

National Drought Management Policy Guidelines

A Template for Action

Integrated Drought Management Programme (IDMP)



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The **National Drought Mitigation Center**, established at the University of Nebraska-Lincoln in 1995, helps people and institutions develop and implement measures to reduce societal vulnerability to drought, stressing preparedness and risk management rather than crisis management. The NDMC collaborates with many federal, state and international agencies.

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Note to the reader:

This publication is part of the 'Integrated Drought Management Tools and Guidelines Series', being compiled by the Integrated Drought Management Programme (IDMP). These *National Drought Management Policy Guidelines* are based on available literature, and draw findings from relevant works wherever possible. These guidelines address the needs of practitioners and policy makers. The publication is considered as a resource guide/material for practitioners and not an academic paper.

This publication is a 'living document' and will be updated based on experiences from its readers. The IDMP encourages water managers and related experts engaged in the management of droughts around the globe to participate in the enrichment of this publication. For this purpose, comments and other inputs are cordially invited. Authorship and contributions will be appropriately acknowledged. Please kindly submit your inputs to the following email address: idmp@wmo.int under Subject: 'National Drought Management Policy Guidelines'.

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Preface

During the opening session of the High-level Meeting on National Drought Policy in March 2013, the Secretary-General of the World Meteorological Organization, Michel Jarraud, stated:

In many parts of the world, the approach to droughts is generally reactive and tends to focus on crisis management. Both at the national and regional scale, responses are known to be often untimely, poorly coordinated and lacking the necessary integration. As a result, the economic, social and environmental impacts of droughts have increased significantly in many regions of the world. We simply cannot afford to continue in a piecemeal mode, driven by crisis rather than prevention. We have the knowledge, we have the experience and we can reduce the impacts of droughts. What we need now is a policy framework and action on the ground for all countries that suffer from droughts. Without coordinated national drought policies, nations will continue to respond to drought in a reactive way. What we need are monitoring and early warning systems to deliver timely information to decision makers. We must also have effective impact assessment procedures, proactive risk management measures, preparedness plans to increase coping capabilities and effective emergency response programmes to reduce the impact of drought.

In 2013, the Secretary-General of the United Nations, Ban Ki-moon, stated:

Over the past quarter-century, the world has become more drought-prone, and droughts are projected to become more widespread, intense and frequent as a result of climate change. The long-term impacts of prolonged drought on ecosystems are profound, accelerating land degradation and desertification. The consequences include impoverishment and the risk of local conflict over water resources and productive land. Droughts are hard to avert, but their effects can be mitigated. Because they rarely observe national borders, they demand a collective response. The price of preparedness is minimal compared to the cost of disaster relief. Let us therefore shift from managing crises to preparing for droughts and building resilience by fully implementing the outcomes of the High-level Meeting on National Drought Policy held in Geneva last March.¹

¹ Complete statement available at <http://www.un.org/sg/statements/?nid=6911>

Acknowledgements

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Overall coordination was provided by Frederik Pischke, WMO/GWP Integrated Drought Management Programme.

Introduction

The implementation of a drought policy based on the philosophy of risk reduction can alter a nation's approach to drought management by reducing the associated impacts (risk). This was the idea that motivated the World Meteorological Organization (WMO), the Secretariat of the United Nations Convention to Combat Desertification (UNCCD), and the Food and Agriculture Organization of the United Nations (FAO), in collaboration with a number of UN agencies, international and regional organizations, and key national agencies, to organize the High-level Meeting on National Drought Policy (HMNDP), which was held in Geneva from 11 to 15 March 2013. The theme of the HMNDP was 'Reducing Societal Vulnerability – Helping Society (Communities and Sectors)!'.

The spiralling impacts of drought on a growing number of sectors is cause for significant concern. No longer is drought primarily associated with the loss or reduction of agricultural production. Today, the occurrence of drought is also associated with significant impacts in the energy, transportation, health, recreation/tourism and other sectors. Equally important is the direct impact of water shortages on water, energy and food security. With the current and projected increases in the incidence of drought frequency, severity and duration as a result of climate change, the time to move forward with a paradigm shift from crisis to risk management is now. This approach is directed at improving the resilience or coping capacity of nations to drought.



The outcomes and recommendations emanating from the HMNDP are drawing increased attention to this issue from governments, international and regional organizations, and non-governmental organizations. One of the specific outcomes of the HMNDP was the launch of the the Integrated Drought Management Programme (IDMP) by the World Meteorological Organization (WMO) and and the Global Water Partnership (GWP). The IDMP is addressing these concerns with a number of partners with the objective of supporting stakeholders at all levels by providing them with policy and management guidance through globally coordinated generation of scientific information and sharing best practices and knowledge for integrated drought management. The IDMP especially seeks to support regions and countries to develop more proactive drought policies and better predictive mechanisms and these guidelines are a contribution to this end.

Drought Policy and Preparedness: Setting the Stage

Drought is a complex natural hazard, and the impacts associated with it are the result of numerous climatic factors and a wide range of societal factors that define the level of societal resilience. Population growth and redistribution and changing consumption and production patterns are two of the factors that define the vulnerability of a region, economic sector or population group. Many other factors, such as poverty and rural vulnerability, weak or ineffective governance, changes in land use, environmental degradation, environmental awareness and regulations, and outdated or ineffective government policies are a few of the factors that also contribute to changing vulnerability.

Although the development of drought policies and preparedness plans can be a challenging undertaking, the outcome of this process can significantly increase societal resilience to these climatic shocks. One of the primary goals of the guidelines presented in this document is to provide a template in order to make the development of national drought policies and associated preparedness plans at the sub-national level less daunting.

Simply stated, a national drought policy should establish a clear set of principles or operating guidelines to govern the management of drought and its impacts. The overriding principle of drought policy should be an emphasis on risk management through the application of preparedness and mitigation² measures (HMNDP, 2013). This policy should be directed toward reducing risk by developing better awareness and understanding of the drought hazard and the underlying causes of societal vulnerability,

along with developing a greater understanding of how being proactive and adopting a wide range of preparedness measures can increase societal resilience. Risk management can be promoted by:

- encouraging the improvement and application of seasonal and shorter-term forecasts
- developing integrated monitoring and drought early warning systems and associated information delivery systems
- developing preparedness plans at various levels of government
- adopting mitigation actions and programmes
- creating a safety net of emergency response programmes that ensure timely and targeted relief
- providing an organizational structure that enhances coordination within and between levels of government and with stakeholders.

The policy should be consistent and equitable for all regions, population groups and economic sectors, and consistent with the goals of sustainable development.

As vulnerability to and the incidence of drought has increased globally, greater attention has been directed to reducing risks associated with its occurrence through better planning to improve operational capabilities (e.g. climate and water supply monitoring, building institutional capacity) and mitigation measures that are aimed at reducing drought impacts. This change in emphasis is long overdue. Mitigating the effects of drought requires the use of all components of the cycle of disaster management (Figure 1), rather than only the crisis management portion of this cycle. Typically, when drought occurs, governments and donors have followed with impact assessment, response, recovery and reconstruction activities to return the region or locality to a pre-disaster state. Historically, little attention has been given to preparedness, mitigation or prediction/early warning actions (i.e. risk management) and

² In the natural hazards field, mitigation measures are commonly defined as actions taken in advance of drought to lessen impacts when the next drought occurs. In contrast, mitigation in the context of climate change is focused on reducing greenhouse gas (GHG) emissions and thereby mitigating or limiting future temperature increases.

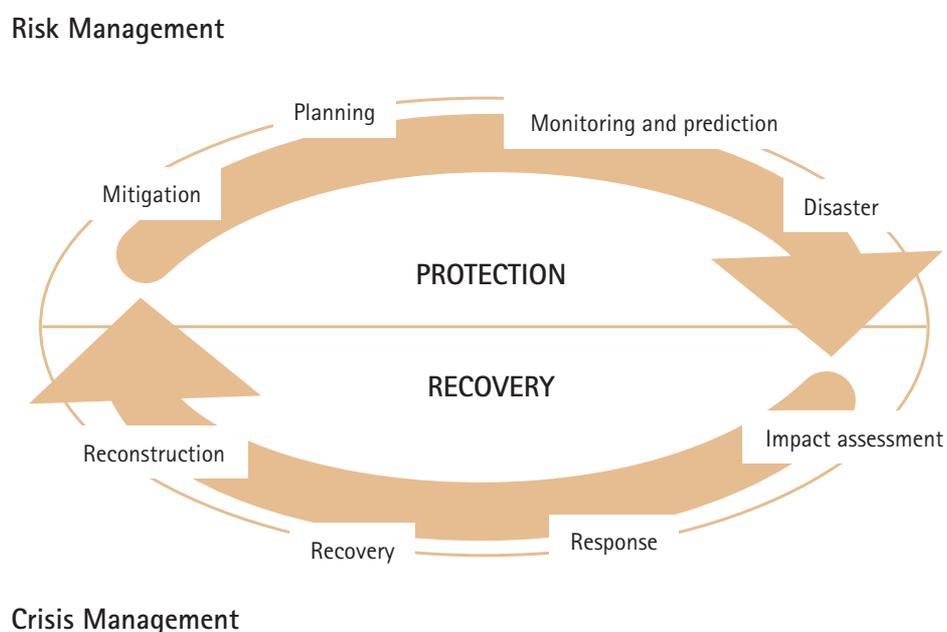
the development of risk-based national drought management policies that could avoid or reduce future impacts and lessen the need for government and donor interventions in the future. Crisis management only addresses the symptoms of drought, as they manifest themselves in the impacts that occur as a direct or indirect consequence of drought. Risk management, on the other hand, is focused on identifying where vulnerabilities exist (particular sectors, regions, communities or population groups) and addresses these risks through systematically implementing mitigation and adaptation measures that will lessen the risk associated with future drought events. Since societies have emphasized crisis management in past attempts at drought management, countries have generally moved from one drought event to another with little, if any, reduction in risk. In addition, in many drought-prone regions, another drought event is likely to occur before the region fully recovers from the last event. If the frequency of drought increases in the future, as

projected for many regions, there will be less recovery time between these events.

Progress on drought preparedness and policy development has been slow for a number of reasons. It is certainly related to the slow-onset characteristics of drought and the lack of a universal definition. Drought shares with climate change the distinction of being a creeping phenomenon – the challenge being getting people to recognize changes that occur slowly or incrementally over a long period of time. These characteristics of drought make early warning, impact assessment and response difficult for scientists, natural resource managers and policy makers. The lack of a universal definition often leads to confusion and inaction on the part of decision makers, since scientists may disagree on the existence and severity of drought conditions (i.e. the onset and recovery time differences between meteorological, agricultural and hydrological drought). Severity is also difficult to characterize since it is best evaluated on the basis

Figure 1. Cycle of disaster management

(Source: National Drought Mitigation Center, University of Nebraska-Lincoln)



of multiple indicators and indices, rather than on the basis of a single variable. The impacts of drought are also largely non-structural and spatially pervasive. These features make it difficult to assess the effects of drought and to respond in a timely and effective manner. Drought impacts are not as visual as the impacts of other natural hazards, making it difficult for the media to communicate the significance of the event and its impacts to the public. Public sentiment to respond is often lacking in comparison to other natural hazards that result in loss of life and property.

Associated with the crisis management approach is the lack of recognition that drought is a normal part of the climate. Climate change and associated projected changes in climate variability will likely increase the frequency and severity of drought and other extreme climatic events. In the case of drought, the duration of these events may also increase. Therefore, it is imperative for all drought-prone nations to adopt a drought management approach that is aimed at risk reduction. This approach will increase resilience to future episodes of drought.

It is important to note that each occurrence of drought provides a window of opportunity to move toward a more proactive risk management policy. Immediately following a severe drought episode, policy makers, resource managers and all affected sectors are aware of the impacts that have occurred and, at this time, the causal factors associated with these impacts (i.e. the roots of the vulnerability) are more easily recognized. Any deficiencies in the response of government or donor organizations could also be more easily identified. There is no better time to approach policy makers with the concept of developing a national drought policy and preparedness plans aimed at increasing societal resilience.

