought Management Division of the Department of Agriculture and Cooperation proposed a vote of thanks to all the participants and mentioned that the report of the workshop along with all the recommendations and the copies of the presentations and papers of the participants would also be put up on the official web site of the Department. He expressed satisfaction that the Department had been ably guided by the discussions in the workshop and a lot of clarity had come in terms of defining the agenda for the proposed set up.

4 Recommendations:

The recommendations of the workshop are as under:

Institution building

- 4.1 The workshop took note that in Post-Independent India Drought Management has fundamentally changed from gratuitous relief based system to proactive Crisis Management System in which Science & Technology inputs are combined with socio-economic development goals.
- 4.2 The workshop noted the need for holistic assessment of the prevalence of drought/scarcity condition which should cover aspects like drought assessment, drought monitoring, need for relief measures impacts on human health, livelihood and gender bias as well as livestock.
- 4.3 The workshop was of the strong view that all drought management aspects should be inter-related and mutually enhancing in terms of comprehensive drought management policy.
- 4.4 The workshop was of the view that as drought is a complex natural phenomenon; its management requires specialized support to attend to different complexities. Therefore, a need was clearly felt to evolve an institutional framework which would facilitate coordination of inputs from different governmental organizations and institutions without intruding into functional autonomy of different institutions.
- 4.5 The workshop, having taken note of the presentations of different institutions involved in drought management, found that no single organization has full mandate to address to all the issues of drought management in a comprehensive manner. Also, no organization could be entrusted with additional mandate considering their own specialized functions and diverse scope of integration, such as, impacts on health &

nutrition along with livelihood aspects and impact on livestock to fit into a comprehensive policy initiative.

4.6 For a comprehensive drought management on regional and All-India scales, present day information and communication technologies can play a major role in supporting integrated and non-intrusive approach for tackling multi-faceted problems posed by a threat of drought.

4.7 In order to create, manage and use cross-organizational information for designing appropriate policy responses for mitigating the adverse impacts of drought, the workshop desired that a professional body with expertise needs to be created for giving exclusive and full-time attention and bring to the notice of the Central Government all aspects of drought management.

4.8 Taking into account the recommendation of the 2nd Administrative Reforms Commission for setting up a National Institute of Drought Management (in their report on "Crisis Management"), and the assessment made at the Workshop, the workshop recommend that **an independent organization**, having a mandate to holistically view all aspects of drought management, was required to be set up. It could be called **"India Drought Management Centre" (IDMC)**. **This could be set up as an autonomous body under the Department of Agriculture and Cooperation who may initiate plans for its establishment.**

4.9 IDMC would primarily perform two functions, as an integrating umbrella organization facilitating information exchange across different stakeholders, agencies and communities and promoting their conjunctive working and second, as a think tank to continuously monitor drought situation for evolving policy options for more effective response. IDMC may also promote R & D efforts on all aspects

of drought management on All India, regional and sub-regional levels such that inputs of climate as a resource and its variability on intra-seasonal, inter-annual and even decadal scales are available for modulating short-term and long-term holistic policy framework.

Policy Imperatives Theme

- 4.10 Department of Agriculture & Cooperation, being the nodal Department on drought, as recognized by the National Executive Committee of Ministry of Home Affairs, under the Disaster Management Act 2005, should evolve a common policy to dovetail short-term relief measures into long-term interventions being handled in different Departments / organizations for comprehensive and all inclusive drought management.
- 4.11 Policy on Drought Management should be simple, dynamic and actionable in planning right interventions at different stages of drought evolution to help mitigate the impact of drought on the affected population. The policy should use science and technology inputs, and community based practices to promote better coping strategies.
- 4.12 There is a need to create trigger points and an appropriate response matrix for implementing various short-term and long-term interventions. Objectivity should be part of the District and State Drought Plans that would be drawn up on the model guidelines prepared by the IDMC.

Holistic Science and Technology Inputs

- 4.13 India Meteorological Department (IMD) has been compiling district-wise rainfall summary for 533 districts, as against 604 districts administered by States/UTs. IMD may explore a mechanism of mainstreaming in its periodical reports, the rainfall status recorded in the rain gauges established by

different agencies like M/o Railways and M/o Water resources and also by the State Governments at the Tehsil/Block/Village Panchayat levels so that the drought-like conditions in a particular area are rightly identified for appropriate mitigating responses. IDMC could act a conduit for timely availability of rainfall information from different agencies and even promote studies to analyse this data-base with a view to understand District/Sub-District level climate and its variability.

