ASSESSMENT AND MITIGATION OF DROUGHTS IN SOUTH-WEST ASIA: ISSUES AND PROSPECTS

Background Document for the Regional Workshop on Drought Assessment and Mitigation

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INTRODUCTION

Most of the countries in South Asia are regularly affected by severe and often multi-year droughts. The latest droughts of 1999-2002 affected more than 100 million people in the region. Severe impacts were felt in Gujarat and Rajasthan states in India, Pakistan's Sindh and Baluchistan provinces, as well in extensive regions of Iran and Afghanistan. Afghanistan was particularly vulnerable having witnessed over two decades of war, further complicated by the operations of terrorist groups inside Afghanistan and the international action against them.

The severity and persistence of the latest droughts has produced a wide range of impacts across the region. In many areas there is widespread scarcity of potable water as well as depleted supplies for irrigation, industry and sanitation. Agricultural production has been severely affected and there has been a significant reduction in livestock populations that are the mainstay of subsistence livelihoods. Large population movements due to the combination of drought and reduced employment opportunities/ civil unrest have aggravated and compounded these miseries for communities, often with disproportionate impacts on women and children

With increasing population, the region faces serious problems of overall water shortages and scarcity that must be addressed. The ability of governments and international relief agencies to deal droughts in southwest Asia region is constrained by the absence of reliable data, information networks, professional and institutional capacities. There is a need for an assessment of how countries in the region deal with droughts, what drought monitoring mechanisms, if any, are employed, what relevant institutional elements are missing and what potential for drought mitigation exist in the region in the long-term. Droughts represent a problem of long-term common concerns in the region, which may and should be addressed through regional cooperation. Realizing the above needs, in May 2003, the US State Department Regional Environment Office for South Asia and International Water Manageemnt Institute (IWMI) initiated a Project on Drought Assessment and Mitigation in southwest Asia. The focus of the Project is on west India, Pakistan and Afghanistan. The Project is currently in its final stage. The Workshop is held as part of the Project.

The workshop is targeting policy-makers, scientists, national and international NGOs and donors. It will discuss existing needs and constraints in the effective development and application of anti-drought measures in the region and to exchange views on existing good practices and emerging issues. The anticipated outputs of the workshop include:

- The list of priority components for future anti-drought work in the region with recommendations on related benchmarks and targets

- Workshop proceedings, which will document ad synthesize discussions held and presentations made along with the agenda, list of participants and other supporting information.

The purpose of this Background Document is to briefly describe the research activities undertaken as part of the Project and summarize preliminary results available to date. The detailed description and results of individual studies/tasks of the project are summarised in the relevant Working Papers, which have been or are being published and which jointly form a new, IWMI Drought Paper Series. This document together with workshop presentations,

provide material for discussions at the workshop. The, synthesis report of the project will be compiled after the workshop and will be based on project outputs and the outcomes of the workshop.

THE PROJECT AT A GLANCE

Objectives

The project aims to carry out a rapid assessment of the state-of-the-art in drought research and management in three countries in the region (namely India, Pakistan and Afghanistan), to exchange country experiences in drought management and to give recommendations for effective drought mitigation in the region in the short and long-term.

The project is an effort to prepare the groundwork for a larger longer-term regional initiative, linking local and regional efforts in drought management to global networks in climate forecasting and improving disaster relief planning and operations. Such long-term program on drought management in the region should include both technical aspects like measuring and prediction on one hand and developing drought policies, institutions and coping strategies on the other.

Methodology

Drought is a complex natural phenomenon and should be approached from a multidimensional and multidisciplinary perspective. Preparedness to drought implies the existence of an integrated system which includes three key elements:

- Drought monitoring and early warning systems
- Drought risk and impact assessment procedures
- Drought mitigation and response strategies

Drought monitoring is effectively done by measuring precipitation and other climate variables and calculating various drought characteristics. Drought definition should be adopted, and data collection as well as data and information delivery systems - established. Drought risk assessment methods should look at economic and social risks as well as at drought frequency and severity in different areas. Impact assessment methods/ criteria must be reliable and scientific. Drought mitigation implies taking action in advance of a drought to reduce its long-term impacts. It may include a variety of measures from water harvesting and water supply augmentation to awareness campaigns, emergency responses and drought contingency plans.

All three above components complement one another and represent an integrated institutional approach that addresses both short and long-term drought management. All three components include a number of *technical issues* related to drought quantification, analysis and prediction, *issues of policies and institutions* and *socio-economic issues*. The project uses this three-fold framework with each of the three key elements above.

This in turn implies that a range of methodological approaches is necessary. They include literature reviews, socio-economic surveys, tools development (e.g. software development,

use of remote sensing for drought monitoring), topical research on influential issues of drought management, climatic time series data analysis, etc. Each of the above studies and activities has a different spatial scale. The project therefore has several components, topical and geographical, which together effectively form the *project matrix,* presented in the Table below. The outputs, lessons learned and experiences gained through these component studies are being synthesized to formulate the recommendations for future anti-drought work in the Region. The details of individual project components are briefly described in the following sections.