To provide guidance on the preparation of national drought policies and planning techniques, it is important to define the key components of drought policy, its objectives and steps in the implementation process.

An important component of national drought policy is increased attention to drought preparedness in order to build institutional capacity to deal more effectively with this pervasive natural hazard. The lessons learned by a few countries that have been experimenting with this approach will be helpful in identifying pathways to achieve more drought-resilient societies. For this reason, several case studies are included in this document. It is a living document, which will be revised with experiences gained from further case studies.

A constraint to drought preparedness has been the dearth of methodologies available to policy makers and planners to guide them through the planning process. Drought differs in its physical characteristics between climate regimes, and impacts are locally defined by unique economic, social and environmental characteristics. A methodology developed by Wilhite (1991) and revised to incorporate greater emphasis on risk management (Wilhite et al., 2000; 2005) has provided a set of generic steps that can be adapted to any level of government (i.e. national to sub-national) or geographical setting for the development of a drought preparedness plan.

The IDMP, an initiative of the WMO and the GWP, recognizes the urgent need to provide nations with guidelines for the development of national drought management policies. To achieve this goal, the drought preparedness planning methodology referred to above has been modified to define a generic process by which governments can develop a national drought policy and drought preparedness plans at the national and sub-national level that support the principles of that policy. This process is described below with the aim of providing a template that governments or organizations can adapt to their needs to reduce societal vulnerability to drought, thus creating greater resilience for future droughts across all sectors. A national drought policy can be a stand-alone policy or a subset of a natural disaster risk reduction, sustainable development, integrated water resources or climate change adaptation plans that may already exist.

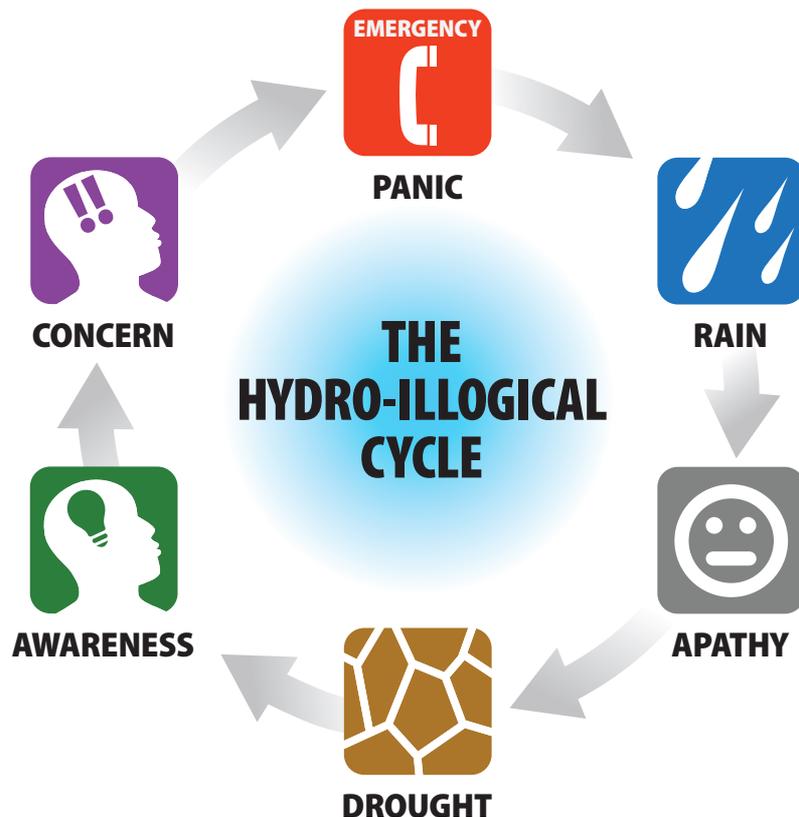
Drought Policy: Characteristics and the Way Forward

As a beginning point in the discussion of drought policy, it is important to identify the various types of drought policies that are available and have been employed for drought management. The first and most common approach followed by both developing and developed nations is post-impact government (or non-government) interventions. These interventions are normally relief measures in the form of emergency assistance programmes aimed at providing money or other specific types of assistance (e.g. livestock feed,

water, food) to the victims (or those experiencing the most severe impacts) of the drought. This reactive approach, characterized by the hydro-illogical cycle (Figure 2) is seriously flawed from the perspective of vulnerability reduction since the recipients of this assistance are not expected to change behaviours or resource management practices as a condition of the assistance. Brazil, a country that has typically followed the crisis management approach, is currently re-evaluating this approach and considering strongly

Figure 2. The hydro-illogical cycle

(Source: National Drought Mitigation Center, University of Nebraska-Lincoln)





the development of a national drought policy that is focused on risk reduction.

Although drought assistance provided through emergency response interventions may address a short-term need, it may in the longer term actually decrease the coping capacity of individuals and communities by fostering greater reliance on these interventions rather than increasing self-reliance. For example, livestock producers that do not maintain adequate on-farm storage of feed for livestock as a drought management strategy will be those that first experience the impacts of extended precipitation shortfalls. These producers will be the first that turn to the government or other organizations for assistance in order to maintain herds until the drought is over and forage supplies return to adequate levels. Likewise, urban communities that have not augmented water supply capabilities in response to population growth or maintained or updated delivery systems may turn to government for assistance during periods of drought-induced water shortages. The shortages that result are the product of poor planning rather than a direct impact of drought. This reliance on the government for relief is contrary to the philosophy of encouraging risk preparedness through an investment by producers, water managers and others to improve their drought coping capacity. Government assistance or incentives that encourage these investments would be a philosophical change in the way governments respond

and would promote a change in the expectations of livestock producers as to the role of government in these response efforts. The more traditional approach of providing relief is also flawed in terms of the timing of assistance being provided. It often takes weeks or months for assistance to be received, at times well beyond the window when the relief would be of greatest value in addressing the impacts of drought. In addition, those livestock producers who previously employed appropriate risk reduction techniques are likely to be ineligible for assistance, since the impacts they experienced were reduced and therefore do not meet the eligibility requirements. This approach rewards those that have not adopted appropriate resource management practices.

Although at times there is a need to provide emergency response to various sectors (i.e. post-impact assessment interventions), it is critically important for the purpose of moving toward a more

Community Based Resilience Analysis in Kenya and Uganda

The Drylands Development Centre of the United Nations Development Programme (UNDP) has demonstrated through Community Based Resilience Analysis (CoBRA) in Kenya and Uganda the existence of 'resilient' households that have been able to sustain their lives and livelihoods without humanitarian aid even in the hardest hit areas. Consultations with these households showed that they are resilient to any hazard because of their strong asset base and diversified risk management options. One of the primary reasons for this higher level of resilience in all four arid and semi-arid assessment areas in Kenya and Uganda was education, not at elementary but higher (secondary or tertiary) levels, which provided them with the knowledge needed to cope with any type of hazard. A higher level of education provided more income-generating opportunities, leading to better access to different goods and services.

Drought Mitigation

As previously noted, mitigation in the context of natural hazards is different from mitigation in the context of climate change, where the focus is on reducing greenhouse gas (GHG) emissions. Mitigation in the context of natural hazards refers to actions taken in advance of drought to reduce impacts in the future.

Drought mitigation measures are numerous, but they may be more confusing to the general public in comparison to mitigation measures for earthquakes, floods and other natural hazards where the impacts are largely structural. Impacts associated with drought are generally non-structural, and thus are less visible, more difficult to assess (e.g. reductions in crop yield) and do not require reconstruction as part of the recovery process. Drought mitigation measures would include establishing comprehensive early warning and delivery systems,

improved seasonal forecasts, increased emphasis on water conservation (demand reduction), increased or augmented water supplies through greater utilization of ground water resources, water reutilization and recycling, construction of reservoirs, interconnecting water supplies between neighbouring communities, drought preparedness planning to build greater institutional capacity and awareness-building and education.

In some cases, such water resource augmentation measures are best developed jointly with a neighbouring state (or country), or at least such measures should be coordinated if they might have an impact on the other riparian state (or downstream use in general). Insurance programmes, currently available in many countries, would also fall into this category of policy types.

proactive risk management approach that the two drought policy approaches described below become the cornerstone of the policy process.

The second type of drought policy approach is the development and implementation of policies and preparedness plans, which include organizational frameworks and operational arrangements developed in advance of drought and maintained between drought episodes by government or other entities. This approach attempts to create greater institutional capacity focused on improved coordination and collaboration within and between levels of government; stakeholders in the primary impact

sectors; and the plethora of private organizations with a vested interest in drought management (i.e. communities, natural resource or irrigation districts or managers, utilities, agribusiness, farmers' organizations and others).

The third type of policy approach emphasizes the development of pre-impact government programmes or measures that are intended to reduce vulnerability and impacts. This approach could be considered a subset of the second approach listed above. In the natural hazards field, these types of programmes or measures are commonly referred to as mitigation measures.

National Drought Management Policy: A Process

The challenges that nations face in the development of a risk-based national drought management policy are complex. The process requires political will at the highest level possible and a coordinated approach within and between levels of government and with the diversity of stakeholders that must be engaged in the policy development process. A national drought policy could be a stand-alone policy. Alternatively, it could contribute to or be a part of a national policy for disaster risk reduction with holistic and multi-hazard approaches that is centered on the principles of risk management (UNISDR, 2009).³

The policy should provide a framework for shifting the paradigm from one traditionally focused on reactive crisis management to one that is focused on a proactive risk-based approach that is intended to increase the coping capacity of the country and thus create greater resilience to future episodes of drought.

The formulation of a national drought policy, while providing the framework for a paradigm shift, is only the first step in vulnerability reduction. The development of a national drought policy must be intrinsically linked to the development and implementation of preparedness and mitigation plans at the sub-national level. These plans will be the instruments through which a national drought policy is executed.

The 10 steps below provide an outline of the process for policy and preparedness planning. The process is intended to be a generic template or road map; in other words, applying this methodology requires adapting it to the current institutional capacity, political infrastructure and technical capacity within the country concerned. It has been modified from a 10-step drought planning process or methodology developed in the United States for application at the state level. Currently, 47 of the 50 US states have developed drought plans, and the majority of these states have followed these guidelines in the preparation or revision of drought plans.⁴

This drought planning methodology has also been followed in other countries in the development of national drought strategies. For example, Morocco applied it beginning in 2000 as part of a process to develop a national drought strategy (see case study on page 20). Their strategy has continued to evolve over the past decade.

The process, originally developed in the early 1990s, has been revised numerous times, placing greater emphasis on mitigation planning with each revision. Now, it has been modified once again to reflect an emphasis on developing a national drought management policy, including the development of drought preparedness plans at the sub-national level that support the goals of a national policy.

³ To this end, the *Hyogo Framework for Action 2005–2015: Building the Resilience of Nations and Communities to Disasters* adopted by member states in 2005, gives strategic directions to cover all phases of disaster risk reduction, from policy and legislation development to institutional frameworks, multi-hazard risk identification, people-centred early warning systems, knowledge and innovation to build a culture of resilience, reduction of underlying risk factors, and strengthening disaster preparedness. Consultations on the implementation of the Hyogo Framework for Action and its successor are under way. This process intends to culminate at the 3rd World Conference on Disaster Risk Reduction agreed on by the UN General Assembly for 14–18 March 2015 in Sendai, Japan.

⁴ Drought planning resources by State. Available at <http://drought.unl.edu/Planning/PlanningInfobyState.aspx>

The 10 steps in the drought policy and preparedness process are:

Step 1: Appoint a national drought management policy commission

Step 2: State or **define** the goals and objectives of a risk-based national drought management policy

Step 3: Seek stakeholder participation; **define** and **resolve** conflicts between key water use sectors, considering also transboundary implications

Step 4: Inventory data and financial resources available and **identify** groups at risk

Step 5: Prepare/write the key tenets of the national drought management policy and preparedness plans, including the following elements: monitoring, early warning and prediction; risk and impact assessment; and mitigation and response

Step 6: Identify research needs and **fill** institutional gaps

Step 7: Integrate science and policy aspects of drought management

Step 8: Publicize the national drought management policy and preparedness plans and **build** public awareness and consensus

Step 9: Develop education programmes for all age and stakeholder groups

Step 10: Evaluate and **revise** national drought management policy and supporting preparedness plans

Step 1: **Appoint a national drought management policy commission**

The process for creating a national drought management policy should begin with the establishment of a national commission to oversee and facilitate policy development. Given the complexities of drought as a hazard, and the cross-cutting nature of managing all aspects of monitoring, early warning, impact assessment, response, mitigation and planning, it is critical to coordinate and integrate the activities of the many agencies/ministries of government at all levels; the private sector, including key stakeholder groups; and civil society. To ensure a coordinated process, the president/prime minister or other key political leader must take the lead in establishing a national drought policy commission. Otherwise, it may not garner the full support and participation of all relevant parties.