4.14 A technical working group shall be formed by Department of Agriculture & Cooperation with the representatives from all Scientific Departments / agencies for finding out an effective and holistic S&T approach for drought monitoring and forecast for facilitating feasibility of regular data exchange as follows:

- a) It would suggest measures for moving from drought management to climate variability management at least in the identified vulnerable districts.
- b) It would examine and suggest ways and means for operationalising various indices used for measuring drought at All India/State and District levels. For this purpose data for objective drought monitoring from space-based systems and other systems could be also used.
- c) There is need to develop ways and means to get soil moisture data and also the evapo-transpiration rates and development of anomalies to correctly forecast the crop health at different phenological stages in a season. Automatic weather stations being set up by different agencies, including IMD, should also include the moisture sensor for getting information about the soil moisture levels under natural environment. Similarly, there is a need to analyse soil samples to get the moisture level for an assessment of the actual crop conditions. Remote

sensing applications should corroborate on a weekly basis their findings on the crop health. All such data could come to IDMC for analysis and presentation as a report to different stakeholders during and at the end of the Cropping Season.

Integrating Social Perspectives

4.15 State Governments should be encouraged to set up a State Drought Monitoring Cell on the lines of the one set up by the Government of Karnataka.

4.16 There is a need for identification of Global and National best-practices. It is recommended that these best-practices may be studied and modulated periodically for effective integration with drought management policy of the Department of Agriculture & Cooperation. Towards this end a partnership may be developed between the FAO, UNDP and other international agencies.

General Recommendations

4.17 The Drought Monitoring Cell in the Department of Agriculture & Cooperation may be strengthened with all required technical facilities and personnel so as to have the capability of analysing and examining the reference and research information from various sources.

4.18 Department of Agriculture & Cooperation and IDMC may also promote the accredited cost-effective methods evolved by individuals / institutes / voluntary agencies for mitigation of drought.

4.19 Government may consider appropriate awards each for outstanding contribution to individuals, institutions and voluntary agencies in drought management for their contribution to social and scientific aspects of drought management.

4.20 Promotion of investment in drought mitigation measures may be encouraged for economic sustainability of small & marginal farmers /businessmen, women and children and disabled resource-less population. IDMC, when setup, should have linkages with the National Food Security Mission and Krishi Vikas Yojana Mission by providing them information on drought situation & its management.

4.21 IDMC may, at the end of each year, issue a comprehensive technical report with regard to deficiency of rainfall, incidence of agricultural droughts and its impact on food grains production, and efforts made to mitigate the droughts etc. by obtaining information from different agencies. The improvements made from the lessons learnt from previous drought studies could be also included in this report.

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5 Annexure I - List of Participants

1. Dr. Mohan Kanda, Member, National Disaster Management Authority (NDMA), M/o Home Affairs, Centaur Hotel, Near IGI Airport, New Delhi-110037.
2. Dr. P.K. Mishra, Secretary, D/o Agriculture & Cooperation, New Delhi.
3. Ms. Charusheela Sohoni, Secretary, D/o Animal Husbandry, Dairying & Fisheries, Krishi Bhawan, New Delhi .
4. Dr. D.R. Sikka, 40, Mausam Vihar, New Delhi-110051.
5. Dr. J. S. Samra, Chief Executive Officer(C.E.O),National Rainfed Areas Authority(NRAA), D/o Agriculture & Cooperation, Pusa, NASC II Floor, New Delhi.
6. Shri Naved Masood, Principal Secretary, Government of Manipur, C-7, MS Flats, Tilak Lane, New Delhi-110001.
7. Shri Prem Narain, Joint Secretary, D/o Agriculture & Cooperation, New Delhi.
8. Shri Mukesh Khullar, Joint Secretary, D/o Agriculture & Cooperation, New Delhi.
8. Dr. Nawab Ali, Deputy Director General(NRM), ICAR, Pusa, New Delhi.
9. Dr. O.P. Sharma, Principal Scientist, NRM Division, ICAR, Pusa, New Delhi.
11. Dr. Ajoy Kumar Gogoi, Assistant Director General, ICAR, Pusa, New Delhi.
12. Dr. KPR Vittal, Director, Central Arid Zone Research Institute(CAZRI), ICAR, Jodhpur-342003.
13. Dr. Amal Kar, Head, Division of Natural Resources & Environment, Central Arid Zone Research Institute(CAZRI), ICAR, Jodhpur-342003.
14. Dr. A.S. Rao, Principal Scientist, Central Arid Zone Research Institute(CAZRI), Jodhpur-342003.
15. Shri A.K. Srivastava, Additional Inspector General, Deptt. Of Land Resources, Ministry of Rural Development, Paryavaran Bhavan, CGO Complex, New Delhi.
16. Dr. C.S. Murthy, Principal Investigator (Drought), National Remote Sensing Authority(NRSA), Balanagar, Hyderabad, PIN-500 037(AP).
17. Dr. G.B. Pant, Scientist – H, Indian Institute of Tropical Meteorology(IITM), Pune.
18. Shri S.M. Jaamdar, Principal Secretary, Government of Karnataka, Bangaluru.
19. Shri V.S. Prakash, Director, Drought Monitoring Cell, Government of Karnataka, Bangalore.
20. Shri Sita Ram Gupta, O.S.D. Cum Dy. Secretary, Government of Rajasthan, Jaipur.