Table 1 Project components and their geographical focus/scale

Project component	**Geographical focus and/or scale**		
Developing a remote sensing based regional drought monitoring system	The entire southwest Asia Region, including west India, Pakistan and Afghanistan		
Drought hazard analysis	India: Rajasthan and Gujarat states	Pakistan: Baluchistan and Sindh provinces	Afghanistan: national
Socio-economic surveys of rural population	India: Rajasthan	Pakistan: Baluchistan and Sindh provinces	Afghanistan: Ghor, Badhgis Helmand and Kandahar provinces,
Review and analysis of drought-related institutions and policies	India: national and Rajasthan	Pakistan: national	Afghanistan: national
Review / assessment of the potential of water harvesting technologies to withstand droughts	India: Rajasthan	Pakistan: Baluchistan and Sindh provinces	Afghanistan: national

Partnerships

The successful implementation of the Project is not possible without partnerships with local organizations, who are ideally placed to conduct case studies in different countries of the region. During the course of the Project, IWMI has established working links and/or conducted collaborative research in three countries together with a number of national research institutes, NGOs, government departments and international agencies, including:

In India:
Indian Council for Agricultural Research (ICAR), Delhi.
Institute of Development Studies (IDS), Jaipur
Central Arid Zone Research Institute (CAZRI), Jodhpur
Sewa Mandir – an NGO based in Udaipur
Indian Meteorology Department (IMD), Pune

In Pakistan:
Pakistan Agricultural Research Council, Islamabad
Water Resources Research Institute, Islamabad
Faisalabad Agricultural University, Faisalabad
Peshawar Agricultural University, Peshawar
Arid Zone Research Institute (AZRI), Quetta
Pakistan Meteorological Department, Islamabad

In Afghanistan:
Catholic Relief Services (CRS), Kabul-Herat
Kabul University, Faculty of Agriculture, Kabul
Ministry of Irrigation, Water and Environment, Kabul
FAO, Afghanistan

The majority of the organizations above directly contribute to the Project through surveys, case studies and reviews. Others provide relevant information (e.g. rainfall data). Yet others provide technical or logistical assistance for IWMI case studies in the region, including vehicles and human resources. A number of other organizations and individuals in three countries have effectively been engaged in the Project through the work of the partners.

Summary of outputs to date

- Regional drought monitoring system (http://dms.iwmi.org). The system uses on-line remote sensing database to monitor drought development through continuous assessment of the condition of ground vegetation. It operates at the district level and pixel level (0.5 km X 0.5 km). New data is added every 2 weeks.

- Software for drought analyses with multiple options for drought indices calculation, display, mapping and import/export. The description is available on the project web site (see below).

- Rainfall database for the region. Over 90 rainfall stations from three countries in the region with monthly time series rainfall data of 30 years long on average.

- Web site www.iwmi.cgiar.org/droughtassessment/index.asp The site contains the overview of the project, project publications, links to partner web sites and other drought related web sites in the world, databases of regional literature on droughts and organizations involved in drought research and management, general information about droughts for educational purposes, software description. Regional Drought Monitoring system is also accessible through the site. The general intention was to convert it into the regional portal of drought-related information, knowledge and network in the region should the project receives further funding.

- Publications
  - Thenkabail P.S., Gamage, M.S.D.N. And Smakhtin V.U.(2004) The Use of Remote Sensing Data for Drought Assessment and Monitoring in South West Asia. IWMI Research Report N 85. Colombo, Sri Lanka
  - Smakhtin, V. U. and Hughes, D.A. (2004) Review, Automated Estimation and Analyses of Drought Indices in South Asia. IWMI Working Paper N 83 – Drought Series Paper N 1. Colombo, Sri Lanka
  - Samra, J.S.(2004) Review and Analysis of Drought Monitoring, Declaration and Impact Management in India. IWMI Working Paper N 84 – Drought Series Paper N 2. Colombo, Sri Lanka
  - Ahmad,S., Hussain, Z., Qureshi, A.S, Majeed, R and Saleem, M. (2004) Drought Mitigation in Pakistan: Current Status And Options For Future Strategies. IWMI Working Paper N 85 – Drought Series Paper N 3. Colombo, Sri Lanka
  - Qureshi, A.S. and Akhtar, M. (2004) Analysis of Drought Coping Strategies in Balochistan and Sindh Provinces of Pakistan. IWMI Working Paper N 86 – Drought Series Paper N 4. Colombo, Sri Lanka
  - Sharma, B.R. and Smakhtin, V.U.(2004) Potential of Water Harvesting as a Strategic Tool for Drought Mitigation. Proceedings of the 9-th ICID Congress, Moscow, 2004
  - *Four forthcoming Papers in the Drought Series*

ADDRESING REGIONAL DROUIGHT ISSUES

Analyzing drought definitions and perceptions

Drought is perhaps the most complex natural hazard. It is often generally defined as a temporary meteorological event, which stems from the lack of precipitation over extended period of time compared with some long-term average condition (e.g. precipitation). But droughts develop slowly, are difficult to detect and have many facets in any single region. Drought always starts with the lack of precipitation, but may (or may not, depending on how long and severe it is) affect streams, soil moisture, groundwater etc. Definitions vary from region to region and may depend upon the dominating perception, and the task for which it is defined.

The literature reviews, questionnaires and multiple discussions during the cause of the Project have revealed a number of issues related to drought definitions and perceptions, many of which are specific to the context of South Asia. There cannot and should not be a universal *quantitative* definition of a drought. But achieving a common *conceptual understanding* of a drought is possible. Failing this leads to a problem of defining drought for a specific area. This in turn may lead to the lack of decision and inappropriate action on the part of managers and policy makers. Therefore, drought definitions may be important in determining drought policies and actions.