The purpose of the commission is twofold. First, the commission will supervise and coordinate the policy development process. This includes bringing together all the necessary resources of the national government and integrating these resources from the various ministries and levels of government in order to develop the policy and supporting preparedness plans. By pooling the government's resources, this initial phase will likely require only minimal new resources coupled with a redirection of existing resources (e.g. financial, data, human) in support of the process. Second, once the policy is developed, the commission will be the authority responsible for the implementation of the policy at all levels of government. The principles of this policy will be the basis for the development and implementation of preparedness or mitigation-based plans at the sub-national level. In addition, the commission will be tasked with the activation of the various elements of the policy during times of drought. The commission will coordinate actions and implement mitigation and response programmes or will delegate this action to governments at the sub-national level. They will also initiate policy recommendations to the political leader

and/or the appropriate legislature body and implement specific recommendations within the authority of the commission and the ministries represented.

The commission should reflect the multidisciplinary nature of drought and its impacts and it should include all appropriate national government ministries. It is also appropriate to consider the inclusion of key drought experts from universities to serve either in an advisory capacity to the commission or as an official member of the body. A representative from the president's office should also be included in order to facilitate communication as well as an awareness of drought impacts, status and actions.

It may also be appropriate to consider the inclusion of representatives from key sectors, professional associations and environmental and public interest groups. If members of these groups are not included, an alternative would be the creation of a citizen's advisory committee composed of these representatives in order for these groups to have a voice in the policy development process and in the identification and implementation of appropriate response and mitigation actions. Having said that, representatives of these groups will also be involved in the development process for the drought preparedness plans at the state/provincial level, so their inclusion on the commission or as a separate citizen's advisory committee may be redundant.

It is also important for the commission to include a public information specialist as an expert on communication strategies. This person can formulate effective communication messages to all media. It is imperative for the commission to communicate with the media with a single voice so the message to the public is clear and concise. Because of the scientific, regional and sectoral complexities of drought, the severity of drought and related impacts, and the wide-ranging response and mitigation programmes/actions that may be involved, the public can be easily confused when information is forthcoming from multiple release points.

Given the wide range of stakeholder groups that will be involved in policy development, implementation and activation, a public participation practitioner should be engaged. This person would be an observer or ex-officio member of the commission and regularly attend commission meetings. This person would also assist in the orchestration of many aspects of the policy development process in order to solicit input from the multitude of stakeholder groups that will be engaged. This person can also ensure that all groups, both well-funded and disadvantaged stakeholder or interest groups, are included in the process.

The composition of the membership of national drought commissions that have been engaged in the policy development process in specific countries may provide useful insights. For example, in Mexico, a national drought programme was announced by the President, Enrique Peña Nieto, on the 10th January 2013. The goals of this programme are early warning and early action to identify preventive actions leading to timely decisions to prevent and/or mitigate the effects of drought.

Step 2: **State or define** the goals and objectives of a risk-based national drought management policy

Drought is a normal part of climate but there is considerable evidence and growing concern that the frequency, severity and duration of droughts are increasing in many parts of the world – or will increase in the future – as a result of anthropogenic climate change. The HMNDP, held in March 2013, was organized largely in response to this concern, as well as the ineffectiveness of the traditional crisis management approach or response to the occurrence of drought. It provided a forum and launched the IDMP.

The essential elements of a national drought management policy, as identified through the HMNDP, are:

- Developing proactive mitigation and planning measures, risk management approaches, and public outreach and resource stewardship.

Mexico's National Programme Against Drought

Recurrent drought in most parts of the country during 2010–2013 led the President of Mexico to announce in January 2013 the National Programme Against Drought (PRONACOSE), to be coordinated by the National Water Commission (CONAGUA). Technical support to the Mexican Government is provided by the WMO/GWP Integrated Drought Management Programme (IDMP).

The objective of PRONACOSE is the development of tools with a new proactive and preventive approach for integrated drought management at the level of the basin councils. The objectives can be summarized as follows:

- Initiate a targeted training programme on the basic concepts of drought and best practices to develop local capacity to ensure the sustainability of integrated drought management in Mexico.
- Raise awareness at the basin level and develop a host of preventive and mitigation measures against droughts.
- Establish an interagency committee to coordinate and direct existing drought programmes, guide and assess PRONACOSE, and fund the actions proposed by stakeholders at the basin level.
- Involve experts and researchers in responding to the identified needs in drought management.
- Develop a communication and outreach programme, which emphasizes vulnerability, participation, prevention and the evolution of drought.

In addition to the five points above, an important element to be factored into the framework of the PRONACOSE is an evaluation mechanism to assess the effectiveness of each implemented activity/strategy and ensure sustainability by including continuous feedback and lessons learned in the various implementation phases.

The PRONACOSE activities are structured under three main activity lines:

- Formulation and implementation of measures to prevent and mitigate drought impacts, including monitoring and early warning.
- Establishment of a legal framework to ensure continuous drinking water supplies during droughts.
- Coordination of institutional response towards drought mitigation measures.

In the framework of the PRONACOSE, CONAGUA monitors droughts on a monthly basis at the basin, state and

municipal levels according to the standard agreed with the North American Drought Monitor Programme in 2013. Weekly Standardized Precipitation Index (SPI) and Silt Density Index (SDI) measurements are taken for major dams and gauging stations and are published on the CONAGUA website.

PRONACOSE is due to run for six years. As a starting point, CONAGUA has developed 26 programmes on drought prevention and mitigation measures (PMPMS) for each basin council, building on the experience of other countries, especially that of the US National Drought Mitigation Center. These programmes address the drought characteristics and vulnerability of each basin. A guide was developed and CONAGUA staff, as well as researchers from 12 national institutions, were trained to standardize activities and contents of the PMPMS. The programmes will be implemented during the second and third years of PRONACOSE, evaluated in the fourth and fifth, and improved and implemented once again from the sixth year. The aim is to ensure ownership of the programmes by the basin councils and a continued gradual implementation beyond Year six.

On 5 April 2013, the Interministerial Commission for the Investigation of Drought and Flooding was created to assess the 26 PMPMS in each basin council, as well as to formulate and guide federal institutions in funding the proposed actions of the councils. A committee of experts has been created to develop and propose strategies and lines of research, as well as to evaluate, guide and support PRONACOSE.

Since the beginning of the programme, a broad outreach campaign focusing on communication and education has proven fundamental. Even though drought is a recurrent phenomenon in Mexico, there is a lack of documentation regarding its drivers as well as its economic and social impacts. Organizing and disseminating historical information is part of the strategy, in order to raise awareness among water users and society in general.

Training on drought evolution and mitigation for all stakeholders and officials in the basin councils has proven crucial. The participation of national and international experts to support local capacity building is a basic premise of PRONACOSE.

- Enhancing collaboration between national, regional and global observation networks and developing information delivery systems that improve public understanding of, and preparedness for, drought.
- Creating comprehensive governmental and private insurance and financial strategies.
- Recognizing the need for a safety net of emergency relief based on sound stewardship of natural resources and self-help at diverse governance levels.
- Coordinating drought programmes and response efforts in an effective, efficient and customer-oriented manner.

Following the formation of the commission, its first official action should be to establish specific and achievable goals for the national drought policy and a timeline for implementing the various aspects of the policy, as well as a timeline for achieving the goals. Several guiding principles should be considered as the commission formulates a strategy to move from crisis management to a drought risk reduction approach. First, assistance measures, if employed, should not discourage agricultural producers, municipalities and other sectors or groups from the adoption of appropriate and efficient management practices that help to alleviate the effects of drought (i.e. assistance measures should reinforce the goal of increasing resilience or coping capacity to drought events). Those assistance measures employed should help to build self-reliance to future drought episodes. Second, assistance should be provided in an equitable (i.e. to those most affected), consistent and predictable manner to all without regard to economic circumstances, sector or geographic region. It is important to emphasize that the assistance provided is not counter-productive or a disincentive to self-reliance. Third, the protection of the natural and agricultural resource base is paramount, so any assistance or mitigation measures adopted must not run counter to the goals and objectives of the national drought policy and long-term sustainable development goals.

As the commission begins its work, it is important to inventory all emergency response and mitigation programmes that are available through the various ministries at the national level. It is also important to assess the effectiveness of these programmes and past disbursement of funds through these programmes. A similar exercise should be implemented at the state or provincial level in association with the development of drought preparedness and mitigation plans.

To provide guidance in the preparation of national drought policies and planning techniques, it is important to define the key components of drought policy, its objectives, and steps in the implementation process. Commission members, supporting experts and stakeholders should consider many questions as they define the goals of the policy:

- What is the purpose and role of government in drought mitigation and response efforts?
- What is the scope of the policy?
- What are the country's most vulnerable economic and social sectors and regions?
- Historically, what have been the most notable impacts of drought?
- Historically, what has been the government's response to drought and what has been its level of effectiveness?
- What is the role of the policy in addressing and resolving conflict between water users and other vulnerable groups during periods of shortage?
- What current trends (e.g. climate, drought incidence, land and water use, population growth) may increase/vulnerability and conflicts in the future?
- What resources (human and financial) is the government able to commit to the planning process?
- What other human and financial resources are available to the government (e.g. climate change adaptation funds)?
- What are the legal and social implications of the plan at various jurisdictional levels, including those extending beyond the state borders?
- What principal environmental concerns are exacerbated by drought?

A generic statement of purpose for the drought policy and preparedness plans is to reduce the impacts of drought by identifying principal activities, groups or regions most at risk and developing mitigation actions and programmes that reduce these vulnerabilities. The policy should be directed at providing government with an effective and systematic means of assessing drought conditions, developing mitigation actions and programmes to reduce risk in advance of drought, and developing response options that minimize economic stress, environmental losses and social hardships during drought.

Step 3: **Seek stakeholder participation; define and resolve conflicts between key water use sectors, considering also transboundary implications**

As noted in Step 1, a public participation specialist is an important contributor in the policy development process because of the complexities of drought as it intersects with society's social, economic and environmental sectors, and the dependence of these sectors on access to adequate supplies of water in support of diverse livelihoods. As drought conditions intensify, competition for scarce water resources increases and conflicts often arise. These conflicts cannot be addressed during a crisis and thus it is imperative for potential conflicts to be addressed during non-drought periods when tension between these groups is minimal. As a part of the policy development process, it is essential to identify all citizen groups (i.e. stakeholders), including the private sector, that have a stake in the process and their interests. These groups must be involved early and continuously for fair representation to ensure an effective drought policy development process at

the national and sub-national levels. In the case of transboundary rivers, international obligations under agreements to which the state is a party should also be taken into account. Discussing concerns early in the process gives participants a chance to develop an understanding of one another's various viewpoints, needs and concerns, leading to collaborative solutions. Although the level of involvement of these groups will vary notably from country to country and even within countries, the power of public interest groups in policy making is considerable in many settings. In fact, these groups are likely to impede progress in the policy development process if they are not included in the process. The commission should also protect the interests of stakeholders who may lack the financial resources to serve as their own advocates. One way to facilitate public participation is to establish a citizen's advisory council (as noted in Step 1) as a permanent feature of the commission's organizational structure in order to keep information flowing and address/resolve conflicts between stakeholders.