21. Shri Mukesh Verma, C.O., Disaster Management & Relief, Government of Rajasthan, Jaipur.
22. Dr. Anshu Bhardwaj, Assistant Professor, Gujarat State Disaster Management Authority (GSDMA), G/o Gujarat, Ahmedabad.
23. Dr. B.K. Singh, C.E.O., Skeymet Corpn., Noida.
24. Shri M. Moni, Deputy Director General, National Informatics Centre(NIC), Lodi Road Complex, New Delhi-110003.
25. Dr. M.V.S. Sarma, Senior Technical Director, National Informatics Centre (NIC), Department of Agriculture & Cooperation, New Delhi.
25. Mrs. Samema Mukhija, Scientist-D, National Informatics Centre(NIC), Department of Agriculture & Cooperation, New Delhi.
26. Shri Vijay Kumar, Senior System Analyst, National Informatics Centre (NIC), Department of Agriculture & Cooperation, New Delhi.
28. Dr. P. Sanjeeva Rao, Scientist – F, Department of Science & Technology, Technology Bhavan, Old Mehrauli Road, Katwaria Sarai, New Delhi.
29. Shri H. Ramachandran, Professor, Department of Geography, Delhi School of Economics, University of Delhi.
30. Prof. Santosh Kumar, Professor & Head, Public Policy, Division, National Institute of Disaster Management(NIDM), IIPA Complex, New Delhi.
31. Shri R.K. Tiwari, Deputy Commissioner, Department of Agriculture & Cooperation, New Delhi.
32. Shri B.P. Yadav, Director, India Meteorological Department(I.M.D.), Mausam Bhavan, Lodi Road, New Delhi-110003.
33. Dr. Jayanta Sarkar, Director(Agrimet), India Meteorological Department(I.M.D.), Pune
34. Dr. A.K. Bohra, Adviser & Head, National Centre for Medium Range Weather Forecasting(NCMRWF), A-50, Institutional Area, Phase-II, Sector-62, Noida(UP)-201301.
35. Dr. Rajendra K. Gupta, IBM, Lead Solution Architect, 1st & 2nd Floor, Birla Tower, Bharkanba Road, Rajiv Chowk, New Delhi.
36. Dr. K. Mazumdar, Deputy Adviser, Department of Drinking Water Supply, M/o Rural Development, Nirman Bhawan, New Delhi.
37. Dr. R.C. Sharma, Office-in-charge, Desert Medicine Research Centre(ICMR), Jodhpur
38. Dr. Y.S. Ramakrishna, Director, Central Research Institute for Dryland Agriculture(CRIDA), Hyderabad

39. Shri Jitender Kumar, Director & Head, National Crop Forecasting Centre(NCFC), Department of Agriculture & Cooperation, New Delhi.
40. Prof. Vinod K. Sharma, Professor, Disaster Management, Indian Institute of Public Administration, I.P. Estate, New Delhi.
41. Shri Rajendra Kumar Jain, Senior Joint Commissioner, Ministry of Water Resources, Shram Shakti Bhavan, New Delhi.
42. Shri C.M. Sharma, Deputy Secretary, Drought Management, Department of Agriculture & Cooperation, New Delhi.
43. Shri S. Janakiraman, Under Secretary, Drought Management, Department of Agriculture & Cooperation, New Delhi.
44. Shri S.V. Patil, Under Secretary, Drought Management, Department of Agriculture & Cooperation, New Delhi.
45. Shri P.J. Soundarajan, Assistant, Drought Management, Department of Agriculture & Cooperation, New Delhi.
46. Mr. Luca Alinovi, Programme Manager, EC-FAO Food Security Information for Action, Agricultural and Development Economics Division, Economic and Social Department, Room C-332, Viale della Tarme di Caracalla-00100 Rome.
Luca.alinovi@fao.org
47. Mr. Daniel Gustafson, FAO Representative in India, 55, Lodi Estate, New Delhi – 110003.
48. Mr. A.R. Subbiah, Director, CRM, Asian Disaster Preparedness Centre(ADPC), P.O. Box - 4, Klong Luang, Pathumthani 12120 Thailand.