As all other natural disasters, drought has both a physical and social component. Droughts occur inevitably and regardless of whether people live in the area or not. If there is no population in the area, then there is no social impact of a drought. If the society is "well equipped" to withstand droughts, then social impacts are minimized. Some of the social factors that determine our vulnerability are level of development, population density and composition, growth and distribution, demands on water and other natural resources, government policies (sustainable versus non-sustainable resource management), technological changes, political system, etc.

One of the issues is the lack of distinction between "drought" and "aridity" (or "dryness"). Aridity is a measure of how dry/wet the region is on average over long-term. *Aridity is a permanent characteristic feature of climate* of an area. Drought is a deviation from this long-term mean (which is obviously different in different areas). Drought comes and goes, but aridity (in an arid area) –stays. *Drought is a temporary phenomenon*. Terms like "permanent drought" are questionable as they deny the temporary nature of a drought. It is however, true to say that in arid areas, aridity and drought are more associated with each other, as even a small deviation from the small long-term mean rainfall immediately hurts. In this context, management measures which should be taken in arid areas to alleviate unreliable water supplies (whether in a drought or not) are similar.

The second issue, is the perception that a dry period in each year always constitutes a drought. Such periods can, of course, be referred to as "annual droughts". But at the same time, they are part of the annual climatic cycle and what matters here is how dry and how long such periods are. Questions are often asked - if every year we have a drought- then what is normal? The answer to this lies in differentiating between long-term multiyear and "annual" droughts and determining a band around the long-term mean, within which the precipitation and/or river flow fluctuations are considered to be within normal deviation for that area. If there are

affected people, agriculture and industries within this defined normal climatic fluctuation, the problem is much more acute in the area. If we are not prepared for normal climate fluctuations, how can we possibly deal with real rare, extreme and extended drought cases?

The third issue relates to different types of droughts. It is widely accepted that it is useful to subdivide definition of drought into four types on the basis of disciplinary perspective. The four types include Meteorological, Agricultural, Hydrological and Socio-economic droughts. It may be useful to accept that since every drought event results from the lack of precipitation, every drought is always a meteorological drought no mater how long it is. Agricultural drought starts as the duration and intensity of meteorological drought increases and so is the hydrological drought - latter. Socio-economic drought may, however, be perceived as a special case. It is often used to refer to cases when a supply of some commodity (electricity, drinking water, food, fodder, etc) becomes less than the demand for it. But it is always necessary to consider this in a specific context and relate to causes of such a "drought". If due to the deficient precipitation and inflow, there is lack of water in a reservoir and it generates less power and restrictions on electricity have to be imposed, this does in fact constitute a socio-economic drought. If the same happens due to the failure of equipment, when the reservoir is full, then there is no drought. Another dimension of a problem is that both supply and demand grow and it is the rate of growth which matters. If supply rate is less than the rate of the demand, the incidence of the cases when a commodity is lacking will increase. This may or may not constitute a "drought". If the slow growth in supply is due to political system, or poor planning of facilities, a different name should ideally be used to avoid confusion.

The fourth issue relates to continuous overexploitation of water resources versus drought effects. Continuous depletion of groundwater tables and / or river flow in many Asian rivers may occur due to increasing pressure on water resources from growing population, and associated growth in agriculture and industries. Meteorological droughts can certainly speed up this depletion but it is preferable to differentiate the later from droughts, because constant decline does not match with the temporal nature of a drought event.

Fifth, there is a perception that droughts do not occur in irrigated areas. However, an irrigated area is nothing else, but an area where drought coping measures (irrigation) have been implemented. The naturally occurring droughts (e.g. defined as above in very general terms as a temporary deviation from the long-term mean rainfall for this area) will still occur. But the impacts of such droughts have been partially or completely alleviated by the water brought in by an inter-basin transfer, by sustainable groundwater development or by both. Manifestation of droughts in irrigated areas occurs if the duration of the deficient precipitation increases: such areas are most likely to be affected latter, when and if hydrological drought develops.

The issues described above are often discussed at scientific and policy levels. Perceptions of people on the ground may differ and are more related to shortages that they have in everyday life. Different perceptions about droughts are currently being documented, analyzed and synthesized in the Project in order to suggest a common *conceptual* platform for drought policies and actions in the region.

Developing regional drought monitoring system

The success of drought preparedness and mitigation depends, to a large extent, upon timely information on drought onset, progression and extent. Such drought monitoring and early

warning systems should be the major components of any drought management program. Many international, regional and national initiatives emphasize this need. The project initiated the development of a near-real-time drought monitoring system for south-west Asia. The system makes an extensive use of high-resolution remote sensing data (MODIS) and is based on drought-related indices derived from it. The indices continuously examine the condition of the ground vegetation. The unique feature of this system is linking the two generations of remote sensing data - MODIS and AVHRR - which have different temporal and spatial resolution and optical characteristics. These relationships were established for each month of the year separately, as well as for the pooled data of all months, and were validated in randomly chosen districts outside the study area. The results ensure the continuity of the two data sets and will allow the reports on drought development in the region to be made in near-real time with a spatial resolution of 500 meters and at 8 or 16 days interval. The first release of the system is currently available, via the Internet, to all stakeholders in the region at http://dms.iwmi.org. At present, the user can:

- Explore the spatial condition of ground vegetation throughout the entire south-west region, at the level of specific district or province in respective countries and at the level of specific pixel of 0.5 by 0.5 km. The new remote sensing images are uploaded every 16 days.