A national drought policy development process must be multi-level and multi-dimensional in its approach, as noted in the example of Mexico (above). In the case of Mexico, 26 district basin plans are being developed in concert with the national drought programme initiative. Thus, the goals of basin plans should mirror or reflect national policy goals. State or provincial governments need to consider if district or regional advisory councils should be established and what their composition might be. These councils could bring stakeholder groups together to discuss their water use issues and problems and seek collaborative solutions in advance of the next drought.

Step 4: **Inventory data and financial resources available and identify groups at risk**

An inventory of natural, biological, human and financial resources, including the identification of constraints that may impede the policy development,

United States Drought Management, Policy and Preparedness

Drought is a normal part of the climate for virtually all portions of the United States; it is a recurring, inevitable feature of climate that results in serious economic, environmental and social impacts. In 1995, the Federal Emergency Management Agency (FEMA) estimated average annual losses due to drought in the US to be US\$6–8 billion, more than for any other natural hazard. The recent 2012 drought resulted in impacts estimated at between US\$35 and US\$70 billion. Yet the US has, historically, been ill-prepared for the recurrence of severe drought and responds, like most nations, with a reactive, crisis management approach, focusing on responding to the symptoms (impacts) of drought through a wide assortment of emergency response or relief programmes. These programmes can best be characterized as too little and too late. More importantly, drought relief does little if anything to reduce the vulnerability of the affected area to future drought events. Today, the nation has a better understanding of the pathway needed for improving drought management, which will require a new paradigm, one that encourages preparedness and mitigation through the application of the principles of risk management.

Beginning in the early 1980s, a growing number of states have developed drought plans. To date, 47 of the 50 states have developed such plans and, of these, 11 are more proactive, stressing the importance of mitigation in the preparedness process. The majority of states have relied upon the 10-step drought planning process as a guide in the plan preparation process, either by directly applying the process or by replicating the plans of other states that have followed this 10-step process.

The most significant progress in drought preparedness at the state level has occurred since the mid-1990s and, especially, since 2000. In these recent years, there has been a stronger emphasis on mitigation. This progress can be attributed largely to several key factors. First, a series of significant droughts have affected nearly all portions of the country since 1996 and, in many cases, for five to seven consecutive years. These events have raised the awareness of drought within the science and policy communities, as well as with the public. The US Drought Monitor Map, a weekly product produced since 1999 through a partnership between the National Drought Mitigation Center at the University of Nebraska, the National Oceanic and Atmospheric Administration and the US Department of Agriculture, has helped to raise awareness of drought conditions and impacts across the nation. It is highly regarded by both federal and state government as an excellent integrated approach to characterize the severity of drought and its spatial dimensions across the nation. The US Drought Monitor Map is not only used effectively at the federal level but also by states for drought assessment and as a trigger for drought response and mitigation programmes. Second, the spiralling impacts of drought and the increasing number of key sectors affected, as well as the conflicts between sectors, has elevated the importance of drought

preparedness within the policy community at all levels. Third, the creation of the National Drought Mitigation Center (NDMC) at the University of Nebraska in 1995 has resulted in increased attention on issues of drought monitoring, impact assessment, mitigation and preparedness. Many states have benefited from the existence of this expertise to guide the drought planning process. This is especially noticeable through the trend in the number of states developing or revising plans with a substantial emphasis on mitigation. As states have moved along the continuum from response to mitigation planning, there is an increasing need for better and timelier information on drought status and early warning, including improved seasonal forecasts and the delivery of that information to decision makers and other users of that information. It is also important for these users or stakeholders to be involved in the development of products or decision support tools to ensure that their concerns and needs are being met.

Although the US has not developed a national drought policy, there has been considerable pressure from states for the federal government to move towards a risk-based national drought policy. This pressure has been quite effective and led to the introduction of legislation in the US Congress directed at improved preparedness and early warning. The National Drought Policy Act of 1998 created a National Drought Policy Commission (NDPC) charged with making recommendations to the US Congress on future approaches to drought management. The final report of the Commission was submitted to Congress in 2000 and included a recommendation that the US move forward with the development of a national drought policy based on the principles of risk management (NDPC, 2000). The National Drought Preparedness Act, largely embodying the most significant recommendations from the NDPC, was introduced in Congress in 2001, and then reintroduced in 2003 and 2005. Although this bill did not pass and become law, it did generate another bill, the National Integrated Drought Information System (NIDIS) Act, which passed Congress in 2006 and was signed by the President later that year. This system (NIDIS) has been implemented by the National Oceanic and Atmospheric Administration (NOAA) with partners from other federal agencies, state and regional organizations and universities. NIDIS was recently reauthorized for a period of five years by the US Congress.

Largely in response to the severe drought of 2012 in the US, which at its peak affected 65% of the contiguous states, the Obama Administration authorized the creation of a National Drought Resilience Partnership through an Executive Order in November 2013. This partnership includes seven federal agencies with the goal of assisting communities to better prepare for and reduce the impact of drought events on communities, families and businesses. This action by the President has the potential to continue moving the US on a path towards a risk-based national drought policy as part of the Administration's Climate Change Action Plan.

may need to be initiated by the commission. In many cases, much information already exists about natural and biological resources through various provincial and national agencies/ministries. It is important to determine the vulnerability of these resources to periods of water shortage that result from drought. The most obvious *natural* resource of importance is water (i.e. location, accessibility, quantity, quality), but a clear understanding of other natural resources such as climate and soils is also important. *Biological/ecological resources* refer to the quantity and quality of grasslands/rangelands, forests, wildlife, wetlands and so forth. *Human resources* include the labour needed to develop water resources, lay pipelines, haul water and livestock feed, process and respond to citizen complaints, provide technical assistance, provide counselling and direct citizens to available services.

It is also imperative to identify constraints to the policy development process and to the activation of the various elements of the policy and preparedness plans as drought conditions develop. These constraints may be physical, financial, legal or political. The costs associated with policy development must be weighed against the losses that are likely to result if no plan is in place (i.e. the cost of inaction). As stated previously, the goal of a national drought policy is to reduce the risk associated with drought and its economic, social and environmental impacts. Legal constraints can include water rights, existing public trust laws, requirements for public water suppliers, transboundary agreements (e.g. specifying that a certain volume or share of river flow across the border has to be guaranteed) and liability issues.

The transition from crisis to risk management is difficult because, historically, little has been done to understand and address the risks associated with drought. To solve this problem, areas of high risk should be identified, as should actions that can be taken before a drought occurs to reduce those risks. Risk is defined by both the exposure of a location to the drought hazard and the vulnerability of

that location to periods of drought-induced water shortages (Blaikie et al., 1994). Drought is a natural event; it is important to define the exposure (i.e. frequency of drought of various intensities and durations) of various parts of the country, province or watershed to the drought hazard. Some areas are likely to be more at risk than others because of greater exposure to the hazard, which inhibits or shortens the recovery time between successive droughts. As a result of current and projected changes in climate and the frequency of occurrence of extreme climatic events, such as droughts, it is important to assess historical as well as projected future exposure to droughts. Vulnerability, on the other hand, is affected by social factors such as population growth and migration trends, urbanization, changes in land use, government policies, water use trends, diversity of economic base and cultural composition. The commission can address these issues early in the policy development process, but the more detailed work associated with this risk or vulnerability process will need to be directed to specific working groups at the state or provincial level as they embark on the process of drought preparedness planning. These groups will have more precise local knowledge and will be better able to garner input from local stakeholder groups.

Step 5:

Prepare/write the key tenets of the national drought management policy and preparedness plans, including the following elements: monitoring, early warning and prediction; risk and impact assessment; and mitigation and response

Drought preparedness/mitigation plans, as stated earlier, are the instruments through which a national drought policy is carried out. It is essential for these plans to reflect the principles of the national drought policy, which is centred on the concept of risk reduction. What is defined below is the creation of institutional capacity that should be replicated within each state or province within a country, with formal

communication and reporting links to a national drought commission.

At the outset, it is important to point out that preparedness planning can take two forms. The first form: response planning, is directed toward the creation of a plan that is activated only during drought events and usually for the purpose of responding to impacts. This type of planning is reactive and the responses that are forthcoming, whether from national or state government or donor organizations, are intended to address specific impacts on sectors, population groups and communities and, therefore, reflect the key areas of societal vulnerability. In essence, responding to impacts through emergency measures addresses only the symptoms of drought (impacts) and these responses are usually untimely, poorly coordinated and often poorly targeted to those most affected. As noted earlier, this largely reactive approach actually leads to an increase in societal vulnerability since the recipients of drought relief or assistance programmes become dependent on government and other programmes through the assistance provided to survive the crisis. This approach discourages the development of self-reliance and implementation of improved resource management practices that will reduce risk in the longer term. Stated another way, why should the potential recipients of emergency assistance institute more proactive mitigation measures if government or others are likely to bail them out of a crisis situation? Emergency measures are appropriate in some cases, particularly with regard to providing humanitarian assistance, but they need to be used sparingly and be compatible with the longer-term goals of a national drought policy that is focused on improving resilience to future events.

The second form of preparedness planning is mitigation planning. With this approach, the vulnerabilities to drought are identified as part of the planning process through the analysis of both historical and more recent impacts of droughts. These impacts represent those sectors, regions and

population groups that are most at risk. The planning process can then focus on identifying actions and governmental or non-governmental authorities that can assist in providing the necessary resources to reduce the vulnerability. In support of a risk-based national drought policy, mitigation planning is the best choice if risk reduction is the goal of the planning process. The discussion below shows how states/provinces might go about creating a plan that emphasizes mitigation.

Each drought task force at the sub-national level should identify the specific objectives that support the goals of the plan. The objectives that should be considered include the following:

- Collect and analyse drought-related information in a timely and systematic manner.
- Establish criteria for declaring drought emergencies and triggering various mitigation and response activities.
- Provide an organizational structure and delivery system that ensures information flow between and within levels of government and to decision makers at all levels.
- Define the duties and responsibilities of all agencies or ministries with respect to drought.
- Maintain a current inventory of government programmes used in assessing and responding to drought emergencies and in mitigating impacts in the longer term, if available.
- Identify drought-prone areas of the state and vulnerable economic sectors, individuals or environments.
- Identify mitigation actions that can be taken to address vulnerabilities and reduce drought impacts.
- Provide a mechanism to ensure timely and accurate assessment of the impacts of drought on agriculture, industry, municipalities, wildlife, tourism and recreation, health and other areas.
- Keep the public informed of current conditions and response actions by providing accurate and timely information to the media in print and electronic form (e.g. via TV, radio and the Internet).

- Establish and pursue a strategy to remove obstacles to the equitable allocation of water during shortages and establish requirements or provide incentives to encourage water conservation.
- Establish a set of procedures to continually evaluate and exercise the plan and periodically revise the plan so it will remain responsive to local needs and reinforce national drought policy.