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6 Annexure II - Agenda and Schedule

Government of India
Department of Agriculture & Cooperation

“Workshop to discuss the Mechanism for Continuous and Integrated Drought Management”

Date: 21st September 2007, Friday

Venue: Training Hall, 2ND Floor, NASC, ICAR, PUSA, New Delhi

AGENDA

- 9.30 AM **REGISTRATION OF PARTICIPANTS**
- 10.00 AM Welcoming Note and Meeting Objectives
- **Shri Mukesh Khullar**, Joint Secretary (Drought Management), Department of Agriculture & Cooperation
- 10.15 AM **Inaugural Session – Integrated Drought Management – Policy Imperatives**
Climate Information Applications a presentation by Mr. A.R. Subbiah, ADPC, Bangkok
Dr. Mohan Kanda, Member, National Disaster Management Authority, Government of India (Chief Guest)
- Dr. P.K. Mishra**, Secretary to the Govt. of India, Department of Agriculture & Cooperation - In Chair
- Shri Naved Masood**, Principal Secretary, Govt. of Manipur - wrap up.
- 11.15 AM **Tea Break**
- 11.30 AM **2nd Session - Holistic S&T inputs for objective Drought Monitoring**
Dr. Nawab Ali, Deputy Director General, (NRM & IC), ICAR – In Chair
- Presentations**
- 11.40 AM Better Forecasting is the key - IMD & Dr. Jayant Sarkar, Director, IMD (Agrimet), Pune
- 11.40 AM
- 12.00 PM Drought Indices as integrators - Dr. KPR Vittal, Director, CAZRI, Jodhpur
- 12.20 PM Remote Sensing tools for objectivity - Dr. P.S. Roy, Dy. Director (RS&GIS Appl. Area, NRSA)
- 12.40 PM ICT tools as glue for holistic approach- Dr. M. Moni, DDG, NIC
Mr. Rajendra Gupta, IBM
- 1.00 PM **Interactions with the Floor** - Interventions by CRIDA, IMD, NCMRWF, Adviser to Min S&T, IITM, Water Resources, IIT, CGWB
- 1.30 PM **LUNCH BREAK**

- 2.15 PM **3rd Session – Integrating Social Perspectives – Best Practices**
Shri Prem Narain, JS (NRM, RFS & M&T), DAC
- Presentations**
- 2.20 PM IPC for real time impact assessment - Mr. Luca Alinovi, FAO
2.35 PM Efforts in India /Abroad - UNDP
- 2.50 PM Monitoring Nutrition status in Desert areas- Dr. R.C. Sharma,
Desert Medicine Research Centre, Jodhpur (ICMR)
- 3.05 PM Central Efforts - Ministry of Rural Development (Land Resources)
Ministry of Women and Child Development
- 3.25 PM State Efforts - Governments of Rajasthan, Karnataka, Orissa,
Gujarat
- 4.05 PM Video presentation of Sir Ratan Tata Trust on drought mitigation in Rajasthan
- 4.20 PM **Interactions with the Floor & Open House** - Interventions by representatives
from Delhi School of Economics, MHA, IIPA, NIDM, Drinking Water Supply,
Animal Husbandry, Dairying & Fisheries, Water Resources, Food and Public
Distribution, E&S Directorate(DAC) etc.)
- 5.00 PM Presentation and Adoption of Summary Report of Proceedings
- **Dr. J.S. Samra, CEO, NRAA – in Chair**
- **Ms. Charusheela Sohoni**, Secretary, (Animal Husbandry,
Dairying & Fisheries) – Concluding remarks.
- **Dr. D.R. Sikka**, Ex-Director, IITM- Rapporteur

7 List of Papers presented in the Workshop

- Presentation on Climate Forecast Applications for Drought and Role of ADPC by Shri A.K. Subbiah, Director(CRM), ADPC, Bangkok
- Presentation on "Better forecasting is the key " by Dr.Jayant Sarkar, Director, IMD (Agrimet),Pune
- Presentation on "Drought Indices as integrators" by Dr.KPR Vittal, Director CAZRI, Jodhpur
- Presentation on "Remote Sensing tools for objectivity" by Dr.C.V.R. Murty, Principal Investigator (Drought) (RS &GIS Appl.Area, NRSA)
- Presentation by CRIDA by Dr. Y.V. Ramakrishna, Director
- Presentation on "ICT tools as glue for holistic approach" by Dr.M.Moni,DDG,NIC /Mr.Rajendra Gupta,IBM
- Presentation on "IPC for real time impact assessment " by Mr. Luca Alinovi ,FAO
- Presentation on "Monitoring Nutrition in Desert areas" by Dr.R.C.Sharma, Medicine Research Centre, Jodhpur(ICMR)
- Presentation by Department of Land Resources, Ministry of Rural Development
- Presentation by Govt. of Gujarat
- Presentation by Govt. of Karnataka
- Presentation by Govt. of Rajasthan
- Extracts of Vision Document for R&D in Agro Meteorology
- An article by Dr. Akhilesh Gupta, Adviser to M/o S&T
- Extracts of Recommendations of 2nd ARC