- Create the on-line time –series graphs of drought-related vegetation characteristics and study the deviation of those from the long-term mean for a district or pixel. The graphs can be built for a time period selected by the user and allow the developing deficits of vegetation density and vigor to be detected and quantified on line.

- Download images of vegetation indices for selected districts / provinces for inclusion in various reports or presentations. Downloading of the actual data behind the images - for other types of more detailed analysis off-line will also be possible in the nearest future.

- Learn about the use of remote sensing data for drought monitoring and link to other drought monitoring web sites.

It is envisaged that the system will benefit the government agencies, research institutions and NGOs involved in drought management and will be a valuable addition to decision support tools in the region. The system needs to be developed and tested further to provide more targeted warning messages and to suit the specific requirement of individual countries. This calls for collaborative action in the region and for input from responsible national agencies. The principles on which the system is based are generic and can be reproduced nationally – within and outside the study region.

Regional drought risks analysis

As outlined above, drought risk assessment is one of the three key elements of drought preparedness and therefore, the risk of drought hazard in different parts of the region should be evaluated. This may be necessary to design effective drought management plans, to properly locate and create the reserves of water, food and fodder. To assess drought risks, the project is using various drought characteristics (indices) based on rainfall data data. Drought indices provide decision makers with an opportunity to place the current drought conditions

into historical perspective, allow for temporal and spatial representation of historical droughts, provide a measurement of abnormality of recent weather in a region and can be used to trigger drought contingency plans. This component intends to:

- Identify suitable drought indices, which could be applied consistently over the region
- Examine the ability of various drought indices to detect droughts of varying duration.
- Develop a set of maps which describe characteristics of drought severity in the region

The availability of information on rainfall in the region varies between countries. Also, the data may be available from different agencies within one country. About 50 stations are maintained by the Indian Meteorology Department in Rajasthan and Gujarat, and the priority is accorded to these stations, since they are operated by specially trained observers and good recording equipment is used. Rainfall data for some 20 stations in Baluchistan and Sindh Provinces were supplied by Pakistan Meteorology Department. In Afghanistan, a lot of data appear to have been lost during the last 20 year due to continuous war and civil unrest. Only 5 stations with long records have been identified. Several observed monthly rainfall data sets from stations located in Iran along the border with Afghanistan were acquired from Iran Meteorological Department, but they were also very few. Despite these data limitations, the study made a good progress and preliminary drought risk maps for the regions are being compiled. One of the related outputs is the rainfall time-series database for the region, available from IWMI.

Enhancing decision support tools: drought assessment software

No drought characteristics is ideal for all regions or tasks. In most cases, it is useful to consider more than one index, examine the sensitivity and accuracy of indices, the correlation between them, and explore how well they compliment each other in the context of specific research or management objective. Also, droughts may affect multiple components of a hydrological cycle. Often the application of hydrological, ecological and water resources models is required to analyze different components of droughts and to interpret their outputs using various drought indices. It is beneficial to ensure that such models are available and can be run within the same software environment. Therefore it was also logical to consider incorporating the drought indices estimation and analyses routines into some existing software package, which already had some of the above features, which is flexible enough to work efficiently with large datasets, which is cost effective and permanently developing to include more analytical components. IWMI formed a partnership with the Institute for Water Research (IWR, South Africa) to develop drought assessment software and to build it into their comprehensive, multipurpose water resources analyses package – SPATSIM (SPatial and Time Series Information Modeling).

Drought software at present can calculate a variety of drought indices (each has a multiple options of time period selection, data pre-processing etc), display time series graphs of indices, create maps of drought indices for an area for a particular date, export and import drought index time series and many other useful options. The software developed provides specific target groups in south Asia with a comprehensive modeling and data processing tool, which may be used for regional drought analyses and for a multitude of other water resources applications. The same package may be used by many agencies and organizations, which can create a regional community of practice, where assessments are made using the same algorithms and software and where therefore the results can be easily exported, imported,

reproduced and analyzed at different physical locations. The software developed is expected to become a useful addition to decision support tools for drought mitigation. It is available from IWR and IWMI. Links to IWR web site and to more details on the drought software and the SPATSIM package are at www.iwmi.cgiar.org/droughtassessment/index.asp. Both the IWR and IWMI are committed to continuing to support the development of the drought analysis software and will respond to comments and suggestions from various future users in the region and beyond.

Analysis of drought related policies and institutions

The success of drought mitigation is determined by the effectiveness of drought-related policies and institutions. The review and analysis of their current status in India is carried out by the Institute of Development Studies in Jaipur and by the Indian Council of Agricultural Research in Delhi. Analysis of the national policies in Pakistan has been done by the Pakistan Agricultural Research Council. The preliminary outcomes suggest that the state-of-the art of drought related policies differs significantly in three countries, but at the same time there are many similar issues. A number of issues for policy development will certainly also emerge from the results of socio-economic surveys described in the next section.

- All studies emphasize that a shift is needed from the current emphasis on ad-hoc relief measures to drought preparedness with a focus on measures taken in advance of a drought. In some countries (e.g. India) drought relief expenditure has gone up over the years. Useful frameworks for pro-active drought planning have been developed in the world to date. For example, the 10-step process proposed by D.Wilhite (USA) is widely known. This process includes the appointment of a drought task force, formulating the objectives of the plan, identification of risk groups and sectors, development of organizational structure, integration of science with policy, etc. The reviews, however, have not shown that this or similar frameworks have been used in the three countries of the region to date.