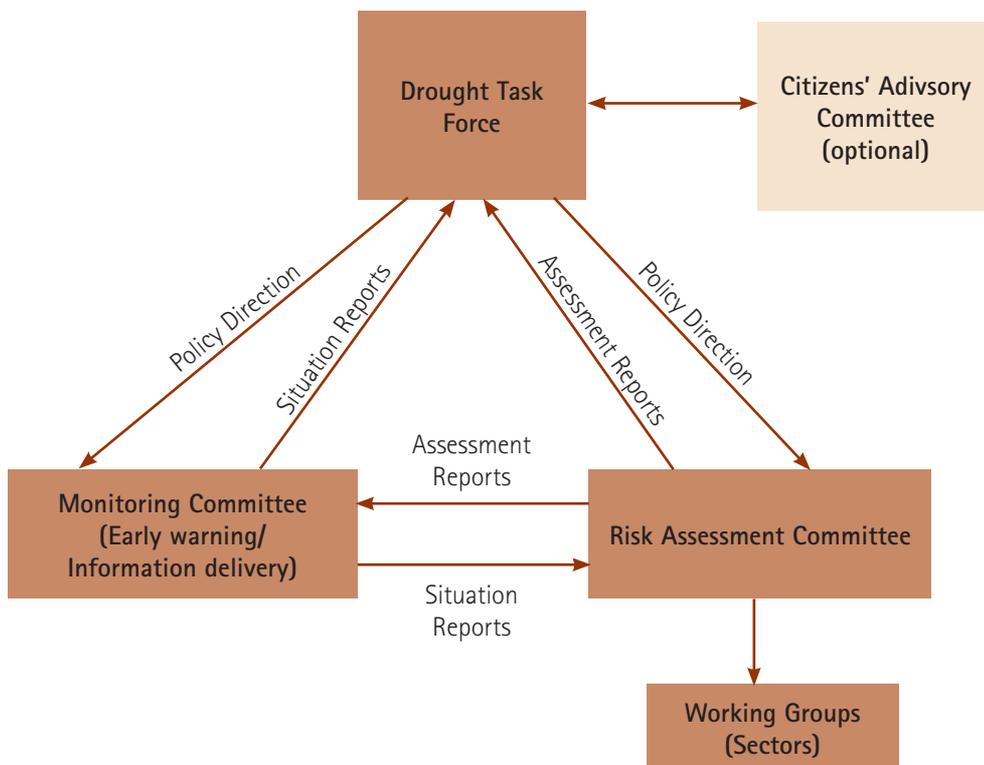
The development of a drought preparedness plan that emphasizes mitigation begins with the establishment of a series of committees to oversee the development of the institutional capacity necessary for the plan as well as its implementation and application during times of drought when the various elements of the plan are activated. At the heart of the mitigation plan is the formation of a drought task force at the

sub-national level (e.g. state or province, community) that mirrors to a large extent the makeup of the national drought commission (i.e. representatives from multiple agencies/ministries, key stakeholder groups). The organizational structure for the drought plan (Figure 3) reflects the three primary elements of the plan: monitoring, early warning and information delivery; risk and impact assessment; and mitigation, preparedness and response. It is recommended that a committee is established to focus on the first two of these requirements; the drought task force can, in most instances, carry out the mitigation and response functions since these are heavily policy oriented.

These committees will have their own tasks and goals, but well-established communication and information flow between committees and the task force is a necessity to ensure effective planning.

Figure 3. Drought preparedness and mitigation plan organizational structure

(Source: National Drought Mitigation Center, University of Nebraska-Lincoln)



Morocco's Integrated Drought Management System

Drought is a recurrent natural phenomenon of Morocco's climate. A dendrochronological study undertaken in the early 1980s helped reconstruct the history of drought over the last millennium (Year 1000–1984). It showed over 89 droughts of one to six years duration, with an average occurrence interval of about 11 years. The average duration of a drought is around 1.6 years with the 20th Century having been one of the driest in the last nine centuries.

Morocco's experience over the years has allowed the country to gradually establish an integrated drought management system, structured around three essential elements:

1. **A monitoring and early warning system:** Morocco has developed national institutional and technical capacities particularly in the areas of climate modelling, remote sensing and crop forecasting. A national Drought Observatory was established in 2000 to improve forecasting, assess impacts and develop strategies and tools for decision support and drought preparedness.
2. **Emergency operational plans to alleviate the impacts of drought:** Morocco has longstanding experience in the development and implementation of programmes to alleviate the impacts of drought. These programmes are based on interventions aimed at:
 - securing safe drinking water for rural populations in particular
 - preserving livestock through feed distribution
 - implementing income and job-creating activities (maintenance of rural roads and irrigation infrastructures)
 - conserving forests and natural resources.
3. **A long-term strategy to reduce vulnerability to drought:** This strategy is based on a risk management approach that reduces the vulnerability to drought of the national economy as a whole and of agriculture and

the rural economy in particular. It involves a diverse and multidimensional array of policies that take into account the drought risk in its geographical diversity and economic and social implications, as well as in its long-term recurrence. The three pillars of the strategy are:

- An integrated approach to water resources management through mutually reinforcing policy and institutional reforms, as well as the development of a long-term investment programme aimed at capturing most of the remaining runoff potential and developing accompanying hydropower infrastructure to reduce energy imports.
- Improving access to water supply and sanitation and increasing waste water treatment capacity through optimized financing strategies and increased budget support for public good infrastructure (rural water supply, sanitation and pollution control, service extension to poor peri-urban areas). A National Sanitation Plan has been established for 2006–2030 with a pollution abatement objective of 60%.
- Conserving water and improving efficiency, productivity, cost effectiveness and the sustainability of irrigated agriculture are increasingly necessary if Morocco's economic growth is to continue. In this context, an integrated approach has been adopted, along with the expansion investments, to drive improvements in three major interrelated areas: (i) improving the hydraulic efficiency of irrigation systems; (ii) strengthening the managerial capacities of irrigation agencies; and (iii) increasing productivity. A comprehensive National Plan for Conservation of Irrigation Water has been developed to increase the efficiency of on-farm irrigation water usage, improve water cost recovery and asset management in public irrigation perimeters and promote public-private partnerships for irrigation development and management.

Monitoring, early warning and information delivery committee

A reliable assessment of water availability and its outlook for the near and long term is valuable information in both dry and wet periods. During drought, the value of this information increases markedly. A monitoring committee should be a part of each state or provincial committee since it is important to interpret local conditions and impacts and communicate this information to the national drought policy commission and its representative from the national meteorological service. In some instances, a monitoring committee may be set up for certain regions with similar climatic conditions and exposure to drought, rather than for each state or province. However, the makeup of this committee should include representatives from all agencies with responsibilities for monitoring climate and water supply. It is recommended that data and information on each of the applicable indicators (e.g. precipitation, temperature, evapotranspiration, seasonal climate forecasts, soil moisture, streamflow, ground water levels, reservoir and lake levels and snowpack) are considered in the committee's evaluation of the water situation and outlook. The agencies responsible for collecting, analysing and disseminating data and information will vary considerably from country to country and province to province. Also, the

data included in systematic assessments of water availability and future outlooks will need to be adjusted for each setting to include those variables of greatest importance for local drought monitoring.

The monitoring committee should meet regularly, especially in advance of the peak demand season and/or beginning of the rainy season(s). Following each meeting, reports should be prepared and disseminated to the provincial-level drought task force, the national drought policy commission and the media. The chairperson of the monitoring committee should be a permanent member of the provincial drought task force. In many countries, this person would be the representative from the national meteorological service. If conditions warrant, the task force leadership should brief the provincial governor or appropriate government official about the contents of the report, including any recommendations for specific actions. Public dissemination of information should be screened by a public information specialist to avoid confusing or conflicting reports on the current conditions.

The primary objectives of the monitoring committee are to:

- Adopt a workable definition of drought that could be used to phase in and phase out levels of state and national mitigation actions and emergency measures associated with drought conditions. It may be necessary to adopt more than one definition of drought to identify the impacts in various economic, social and environmental sectors since no single definition of drought applies in all cases.

The committee will need to consider appropriate indicators (e.g. precipitation, temperature, soil moisture, streamflow) and indices as integral to the water supply assessment process. Many indices are available and the strengths and weaknesses of each index should be carefully considered. The trend is to rely on multiple drought indices to trigger mitigation and response actions, which are



Drought Management in Brazil

Brazil has a rich history of coping with and managing droughts, particularly in the semi-arid northeast. The extreme drought that has beset the region since 2012 has caused significant crop and cattle losses, and has reduced many reservoirs to critically low levels. This drought has grabbed the attention of the broader Brazilian population, the media, decision makers and international experts. Brazil is now taking progressive action to reform drought management and planning; particularly to move from reactive crisis management to proactive risk-based management of droughts.

Brazil played an active role in the High Level Meeting on National Drought Policy (HMNDP) in Geneva in March 2013. The Government of Brazil (under the leadership of the Ministry of National Integration) followed up on the meeting. It partnered with the UN organizations involved

in the HMNDP to plan and host a Latin America regional workshop to build drought policy and management capacity. The workshop, held in December 2013 in Fortaleza, Ceará, engaged governments from Latin America and the Caribbean region to help conduct a 10-step planning process for developing a national drought policy.

Meanwhile, several activities at the national, regional, state and local levels in Brazil over the next year will draw further attention to the issue of drought. These include the organization of a formal process for the federal and state governments to discuss the composition of a national drought policy and the design and implementation of a Northeast Drought Monitor, among others. The convergence of such efforts presents a unique opportunity for Brazil to make significant progress on improving drought preparedness and resilience over the coming years.

calibrated to various intensities of drought and/or impacts. The current thought is that no single index of drought is adequate to measure the complex interrelationships between the various elements of the hydrological cycle and impacts.

It is helpful to establish a sequence of descriptive terms for drought and water supply alert levels, such as 'advisory', 'alert', 'emergency' and 'rationing' (as opposed to more generic terms such as 'phase 1' and 'phase 2', or sensational terms such as 'disaster'). It would be helpful to review the terminology used by other entities (i.e. local utilities, irrigation districts, river basin authorities) and choose terms that are consistent so as not to confuse the public with different terms in areas where there may be authorities with overlapping regional responsibilities. Consistency of terminology between state preparedness plans is essential. These alert levels should be defined in discussions with both the risk assessment committee and the provincial task force.

In considering emergency measures such as rationing, it is important to remember that the impacts of drought may vary significantly from one area to the next, depending on the sources and uses of water and the degree of planning previously implemented. For example, some cities may have expanded their water supply capacity while other adjacent communities may have an inadequate water supply capacity during periods of drought. Imposing general emergency measures on people or communities without regard for their existing vulnerability may result in political repercussions and loss of credibility.

A related consideration is that some municipal water systems may be out of date or in poor operating condition, so that even moderate drought strains a community's ability to supply customers with water. Identifying inadequate (i.e. vulnerable) water supply systems and putting in place programmes to upgrade those systems should be part of a long-term drought mitigation strategy.

- Establish drought management areas (i.e. subdivide the province or region into more conveniently sized districts by political boundaries, shared hydrological characteristics, climatological characteristics or other means such as drought probability or risk). These subdivisions may be useful in drought management since they may allow drought stages and mitigation and response options to be regionalized as the severity of drought changes over time.
- Develop a drought monitoring system. The quality of meteorological and hydrological networks is highly variable from country to country and region to region within countries (e.g. number of stations, length of record, amount of missing data). Responsibility for collecting, analysing and disseminating data is divided between many government authorities. The monitoring committee's challenge is to coordinate and integrate the analysis so decision makers and the public receive early warning of emerging drought conditions.

Considerable experience has been gained in recent years with automated weather data networks that provide rapid access to climate data. These networks can be invaluable in monitoring emerging and ongoing drought conditions. The experiences of regions with comprehensive automated meteorological and hydrological networks should be investigated and lessons learned should be applied, where appropriate. It is essential that automated weather networks are established and networked in order to retrieve the data in a timely manner.

- Inventory data quantity and quality from current observation networks. Many networks monitor key elements of the hydrologic system. Most of these networks are operated by national or provincial agencies, but other networks may also exist and could provide critical information for a portion of a province or region. Meteorological

data are important but represent only one part of a comprehensive monitoring system. These other physical indicators (soil moisture, streamflow, reservoir and groundwater levels, etc.) must be monitored to reflect the impacts of drought on agriculture, households, industry, energy production, transportation, recreation and tourism and other water use sectors.

It is also imperative to establish a network of observers to gather impact information from all of the key sectors affected by drought and to create an archive of this information. Both quantitative and qualitative information is important. The value of this information is two-fold. First, it is of pronounced importance in assisting researchers and managers to identify the linkages or correlations between thresholds of various drought indices and indicators and the emergence of specific impacts. It is those correlations between indices/indicators and impacts that can be used to trigger a wide range of mitigation actions as key components of the preparedness plan, which is based on the principles of risk reduction. Second, the establishment of an archive of drought impacts will illustrate the trend in impacts over time on specific sectors. This information is critically important to policy makers who must demonstrate how those investments in mitigation measures up front are paying off in the longer term through vulnerability reduction, as measured by reduced impacts and government expenditures on drought assistance.

- Determine the data needs of primary users for information and decision support tools. Developing new or modifying existing data collection systems is most effective when the people who will be using the data are consulted early and often to determine their specific needs or preferences and the timing of critical decision points. Soliciting input on expected new products/decision support tools or obtaining feedback on existing products is critical to ensuring that products meet the

needs of primary users and, therefore, will be used in decision making. Training on how to use or apply products in routine decision making is also essential.