- All studies indicate the need for an integrated response to drought, for which local, provincial, federal and regional policies should be made congruent with each other. A national drought policy can be developed under existing Calamity Acts or similar national legislation. The challenge is to make drought management more effective within current administrative and governmental system and to integrate drought preparedness policies with other national plans or strategies, such as those which aim to ensure food security or sustainable water resources management.

- Pakistan study reveals that national-level integrated institutional mechanism is not operational in the country at present and that drought related programs at federal and provincial levels and the efforts of civil society and NGO's are not coordinated. The suggestion is made to develop a National Drought Policy Commission, which will guide the relevant policy and institutional development for drought mitigation and will coordinate different ministries and line agencies involved. For implementation of the National Drought Policy to be developed, it is suggested to establish an apex organization, which would coordinate and monitor policy interventions at the federal level and motivate provincial governments to establish similar organizational set-up. A consultant input will be required to prepare the outline for the proposed organization at all levels.

- In Pakistan, dissemination and sharing of information between government departments and with organizations outside government is limited. There is a need to develop a policy for access to information related to drought and water management. Such information and data themselves are limited in all countries at present.
- A common concern in national studies is the need to develop appropriate policies that allow effective management and monitoring of groundwater use throughout the region. Steps should be taken for the revision and enforcement of water laws and improvement of the overall groundwater governance. This is one of the obvious areas for sharing experiences and coordinating programs between countries.
- In India, till recently, drought management was also considered an ad-hoc and empirical famine intervention to provide instant relief. The same attitude is still prevalent in some of the States. The institutional process of monitoring, communication of drought-related information and design of drought mitigation measures varies significantly between States. The use of modern tools and procedures for drought impact analysis, as well as capacity building is inadequate. Officials are often drawn temporarily from different departments when drought occurs and are not supported by trained personnel.

- Indian States' codes and manuals did not cater for unprecedented manifestations of droughts (e.g. delayed or sudden withdrawal of a monsoon etc) and need to be revisited. Crop cutting surveys have been prescribed for estimating crop losses by the states for declaring a drought condition. Naturally the states have to wait till maturity of the crops, which delays the responses. In 2002 crops could not be sown due to failure of onset of rains and surveys became redundant. States requested the Federal government to waive crop cutting experiments and allow "eye estimation" to be done. This delayed responses and subsequent management interventions. It is suggested that inefficient and time consuming procedures of crop cutting for estimating losses and subsequent drought declaration is replaced by remote sensing based monitoring systems. An additional consideration is that there is a lot of politics in estimation of losses and drought declaration especially when different political parties are in power at the states and federal level. States can inflate their claims, but relief can also be granted to a less drought-affected state.

- In many drought prone states of India, livestock is an important source of livelihood. The experience of the past droughts showed that drought affected neighboring states can impose a ban on inter-state migration of animals and/or movement of fodder, which restricted drought-escaping opportunities. Resolving such issues through relevant policies should be part of good governance.

- Probabilities of drought occurrence in different states/districts should be calculated on the basis of long climatic records. Maps, showing these probabilities, should be prepared. Mitigation measures and institutional infrastructure, capacity building and logistic of relief material for a quick response should be planned and located according to vulnerability level of the regions. The experience of the 2002 drought has shown that transportation of relief to drought affected regions was a serious constraint to quick response. Surprisingly, food grains are generally stored in food surplus states, where such surpluses are seldom required. Developing banks of relief commodities in vulnerable regions during normal years should be supported by relevant policies.

- At present, there exist no drought-related policies and formal institutions in Afghanistan. The Ministry of Internal Affairs has organized a department with a mandate to coordinate responses to emergency situations. It is, however, unclear whether drought response falls under this department. The initial attempts are made by the Ministry of Irrigation, Water Resources and Environment (MIWRE) for establishing procedures for drought monitoring and declaration - in collaboration with Ministry of Agriculture and Animal Husbandry, Ministry of Rural Development and Reconstruction, and others. MIWRE has conducted an emergency drought assessment in 12 southern provinces and initiated a similar survey in 14 central and Northern provinces. The purpose of these surveys is to identify which priorities should be presented to international donors for emergency drought relief and mitigation.

Socio-economic surveys

The project undertook several socio-economic surveys of rural population in all three countries. All studies aimed to identify and document how people on the ground perceived and adapted to recurring water scarcity, what interventions by the government and NGOs are needed to enhance this adaptation and how effective the previous interventions were. In Afghanistan the surveys have been done in cooperation with Water Management Department of the Agricultural University in Peshawar, Catholic Relief Services (CRS) and Kabul University. In Pakistan, the study was conducted by IWMI-Pakistan in cooperation with the Pakistan Agricultural Research Council. A similar study is conducted by Sewa Mandir in Rajasthan State of India. The standard questionnaires for individual households and community focused group discussions as well as for interviews with NGOs and government officials have been developed. They are available from the project web site and can be used for similar surveys in other areas and countries. The results of the surveys are currently being analyzed. Some of the lessons learned, which should be considered when formulating the course of the future action are summarized below.

- A general observation from the surveys is that in south-west Asia, where livelihoods of the large strata of population are dependent on agriculture directly, physical water availability and access to reliable water sources are the two fundamental factors influencing the level of poverty in general and the magnitude of detrimental impacts of droughts and responses to drought in particular.