- Develop and/or modify current data and information delivery systems. People need to be warned of drought as soon as it is detected, but often they are not. Information must reach people in time for them to use it in making decisions. In establishing information channels, the monitoring committee needs to consider when people need what kinds of information. Knowledge of these decision points will make a difference as to whether the information provided is used or ignored.

Risk assessment committee

Risk is the product of exposure to the drought hazard (i.e. probability of occurrence) and societal vulnerability, represented by a combination of economic, environmental and social factors. Therefore, in order to reduce vulnerability to drought, it is essential to identify the most significant impacts and assess their underlying causes. Drought impacts cut across many sectors and across normal divisions of government authority.

Membership of the risk assessment committee should include representatives or technical experts from the economic sectors, social groups and ecosystems most at risk from drought. The committee's chairperson should be a member of the drought task force to ensure seamless reporting. Experience has demonstrated that the most effective approach to follow in determining vulnerability to and impacts of drought is to create a series of working groups under the aegis of the risk assessment committee. The responsibility of the committee and working groups is to assess sectors, population groups, communities and ecosystems most at risk and identify appropriate and reasonable mitigation measures to address these risks.

Working groups would be composed of technical specialists representing those areas referred to above. The chair of each working group, as a member of the risk assessment committee, would report directly to the committee. Following this model, the responsibility of the risk assessment committee is to direct the activities of each of the working groups. These working groups will then make recommendations to the drought task force on mitigation actions to consider for inclusion in the mitigation plan. Mitigation actions are identified in advance and implemented in order to reduce the impacts of drought when it occurs. Some of these actions represent programmes that are long-term in nature while others may be actions that are activated when drought occurs. The activation of these measures at appropriate times is determined by the triggers (i.e. indicators and indices) identified by the monitoring committee in association with the risk assessment committee in relation to the key impacts (i.e. vulnerabilities) associated with drought.

The number of working groups that are set up under the risk assessment committee will vary considerably between provinces, states or river basins, reflecting the principal impact sectors of importance to the region and their respective vulnerabilities to drought due to differences in the exposure to drought (frequency and severity) and the most important economic, social and environmental sectors. More complex economies and societies will require a larger number of working groups to reflect these sectors. It is common for the working groups to focus on some combination of the following sectors: agriculture, recreation and tourism, industry, commerce, drinking water supplies, energy, environment and ecosystem health, wildfire protection and health.

To assist in the drought preparedness and mitigation process, a methodology is proposed to identify and rank (prioritize) drought impacts through an examination of the underlying environmental, economic and social causes of these impacts, followed by the selection of actions that will address these underlying causes. What makes this

methodology different and more helpful than previous methodologies is that it addresses the causes behind drought impacts. Previously, responses to drought have been reactive in nature and focused on addressing a specific impact, which is a symptom of the vulnerability that exists. Understanding why specific impacts occur provides the opportunity to lessen these impacts in the future by addressing these vulnerabilities through the identification and adoption of specific mitigation actions. Other vulnerability or risk assessment methodologies exist and nations are encouraged to evaluate these for application in their specific setting (Wilhelmi and Wilhite, 2002; Iglesias et al., 2009; Sonmez et al., 2005).

The methodology proposed here is divided into six specific tasks. Once the risk assessment committee establishes the working groups, each of these groups would follow this methodology in the risk assessment process.

Task 1. Assemble the team

It is essential to bring together the right people and supply them with adequate data to make fair, efficient and informed decisions pertaining to drought risk. Members of this group should be technically trained in the specific topic areas covered by each working group. Also important is the need to include public input and consideration when dealing with the issues of appropriateness, urgency, equity and cultural awareness in drought risk analysis. Public participation could be warranted at every step, but time and money may limit their involvement to key stages in the risk analysis and planning process (public review vs. public participation). The amount of public involvement is at the discretion of the drought task force and other members of the planning team. The advantage of publicly discussing questions and options is that the procedures used in making any decision will be better understood, and it will also demonstrate a commitment to participatory management. At a minimum, decisions and reasoning should be openly documented to build public trust and understanding.

The choice of specific actions to deal with the underlying causes of the drought impacts will depend on the economic resources available and related social values. Typical concerns are associated with cost and technical feasibility, effectiveness, equity and cultural perspectives. This process has the potential to lead to the identification of effective and appropriate drought risk reduction activities that will reduce long-term drought impacts, rather than ad hoc responses or untested mitigation actions that may not effectively reduce the impact of future droughts.

Task 2. Drought impact assessment

Impact assessment examines the consequences of a given event or change. For example, drought is typically associated with a number of outcomes that result from the shortage of water, either directly or indirectly. Drought impact assessments begin by identifying direct consequences of the drought, such as reduced crop yields, livestock losses and reduced reservoir levels. These direct outcomes can then be traced to secondary consequences (often social effects), such as the forced sale of household assets, food security, reduced energy production, dislocation or physical and emotional stress. This initial assessment identifies drought impacts but does not identify the underlying reasons for these impacts.

The impacts from drought can be classified as economic, environmental or social, even though many impacts may span more than one sector. A detailed checklist of impacts that could affect a region or location is provided in Annex 1. This list should be expanded to include other impacts that may be important for the region. Recent drought impacts, especially if they are associated with severe to extreme drought, should be weighted more heavily than the impacts of historical drought (in most cases), since they better reflect current vulnerabilities, which is the purpose of this exercise. Attention should also be given to specific impacts that are expected to emerge or increase in magnitude because of new vulnerabilities resulting from recent or projected societal changes or changes in drought incidence.

It is appropriate at this point to classify the types of impacts according to the severity of drought, noting that, in the future, droughts of lesser magnitude may produce more serious impacts as vulnerability increases. Hopefully, interventions taken now will reduce these vulnerabilities in the future. It is also important to identify the 'drought of record' for each region. Droughts differ from one another according to intensity, duration and spatial extent. Thus, there may be several droughts of record, depending on the criteria emphasized (i.e. most severe drought of a season or one-year duration versus most severe multi-year droughts). These analyses would yield a range of impacts related to the severity of drought. In addition, by highlighting past, current and potential impacts, trends may become evident that will also be useful for planning purposes. These impacts highlight sectors, populations or activities that are vulnerable to drought, and when evaluated with the probability of drought occurrence, they help identify varying levels of drought risk.

Task 3. Ranking impacts

After each working group has completed the checklist in Annex 1, the unchecked impacts can be omitted from further consideration. This new list will contain the relevant drought impacts for each location or activity. From this list, impacts should be ranked/prioritized by working group members. To be effective and equitable, the ranking should take into consideration concerns such as the cost of mitigation actions, the area/extent of the impact, trends over time, public opinion and fairness. Be



aware that social and environmental impacts are often difficult to quantify. It is recommended that each working group complete a preliminary ranking of impacts. The drought task force and other working groups can participate in a plenary discussion of these rankings following the initial ranking iterations. It is recommended that a matrix is constructed (see an example in Table 1) to help rank or prioritize impacts. From this list of prioritized impacts, each working group should decide which impacts should be addressed and which can be deferred to a later time or stage in the planning process.

Task 4. Vulnerability assessment

Vulnerability assessment provides a framework for identifying the social, economic and environmental causes of drought impacts. It bridges the gap between impact assessment and policy formulation by directing

Table 1. Drought impact decision matrix

Impact	Cost	Equally distributed?	Growing?	Public priority?	Equitable recovery?	Impact rank

Source: (FAO and NDMC, 2008)

policy attention to underlying causes of vulnerability rather than to its result, the negative impacts, which follow triggering events such as drought. For example, the direct impact of precipitation deficiencies may be a reduction in crop yields. The underlying cause of this vulnerability, however, may be that some farmers did not use drought-resistant seeds or other management practices, because of concerns about their effectiveness or high cost, or some commitment to cultural beliefs. Another example might be associated with the vulnerability of a community's water supply. The vulnerability of their water supply system might be largely the result of the lack of expansion of the system to keep pace with population growth, aging infrastructure, or both. The solution to vulnerability reduction would be the development of new supply sources and/or the replacement of infrastructure. Therefore, for each of the identified impacts from Table 1, the members of the working group should ask why these impacts occurred. It is important to realize that a combination of factors might produce a given impact. It might be beneficial to visualise these

causal relationships in some form of a tree diagram. Two examples are shown in Figures 4 and 5. Figure 4 demonstrates a typical agricultural example and Figure 5 a potential urban scenario. Depending on the level of analysis, this process can quickly become somewhat complicated. This is why it is necessary to have each working group composed of people with the appropriate technical expertise.

The tree diagrams illustrate the complexity of understanding drought impacts. The two examples provided are not meant to be comprehensive or to represent an actual scenario. Basically, their main purpose is to demonstrate that impacts must be examined from several perspectives to expose their true underlying causes. For this assessment, the lowest causes – the items in boldface on the tree diagrams – will be referred to as basal causes. These basal causes are the items that have the potential to be acted on to reduce the associated impact. Of course, some of these impact causes should not be or cannot be acted on for a wide variety of reasons (discussed in Task 5).

Figure 4. An example of a simplified agricultural impact tree diagram
 (Source: FAO and NDMC, 2008)

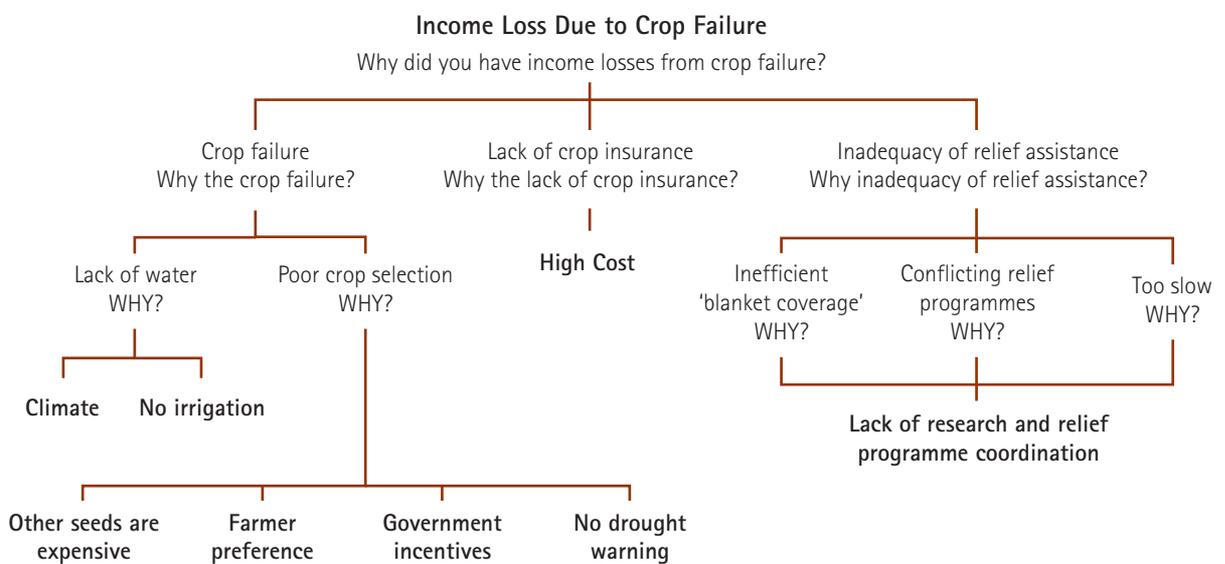
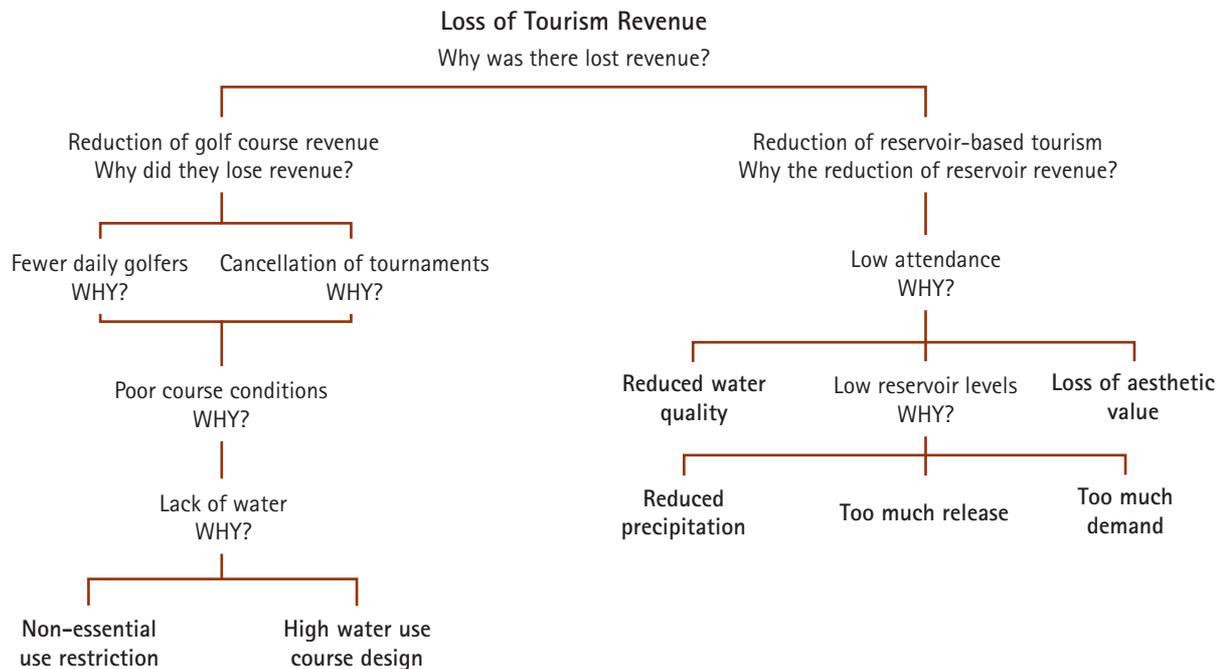