- The agricultural sector - the most vulnerable to drought – is affected in both *rainfed and irrigated areas*. Traditional irrigation systems get completely exhausted during prolonged droughts and rehabilitation of such systems should be given a priority. Government support is imperative, as most of the farmers cannot afford to rehabilitate these systems themselves. A related observation (e.g. in Pakistan) is that old indigenous methods for the construction and rehabilitation of traditional systems (karezes) are used. But due to continuously declining groundwater tables, these methods are no more effective and as a result more than 60% of karezes are not functional in principle – in Baluchistan and Sindh provinces. *The action required is the provision of necessary modern technologies and skilled manpower for the rehabilitation of these irrigation systems*.

- Lack of drinking water is the biggest issue, especially in rainfed areas. It is the main reason for most of the health problems especially for women and children. Communal wells and hand pumps are only available to a small proportion of population. Walking 3 to 8 km daily (e.g. Baluchistan) or even up to 12 km (Afghanistan) to fetch water from communal wells or another water source is a "norm" for many people. Lack of drinking water also appeared to be the major reason for migration of humans and livestock to irrigated areas. *Improved availability of drinking water should be given top priority in drought relief efforts. There is also a strong need to develop strategies for improving drinking water supply for the area – in the long-term.* This would entail the construction of more water harvesting structures, supply of hundreds of water tankers and repair of existing water reservoirs.

- Surveys' results indicate that farmers in drought prone areas are not making good use even of available scarce water resources and tend to over-irrigate due to the lack of knowledge of actual crop water requirements and due to use of traditional systems to flood their fields. This points to the need for training of farmers in the use of more water efficient irrigation methods, which exist in Indian and Pakistan.

- Recharging aquifers with the rainwater appears to be the only possible "on-site" strategy for combating the dropping groundwater table trend in drought prone areas of the region. In many parts of the region, large numbers of delay action dams (check dams) have been constructed to store the floodwater and accelerate the artificial recharge to aquifers. Unfortunately, many of these dams are not performing optimally due to faults in their designs. *Increasing the effectiveness of such structures is a priority for action.* The surveys have shown that people are keen to get support from government agencies and NGOs to improve design of their rainwater-harvesting and artificial recharge structures. Machinery for construction should be provided as manpower is becoming scarce due to migration of male members to nearby towns in search of jobs to supplement their income.

- Survey respondents were concerned about inequitable distribution of water resources. This was particularly true for groundwater exploitation as wealthy farmers can afford to install deep tubewells to meet their water demands. Poor farmers are then forced to buy this tubewell water at high and often unaffordable rates. As a result, they get water neither from these tubewells, nor from the karezes, as the latter go dry because of the former. *Water laws in drought prone areas should be revised and enforced.*

- Credit facilities for buying essential items are scarce. Farmers are often forced to take loans from local rich people at very high interest rates. A possible solution is *to establish permanent public banks for the development of drought prone areas.* Such a bank should extend advisory and financial services to the people not only during the drought period but also in normal years. Micro-credit activities extended by some NGOs in Pakistan have proved very successful in household income generation activities.

- Surveys showed that relief workers often do not reach affected people due to the lack of access, which points to the need to extend road construction programs, supplying electricity and developing transport means in remote drought prone areas.

- Another finding relates to the timing of official relief. It continues to focus primarily on meeting immediate water, fodder and consumption needs. When it stops, people have to find their own ways for recovery. Some communities can make it, but others – won't and will go into extended period of hardships.

- The general outcome of the surveys in Afghanistan is that while government structures are developing, the only possible drought mitigation strategy in drought prone regions is community-driven water harvesting using micro-watersheds.

- Surveys in some areas, e.g. Afghanistan, have revealed the lack of desire of the rural communities to share their experiences as in many cases they have seen no or little benefit in critical drought periods neither from multiple surveys conducted for different purposes by different organizations, nor from their own governments.

Review and Assessment of Water Harvesting Potential

The surveys have effectively highlighted the primary role of role of various forms of water harvesting in drought mitigation in the region. The study therefore attempts to collect information from all three countries on traditional and innovative water harvesting technologies, their strengths and weaknesses and the potential of developing them further for drought mitigation. The reviews of water harvesting measures have been produced for Pakistan – by Pakistan Agricultural Research Council and for India – by IWMI and Central Arid Zone Research Institute (CAZRI). Information for Afghanistan was provided by the CRS-Kabul. This information from these sources may be combined to create *a bank of knowledge on water harvesting in the region,* placed it on a web site and accompanied by relevant photographs.

In addition to reviews, a case study is conducted in the State of Rajasthan with an objective to assess the *potential for water harvesting* at the scale of the State. The study is conducted by CAZRI in cooperation with IWMI. The study is set to explore to what extent the existing water harvesting technologies are capable to withstand the future droughts of varying severity and duration and what technologies have most potential. It is envisaged that the assessment methodology being developed may be replicated in other regions / districts for similar projects.

RECOMMENDATIONS AND THE WAY FORWARD

Many recommendations for future action can be distilled from individual studies undertaken during the project, and some of them (primarily country specific) are listed in the previous sections. Some additional directions and steps for future action are outlined below. These recommendations are preliminary and are subject for discussion at the Workshop. It is envisaged that the Workshop participants, will provide more input to both identification and prioritization of future anti-drought activities and initiatives. All future anti-drought work in the region should aim to stimulate new policy thinking and action focused on the shift *from short-term reactive measures (e.g. relief) to the longer-term and continuous drought preparedness, based on scientific assessment and management of drought risks.*

Developing a common conceptual understanding of a drought

Drought must be accepted by the regional community of scientists and policy makers as a *natural hazard*, as a *normal part of climate* and as a *recurring, temporal event*. It is important to agree on these broad conceptual aspects of drought definition for the development of coherent anti-drought policies and plans. At the same time, for establishing the common conceptual ground it is important to document existing perceptions on droughts in different population groups and in different countries of the region – from Iran to Bangladesh and from Nepal to Sri Lanka.