Figure 5. An example of a simplified urban impact tree diagram

(Source: National Drought Mitigation Center, University of Nebraska-Lincoln)



Task 5. Action identification

Mitigation is defined as actions taken in advance or in the early stages of drought that reduce the impacts of the event. Once drought impact priorities have been set and the corresponding underlying causes of vulnerability have been exposed, actions can be identified that are appropriate for reducing drought risk. The matrix lists the impact as well as the described basal causes of the impact. From this point, the working group should investigate what actions could be taken to address each of these basal causes. The following sequence of questions may be helpful in identifying potential actions:

- Can the basal cause be mitigated (can it be modified before a drought)? If yes, then how?
- Can the basal cause be responded to (can it be modified during or after a drought)? If so, then how?

- Is there some basal cause, or aspect of the basal cause, that cannot be modified and must be accepted as a drought-related risk for this activity or area?

As discussed in Task 6, not all mitigation actions are appropriate in all cases. Many of the actions are more in the realm of short-term emergency response or crisis management, rather than long-term mitigation or risk management. Emergency response is an important component of drought planning, but should only be one part of a more comprehensive mitigation strategy.

Task 6. Developing the 'To Do' list

After the impacts, causes and relevant potential actions have been identified, the next step is to determine the sequence of actions to take as part of the risk reduction planning exercise. This selection

should be based on such concerns as feasibility, effectiveness, cost and equity. Additionally, it will be important to review the impact tree diagrams when considering which groups of actions need to be considered together. For example, if you wanted to reduce crop losses by promoting the planting of a more drought-resistant crop, it would not be effective to educate farmers on the benefits of the new crop if markets do not currently exist or there are government incentives for continuing to grow the current crop. Government policies may often be out of sync with vulnerability reduction actions.

In choosing the appropriate actions, it might be helpful to ask some of the following questions:

- What are the cost/benefit ratios for the actions identified?
- Which actions are considered to be feasible and appropriate by the general public?
- Which actions are sensitive to the local environment (i.e. sustainable practices)?
- Are actions addressing the right combination of causes to adequately reduce the relevant impact?
- Are actions addressing short-term and long-term solutions?
- Which actions would equitably represent the needs of affected individuals and groups?

This process has the potential to lead to the identification of effective and appropriate drought risk-reduction activities that will reduce future drought impacts.

Completion of risk analysis

Following Task 6, the risk analysis is completed at this point in the planning process. Remember, this is a planning process, so it will be necessary to periodically re-evaluate drought risk and the various mitigation actions identified. Step 10 in the mitigation planning process is associated with evaluating, testing and revising the drought plan. Following a severe drought episode would be an appropriate time to revisit mitigation actions to evaluate their effectiveness in association with an analysis of lessons learned.

Mitigation and response committee

It is recommended that mitigation and response actions are placed under the purview of the drought task force. The task force, working in cooperation with the monitoring and risk assessment committees, has the knowledge and experience to understand drought mitigation techniques, risk analyses (economic, environmental and social aspects) and drought-related decision-making processes. The task force, as originally defined, is composed of senior policy makers from various government agencies and, possibly, key stakeholder groups. Therefore, it is in an excellent position to recommend and/or implement mitigation actions, request assistance through various national programmes or make policy recommendations to a legislative body or political leader.

As a part of the drought planning process, the national drought policy commission should inventory all assistance programmes available from national sources to mitigate or respond to drought events. Each provincial drought task force should review this inventory of programmes available from governmental and non-governmental authorities for completeness and provide feedback to the commission for the improvement of these programmes to address short-term emergency situations as well as long-term mitigation programmes that may be useful in addressing risk reduction. In some cases, additional programmes might be available from the provinces or states that have supplemented programmes available at the national level. Assistance should be defined in a very broad way to include all forms of technical, mitigation and relief programmes available. As stated previously, the national drought commission should undertake a similar exercise with national programmes and evaluate their effectiveness in responding to and mitigating the effects of previous droughts.

Writing the mitigation plan

With input from each of the committees and working groups and the assistance of professional writing specialists, the drought task force will draft the drought mitigation plan. After completion of a

working draft, it is recommended that public meetings or hearings are held at several locations to explain the purpose, scope and operational characteristics of the plan and how it will function in relation to the objectives of the national drought policy. Discussion must also be presented on the specific mitigation actions and response measures recommended in the plan. A public information specialist for the drought task force can facilitate planning for the hearings and prepare news stories announcing the meetings and providing an overview of the plan.

After the draft plan has been vetted at the state or provincial level, it should be submitted to the national drought commission for review to determine whether the plan meets the requirements mandated by the commission. Although each state-level plan will contain different elements and procedures, the basic structure should conform to policy standards provided to the states at the outset of the planning process by the national drought commission.

Step 6: Identify research needs and fill institutional gaps

The national drought policy commission should identify specific research needs that would contribute to a better understanding of drought, its impacts, mitigation alternatives and needed policy instruments, leading to a reduction of risk. These needs are likely to originate from the state-level drought task forces that are implemented to develop mitigation plans. It will be the task of the commission to collate these needs into a set of priorities for future action and funding.

Many examples of potential research needs could be mentioned. First, improving understanding of how climate change may affect the incidence of drought events and their severity, particularly at a regional scale, would provide critical information that could facilitate the risk reduction measure. As the science of climate change improves and the resolution



of computer models increases, this information will be invaluable to policy makers, managers and other decision makers. Also critically important are improved early warning techniques and delivery systems, improved understanding of the linkages between indicators and indices and impacts to provide key decision points or thresholds for implementing mitigation actions, and the development of decision-support tools for managers.

It will also become apparent during the policy development and preparedness planning process that institutional gaps exist that will hamper the policy and planning process. For example, serious gaps in monitoring station networks may exist, or existing meteorological, hydrological and ecological networks may need to be automated and networked so that data can be retrieved in a timely manner in support of an early warning system. Archiving the impacts of drought is also a critical component of the process to help identify and quantify losses and discern trends in impact reduction. It is expected that Step 6 will be carried out concurrently with Steps 4 and 5 of the policy and plan development process.

Step 7: Integrate science and policy aspects of drought management

An essential aspect of the policy and planning process is integrating the science and policy aspects of drought management. Policy makers' understanding of the scientific issues and technical constraints involved in addressing problems associated with drought is often limited. Likewise, scientists and managers may have a poor understanding of existing policy constraints for responding to the impacts of drought. In many cases, communication and understanding between the science and policy communities must be enhanced if the planning process is to be successful. This is a critical step in the development of a national drought policy. Members of the national drought policy commission have a good understanding of the policy development process and the political and financial constraints associated with proposed changes in public policy. They are also aware of the difficulties inherent in a change in the paradigm for the recipients of drought emergency assistance to a new approach focused on drought risk reduction. However, those persons at the state or community level that are embedded in the preparedness planning process are less aware of these constraints but have an excellent understanding of drought management actions, local conditions and the key sectors affected and their operational needs. Linking the policy process with critical needs requires an excellent communication conduit from state-based drought task forces and the commission.

In essence, this communication conduit is necessary to distinguish what is feasible from what is desirable for a broad range of science and policy options. Integration of science and policy during the planning process will also be useful in setting research priorities and synthesizing current understanding. The drought task force should consider a wide range of options for drought risk reduction and evaluate the pros and cons of each in terms of their feasibility and potential outcomes.

Step 8: Publicize the national drought management policy and preparedness plans and build public awareness and consensus

If there has been good communication with the public throughout the process of establishing a drought policy and plan, there may already be an improved awareness of goals of the drought policy, the rationale for policy implementation, and the drought planning process by the time the policy is ready to be implemented. The public information specialists that are engaged in this process at the commission level and at the state level are vital in this regard. Throughout the policy and planning development process, it is imperative for local and national media to be used effectively in the dissemination of information about the process. Themes to emphasize in writing news stories during the drought policy and planning process could include:

- How the drought policy and plan is expected to reduce the impacts of drought in both the short and long term. Stories can focus on the social dimensions of drought, such as how it affects local economies and individual families; environmental consequences, such as reduced wildlife habitat; human health; and the impacts on the regional and national economy and the development process.
- Behavioural changes that will be required to reduce drought impacts; various aspects of state drought preparedness plans; new policies associated with water allocations and water management during the various stages of drought severity.

In subsequent years, it may be useful to release 'drought policy and planning refresher' news at the beginning of the most drought-sensitive season, letting people know the current status of water supplies and projections regarding water availability. News releases can also focus on the various aspects of the drought policy and plan. Success stories regarding the application of the plan in various sectors

or communities will help to reinforce the goals of the mitigation plan and the national policy. It may be useful to refresh people's memories ahead of time on circumstances that would lead to water use restrictions. The timing of these news releases would be associated with regular meetings of the monitoring committee at the local and national levels, pinpointing regions and/or sectors of particular concern.

During drought, the commission and state drought task forces should work with public information professionals to keep the public well informed of the current status of water supplies, whether conditions are approaching 'trigger points' that will lead to requests for voluntary or mandatory use restrictions, and how victims of drought can access information and assistance. Websites should be created and updated on a regular basis so the public and managers can get information directly from the task force without having to rely on mass media. Products or dissemination strategies and tools need to be available that effectively communicate information to the user community.

Step 9: **Develop education programmes for all age and stakeholder groups**

A broad-based education programme focused on all age groups is necessary to raise awareness of the new strategy for drought management, the importance of preparedness and risk reduction, short- and long-term water supply issues, and other crucial prerequisites for public acceptance and implementation of drought policy and preparedness goals. This education programme will help ensure that people know how to manage drought when it occurs and that drought preparedness will not lose ground during non-drought years. It would be useful to tailor information to the needs of specific groups (e.g. elementary and secondary education, small business, industry, water managers, agricultural producers, homeowners, utilities). The drought task force in each state or

province and participating agencies should consider developing presentations and educational materials for events such as a water awareness week, community observations of Earth Day and other events focused on environmental awareness, relevant trade shows, specialized workshops, and other gatherings that focus on natural resource stewardship or management.