Favoring drought preparedness against drought crisis management

The best time to prepare for drought is the period when there is no drought. At the same time, significant progress in establishing basic response framework is often accomplished during periods of peak droughty severity. The challenge is to transform this framework into a response/mitigation plan during the post drought period and to make it a permanent establishment. A change from crisis management to risk management will certainly require a paradigm shift and will take time, but it is necessary to continuously built awareness of this - at all levels – from policy and decision makers to the field level.

Drought response in the form of emergency assistance programs may reinforce poor or non-sustainable actions and decrease self-reliance, as people become accustomed to government assistance. One possible strategic direction here is to channel resources to the local level to induce greater willingness of communities to participate in drought risk reduction activities.

Investments in drought preparedness will eventually be more cost effective than relief measures. Important focus should also be on the demonstration and promotion of the cost-benefits of effective drought mitigation measures to national authorities and donors, in order to encourage increased budgetary support from governments and a wider range of donors.

To set an example, it may be suggested to initiate a project, which will focus entirely on development of a comprehensive drought preparedness plan for one drought prone case study area (e.g. Sri Lanka as a country, or Rajasthan as a state). The project should aim to include the three main components, supported by relevant policies: drought early warning, drought risk and impact assessment and drought mitigation and response strategies. The Project should engage policy makers and local and international scientists / consultants and be guided by relevant benchmarks. The latter is a key requirement for mobilizing bureaucratic and political will and decision to allocate funds. Examples of benchmarks for a drought preparedness plan may include its place in national disaster management arrangements (i.e. whether a plan is integrated with other disaster reduction plans or is a separate process), the identified central authority with coordinating responsibility, the existence of established procedures for evaluation of effectiveness of actions after major droughts, and others.

Improving data availability and access

The major problem in the region, which will hamper any good intentions to increase drought preparedness, is the acute lack of hydrometeorological data, including precipitation, river flow, groundwater depths etc. This information is extremely important for quantification of drought characteristics, for drought monitoring and prediction. Also, valid comments on increasing frequency and magnitude of droughts (or floods) may only be made if they are

substantiated by the long-term reliable observations on climate and hydrological variables, including those from the most recent period – to place the recent cases into perspective.

At present, the measuring networks in South Asia are often poorly designed and maintained. Consistent measurements are often disconnected. New projects (like the World Bank supported National Hydrology Project in India) are very recent and cannot yet provide required long-term time series for improved drought risk assessment. The problem is particularly acute in Afghanistan, where most of the observation networks were destroyed in the past decades and many already collected data –lost.

Linked to the above is the issue of *access to existing historical* hydrometeorological data and mechanisms for timely delivery of the *most recent* data to interested stakeholders in the region. Improving both should become *a long-term regional strategy*. Several recommendations for immediate action in this regard are proposed.

First, it is necessary to illustrate the *economic value* of hydrometeorological data through a short-term research project. This may have positive policy implications for data collection, storage and access. A case study could be undertaken in Afghanistan, Baluchistan or Rajasthan. IWMI can produce a concept for such a Project.

Second, it is necessary to set up a test case for data sharing, using a project that would benefit the region as a whole. The Drought Monitoring system developed by IWMI could serve as such a test Project. At present, the system is based on just remote sensing data, which are available for free and in near-real time. But remote sensing data alone is not sufficient for an effective drought early warning system. The minimum requirement for the enhancement of this system would be near-real time access (observed data supplied every 2 weeks with not more than one week delay) to just precipitation data from all rainfall stations in the region (or a defined smaller area), maintained by different agencies in each contributing country. Rainfall data may be perceived as being "less classified" than flow, for example, and it is logical to start from rainfall. IWMI has a database management unit, which could assist with data storage and distribution on certain agreed principles.

Third, in parallel with (or as an alternative to) the above, it may be proposed to work within one small country, such as Sri Lanka – on the same or similar Project. This approach will not illustrate the benefits of international data sharing, but may overcome the obstacles which exist within a country between different agencies. Such experience may be valuable.

Addressing data collection and sharing issues requires innovative approaches for resource allocation, backed by political commitment. This is even more important in South Asia where the spatial and temporal climatic variability is high, but observation networks are sparse. In general, without improved data availability, access and timely delivery mechanisms, very limited success in drought preparedness can be achieved.

<u>Improving regional drought monitoring and early warning systems</u>

Drought early warning systems have repeatedly been identified throughout the world as an essential element of drought preparedness strategies and action plans at all levels. The project has initiated the development of a drought monitoring system, based, at present, entirely on remote sensing data. The major reason for the dominant use of the later is that such data for the region is readily available. Two issues are important for the future development of this

system and its integration into a drought early warning system(s) either at the national or regional scale. The first is that drought monitoring based on remote sensing data, needs to be modified and enhanced in many ways. The second is that drought monitoring represents just part of a drought early warning system. It is necessary to:

- extensively test the system against the ground data on rainfall, plant/ crop characteristics (e.g. density), yield anomalies etc.
- develop reliable categories/threshold of numerical values of remote sensing indices used – for quantification of drought severity
- monitor other climatic variables like rainfall, river flow reservoir storage and groundwater in support of remote sensing information.
- Based on all above variables and their categorization/thresholds - formulate drought warning messages of varying degree (e.g. drought watch, drought warning, drought emergency, etc)
- ensure that drought reports and warnings reach the target groups and relevant agencies
- ensure that drought warning systems are institutionalized in each country, that relevant supporting policies exist and that appropriate responses are developed by each agency concerned for each level of drought severity

Many of these issues are of technical nature, other are clearly policy-related. The goal of further development would be to increase the accuracy of drought prediction in south Asia in terms of time and space (e.g. to ensure that droughts can be predicted a month in advance in any corner of the region and be delineated more accurately). To achieve this, it is necessary to link remote sensing data with medium-term weather forecasting and to increase the accuracy of these forecasts. Both can be achieved through increased support for research in these fileds. If the drought impacts on crop production can be diagnosed long before harvest, this could be the vital step for regional food security and trade. The information generated by the monitoring system should be eventually available on the weather TV channels in the countries of the region. Developing reliable drought warning systems should be considered one of the primary goals of future anti-drought work in the region, which calls for regional cooperation.

One interesting aspect for future development would be linking of traditional early warning systems with the current day technologies. Traditional knowledge must be documented and translated from local languages where necessary. Both types of knowledge should be validated against each other. The complementary features of both can be used for improved accuracy of drought early warnings.

Improving groundwater governance

Given the vital role that groundwater resources play in the life of communities in drought prone areas and a continuing decline of groundwater table, effort should be made to develop policies which regulate the ground water use. The advancements in such policy development made by any country, or group of countries, should be widely disseminated and shared with the neighbors. International experiences in this regard should be reviewed. Reference conditions and eventually management classes linked to groundwater resource protection policies should be established.

Establishing regional drought information center

The mission of such a centre would be to improve knowledge, awareness and understanding of droughts and coordinate and facilitate access to information and resources in order to support effective drought management in South Asia. The center can provide services to governments, researchers, NGOs, international donors, etc. The center will maintain a regional network of organizations and may have its publication series or a newsletter. Its functions will include communicating the results of regional activities and initiatives, distributing the products (including reports, data, software, policies etc). Contact nodes in each country can be created to supply information on a routine basis and to respond to specific queries of the Center. This model may be expanded to create similar centers in other parts of Asia. One of the functions of the Center may be the maintenance of a regional drought monitoring system (as described above) and regular reporting on the developing drought condition to the subscribers in the region. The center will also develop and maintain regional anti-drought community of practice and expertise directory. It can be established at one of the international organizations, active in the region.

Regular regional conference

Linked to the above, it is proposed to establish a regular, preferably biennial, regional drought conference on drought research and management. It could operate either as a stand-alone event, or as a side event of the South Asia Water Forums (SAWAFs). A separate regular conference is however preferable to ensure more focus on drought issues. The first such event could be held in 2005 or 2006 (during the next SAWAF forum). It is envisaged that such a conference is attended by the respected ministerial delegates. The regional drought information center may organize this regular conference.

South Asia Drought Encyclopedia / Drought Management Handbook

The wealth of knowledge and experiences exists in various drought-related fields in the region. As part of the ongoing knowledge dissemination, it may be worth producing a Drought Encyclopedia for a region. Such a product would contain the information on relevant drought related terms, tools and methods, drought-related legislation and policies, water harvesting technologies, etc. International and regional experts from different areas will be invited to contribute to the production of such encyclopedia, which will target a broad anti-drought community and general public. IWMI can provide a draft table of contents and a proposal for the development of an encyclopedia/handbook.

Country-specific issues

Many of the issues raised above are of regional significance/scale and will need to be evaluated in a specific context of individual countries of the region. Some country-specific recommendations have been also listed in the previous section and may be further discussed and expanded at the workshop.

Afghanistan represents a special case, where very limited drought coping capacity currently exists. During the last twenty-five years not much research or policy interventions have occurred in the country due to two decades of violence and instability. Rehabilitation of drought coping capacity in the country should include amongst the others, the promotion of water conservation through public education programs in rural and urban areas, assessment of

the efficiency of water use for different crops in agricultural sector and opportunities for substitute crops in drought years, identification of drought risks in different areas of the country, restoration of climate and flow monitoring network, improvement of historical climate and flow data storage, etc.

Linked to this is the issue of a nation-wide assessment of water resources in Afghanistan. This would include using the existing limited observed rainfall and flow data with modern water resources modeling methods to produce hydrological times series for river basins in the country at a fine spatial resolution. This information may then be analyzed to derive region specific hydrological characteristics, which, in turn, could be used for water resources planning and engineering, for reservoir and rural water supply schemes' design, for accurate assessment of water harvesting potential, which collectively will contribute to the alleviation of drought impacts in the country in the long-term.

However, perhaps, the most immediate need for the country in terms of drought preparedness is to demonstrate to policy and decision-makers what is possible to do – the experiences, which are already working in the neighboring countries. This could include, for example, field trips to other drought affected areas e.g. western parts of Rajasthan to show the existing water harvesting structures like tanka, khadins, etc - to leaders in the drought arena in Afghanistan and practitioners or farmers. The reverse field trips to Afghanistan of Indian and Pakistan specialists to examine local conditions and traditional water harvesting structures should also be useful for both sides. These activities are already happening but they need to be expanded and subsidized. Cross breeding of ideas may help in developing knowledge-based drought mitigation approaches in Afghanistan and may improve the situation in the region in general.