Step 10: **Evaluate and revise national drought management policy and supporting preparedness plans**

The tenets of a national drought policy and each of the preparedness or mitigation plans that serve as the implementation instruments of the policy require periodic evaluation and revision in order to incorporate new technologies, lessons learned from recent drought events, changes in vulnerability and so forth. The final step in the policy development and preparedness process is to create a detailed set of procedures to ensure an adequate evaluation of the successes and failures of the policy and the preparedness plans at all levels. Oversight of the evaluation process would be provided by the national drought policy commission but the specific actions taken and outcomes exercised in the drought-affected states or provinces would need to have the active involvement of those specific drought task forces. The policy and preparedness process must be dynamic; otherwise, the policies and plans will quickly become outdated. Periodic testing, evaluation and updating of the drought policy are needed to keep the plan responsive to the needs of the country, states and key sectors. To maximize the effectiveness of the system, two modes of evaluation must be in place: ongoing and post-drought.

Ongoing evaluation

An ongoing or operational evaluation keeps track of how societal changes such as new technology, new research, new laws and changes in political leadership may affect drought risk and the operational aspects of the drought policy and supporting preparedness plans.

The risk associated with drought in various sectors (economic, social and environmental) should be evaluated frequently while the overall drought policy and preparedness plans may be evaluated less often. An evaluation under simulated drought conditions (i.e. computer-based drought exercise) is recommended before the drought policy and state-level plans are implemented and periodically thereafter. It is important to remember that the drought policy and preparedness planning process is dynamic, not a discrete event.

Another important aspect of the evaluation process and the concept of drought exercises is linked to changes in government personnel, which, in most settings, occurs frequently. If the goals and elements of the national drought policy are not reviewed periodically and the responsibilities of all agencies revisited, whether at the national or state level, governmental authorities will not be fully aware of their roles and responsibilities when drought recurs. Developing and maintaining institutional memory



is an important aspect of the drought policy and preparedness process.

Post-drought evaluation

A post-drought evaluation or audit documents and analyses the assessment and response actions of government, non-governmental organizations and others, and provides a mechanism for implementing recommendations for improving the system. Without post-drought evaluations of both the drought policy and the preparedness plans at the local level, it is difficult to learn from past successes and mistakes, as institutional memory fades.

Post-drought evaluations should include an analysis of the climatic, social and environmental aspects of the drought: i.e. its economic, social and environmental consequences; the extent to which pre-drought planning was useful in mitigating impacts, in facilitating relief or assistance to stricken areas and in post-drought recovery; and any other weaknesses or problems caused or not covered by the policy and the state-based plans. Attention must also be directed to situations in which drought-coping mechanisms worked and where societies exhibited resilience; evaluations should not focus only on those situations in which coping mechanisms failed. Evaluations of previous responses to severe drought are also a good planning aid, if they have been done. These evaluations establish a baseline for later comparisons allowing trends in resiliency to be documented.

To ensure an unbiased appraisal, governments may wish to place the responsibility for evaluating the effectiveness of the drought policy and each of the preparedness plans in the hands of non-governmental organizations such as universities and/or specialized research institutes.

Summary and Conclusion

For the most part, previous responses to drought in all parts of the world have been reactive, reflecting what is commonly referred to as the crisis management approach. This approach has been ineffective (i.e. assistance poorly targeted to specific impacts or population groups), poorly coordinated and untimely; more importantly, it has done little to reduce the risks associated with drought. In fact, the economic, social and environmental impacts of drought have increased significantly in recent decades. A similar trend exists for all natural hazards.

The intent of the policy development and planning process described in this report is to provide a set of generic steps or guidelines that nations can use to develop the overarching principles of a national drought policy aimed at risk reduction. This policy would be implemented at the sub-national (i.e. provincial or state) level through the development and implementation of drought preparedness plans that follow the framework or principles of the national

drought policy. These plans are the instruments for implementing a national drought policy based on the principles of risk reduction. Following these guidelines, a nation can significantly change the way they prepare for and respond to drought by placing greater emphasis on proactively addressing the risks associated with drought through the adoption of appropriate mitigation actions. The guidelines presented here are generic in order to enable governments to choose the steps and components that are most applicable to their situation. The risk assessment methodology embedded in this process is designed to guide governments through the process of evaluating and prioritizing impacts and identifying mitigation actions and tools that can be used to reduce the impacts of future drought episodes. Both the policy development process and the planning process must be viewed as ongoing, continuously evaluating the nation's changing exposure and vulnerabilities and the ways in which governments and stakeholders can work in partnership to lessen risk.

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Annex: Checklist of historical, current and potential drought impacts

To perform an assessment using this checklist, check the box in front of each category that has been affected by drought in your study area. Your checklist selections can be based on either common or extreme droughts, or a combination of the two. For example, if your drought planning was going to be based on the 'drought of record', a historical review would need to be completed to identify the 'drought of record' for your area and to assess the impacts of that drought. The impacts would then be recorded on this checklist by marking the appropriate boxes under the 'Historical' column. Next, with the current knowledge that you have about your local area, if another 'drought of record' were to occur tomorrow, consider what the local impacts may be and record them on the checklist under the 'Current' column. Finally, consider what the impacts of the same drought would be for your area in five or ten years and record these in the 'Potential' column.

If enough time, money and personnel are available, it may be beneficial to conduct impact studies based on common droughts, extreme drought(s) and the 'drought of record' for your region. These analyses would yield a range of impacts related to the severity of the drought, which is necessary for conducting Step 3 of the guide and which could be useful for planning purposes.

H = Historical Drought

C = Current Drought

P = Potential Drought

H	C	P	Economic
			Loss from crop production
✓	✓	✓	· Annual and perennial crop losses
✓	✓	✓	· Damage to crop quality
✓	✓	✓	· Reduced productivity of cropland (wind erosion, etc.)
✓	✓	✓	· Insect infestation
✓	✓	✓	· Plant disease
✓	✓	✓	· Wildlife damage to crops
			Loss from dairy and livestock production
✓	✓	✓	· Reduced productivity of rangeland
✓	✓	✓	· Forced reduction of foundation stock
✓	✓	✓	· Closure/limitation of public lands to grazing
✓	✓	✓	· High cost/unavailability of water for livestock
✓	✓	✓	· High cost/unavailability of feed for livestock
✓	✓	✓	· High livestock mortality rates

H	C	P	Economic (continued)
✓	✓	✓	· Disruption of reproduction cycles (breeding delays or unfilled pregnancies)
✓	✓	✓	· Decreased stock weights
✓	✓	✓	· Increased predation
✓	✓	✓	· Range fires
			Loss from timber production
✓	✓	✓	· Wildland fires
✓	✓	✓	· Tree disease
✓	✓	✓	· Insect infestation
✓	✓	✓	· Impaired productivity of forest land
			Loss from fishery production
✓	✓	✓	· Damage to fish habitat
✓	✓	✓	· Loss of young fish due to decreased flows
✓	✓	✓	Income loss for farmers and others directly affected
✓	✓	✓	Loss of farmers through bankruptcy
✓	✓	✓	Unemployment from drought-related production declines
✓	✓	✓	Loss to recreational and tourism industry
✓	✓	✓	Loss to manufacturers and sellers of recreational equipment
✓	✓	✓	Increased energy demand and reduced supply because of drought-related power curtailments
✓	✓	✓	Costs to energy industry and consumers associated with substituting more expensive fuels (oil) for hydroelectric power
✓	✓	✓	Loss to industries directly dependent on agricultural production (e.g. machinery and fertilizer manufacturers, food processors, etc.)
			Decline in food production/disrupted food supply
✓	✓	✓	· Increase in food prices
✓	✓	✓	· Increased importation of food (higher costs)
✓	✓	✓	Disruption of water supplies
			Revenue to water supply firms
✓	✓	✓	· Revenue shortfalls
✓	✓	✓	· Windfall profits
✓	✓	✓	Strain on financial institutions (foreclosures, greater credit risks, capital shortfalls, etc.)
✓	✓	✓	Revenue losses to federal, state and local governments (from reduced tax base)
✓	✓	✓	Loss from impaired navigability of streams, rivers and canals
✓	✓	✓	Cost of water transport or transfer

H	C	P	Economic (continued)
✓	✓	✓	Cost of new or supplemental water resource development
✓	✓	✓	Cost of increased groundwater depletion (mining), land subsidence
✓	✓	✓	Reduction of economic development
✓	✓	✓	Decreased land prices
			Damage to animal species
✓	✓	✓	· Reduction and degradation of fish and wildlife habitat
✓	✓	✓	· Lack of feed and drinking water
✓	✓	✓	· Disease
✓	✓	✓	· Increased vulnerability to predation (from species concentration near water)
✓	✓	✓	· Migration and concentration (loss of wildlife in some areas and too many in others)
✓	✓	✓	· Increased stress to endangered species
H	C	P	Environmental
✓	✓	✓	Damage to plant species
✓	✓	✓	Increased number and severity of fires
✓	✓	✓	Loss of wetlands
✓	✓	✓	Estuarine impacts (e.g. changes in salinity levels)
✓	✓	✓	Increased groundwater depletion, land subsidence
✓	✓	✓	Loss of biodiversity
✓	✓	✓	Wind and water erosion of soils
✓	✓	✓	Reservoir, lake and drawdown/reduced levels (including farm ponds)
✓	✓	✓	Reduced flow from springs
✓	✓	✓	Water quality effects (e.g. salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)
✓	✓	✓	Air quality effects (e.g. dust, pollutants)
✓	✓	✓	Visual and landscape quality (e.g. dust, vegetative cover, etc.)
H	C	P	Social Impacts
✓	✓	✓	Mental and physical stress (e.g. anxiety, depression, loss of security, domestic violence)
✓	✓	✓	Health-related low-flow problems (e.g. cross-connection contamination, diminished sewage flows, increased pollutant concentrations, reduced fire-fighting capability, etc.)
✓	✓	✓	Reductions in nutrition (e.g. high-cost food limitations, stress-related dietary deficiencies)

H	C	P	Social Impacts (continued)
✓	✓	✓	Loss of human life (e.g. from heat stress, suicides)
✓	✓	✓	Public safety from forest and range fires
✓	✓	✓	Increased respiratory ailments
✓	✓	✓	Increased disease caused by wildlife concentrations
			Increased conflicts
✓	✓	✓	· Water user conflicts
✓	✓	✓	· Political conflicts
✓	✓	✓	· Management conflicts
✓	✓	✓	· Other social conflicts (e.g. scientific, media-based)
✓	✓	✓	Disruption of cultural belief systems (e.g. religious and scientific views of natural hazards)
✓	✓	✓	Re-evaluation of social values (e.g. priorities, needs, rights)
✓	✓	✓	Reduction or modification of recreational activities
✓	✓	✓	Public dissatisfaction with government regarding drought response
✓	✓	✓	Inequity in the distribution of drought relief
			Inequity in drought impacts based on:
✓	✓	✓	· Socioeconomic group
✓	✓	✓	· Ethnicity
✓	✓	✓	· Age
✓	✓	✓	· Gender
✓	✓	✓	· Seniority
✓	✓	✓	Loss of cultural sites
✓	✓	✓	Loss of aesthetic values
✓	✓	✓	Recognition of institutional restraints on water use
			Reduced quality of life, changes in lifestyle
✓	✓	✓	· in rural areas
✓	✓	✓	· in specific urban areas
✓	✓	✓	· increased poverty in general
✓	✓	✓	Increased data/information needs, coordination of dissemination activities
✓	✓	✓	Population migrations (e.g. rural to urban areas, migrants into the United States)

Source: <http://drought.unl.edu/portals/0/docs/10StepProcess.pdf>

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The Integrated Drought Management Programme (IDMP) was launched by WMO and GWP at the High-level Meeting on National Drought Policy in March 2013. The IDMP works with a wide range of partners with the objective of supporting stakeholders at all levels by providing them with policy and management guidance through globally coordinated generation of scientific information and sharing best practices and knowledge for integrated drought management. The IDMP is a contribution to the Global Framework for Climate Services (GFCS), especially with regards to GFCS priority areas of disaster risk reduction, water, agriculture and food security. It especially seeks to support regions and countries to develop more proactive drought policies and better predictive mechanisms and these guidelines are a contribution to this end.

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