National Drought Action Plan of Jordan

Version 1.24 September 2022

Drought Management Unit, Ministry of Water and Irrigation

and

Drought Technical Committee

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Executive Summary

The purpose of the Drought Action Plan is to manage drought risk. The Drought Action Plan takes an integrated approach to drought risk management using three components: preparedness, mitigation, and response.

Preparedness ensures that institutional and operational mechanisms are established in advance, saving time with detecting and responding promptly to drought. Mitigation actions reduce vulnerabilities to and impacts of drought in advance. Response actions are taken during drought events to limit the impacts of drought and promote swift recovery. Together, drought preparedness, mitigation and response actions reduce the costs of drought impacts compared to significant high costs of in-action. Likewise, effective preparedness and mitigation reduce the costs of response actions.

Chronic water stress makes Jordan extremely vulnerable to drought. While widespread drought affecting the whole country is rare, localised droughts are becoming more frequent and can be very severe. Public authorities face challenging conditions in meeting social and economic needs for water under normal conditions; drought could lead to crisis situations. The Government of Jordan has therefore taken steps to address drought risks. The National Water Strategy 2016-2025 and Water Sector Policy for Drought Management (2018) have established the mandate and institutional framework for drought management, while the National Centre for Security and Crisis Management has a mandate for coordinating responses to drought crisis after an official declaration of extreme drought.

The Drought Action Plan defines an operational framework of roles and responsibilities for the different institutions engaged in implementation of the plan, including the National Drought Management Committee and the Drought Technical Committee. It also describes funding and resourcing arrangements. Building capabilities for monitoring, evaluation, research and learning is crucial for effective drought risk management operations. The Drought Action Plan describes needs for assessing vulnerabilities, drought monitoring and early warning, reporting impacts, learning from experience, and adapting the Drought Action Plan to incorporate lessons learned.

The Drought Action Plan identifies actions that prepare for, mitigate and respond to drought impacts in eight priority sectors: water resources, drinking water services, irrigated and rainfed agriculture, livestock, rangeland sustainability, forest sustainability, and diarrhoeal disease. Further sectors and actions may be added to future iterations of the Drought Action Plan. Drought preparedness and mitigation actions are taken before drought events occur and reduce the costs of relief efforts and drought impacts on people, the economy and the environment. Drought response actions are taken during drought events, and are tailored to the severity, location, timing, and duration of drought impacts in the eight priority sectors.

The Drought Action Plan supports the Water Sector Policy for Drought Management (2018). It identifies actions that prepare for and mitigate drought impacts. The Drought Action Plan is a living document, owned by the Drought Technical Committee. The Committee will keep the Drought Action Plan updated as drought challenges and response capacities evolve, and as lessons are learned during drought events.

Glossary and Abbreviations

DAP	Drought Action Plan
DMS	Drought Monitoring Subgroup. A working group of the Drought Technical Committee (DTC).
DoS	Department of Statistics
Drought Class	An assessment of biophysical drought conditions based on indicators such as rainfall, soil moisture, evapotranspiration and vegetation health anomalies.
Drought Response Level	The intensity of activities to reduce the impacts of drought conditions on people, the economy and the environment.
DMU	Drought Management Unit. A unit of the Ministry of Water and Irrigation, responsible for convening the Drought Technical Committee (DTC).
DPS	Drought Planning Subgroup. A working group of the Drought Technical Committee (DTC).
DTC	Drought Technical Committee, responsible for recommending changes in Drought Response Level and response actions to the National Drought Management Committee (NDMC).
JMD	Jordanian Meteorological Department.
JVA	Jordan Valley Authority.
MoA	Ministry of Agriculture.
MoEnv	Ministry of Environment.
MoH	Ministry of Health.
Mitigation	Actions taken to reduce vulnerabilities to and lessen the impacts of drought before drought events occur.
MWI	Ministry of Water and Irrigation.
NARC	National Agricultural Research Centre.
NCSCM	National Centre for Security and Crisis Management.
NDMC	National Drought Management Committee. An inter-ministerial committee responsible for senior drought decision-making and coordination.
Preparedness	Measures to strengthen operational and institutional readiness for responding to drought events in advance.
Response	Actions taken to reduce vulnerabilities to and lessen the impacts of drought during drought events.
WAJ	Water Authority of Jordan.

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Part A. Background and context

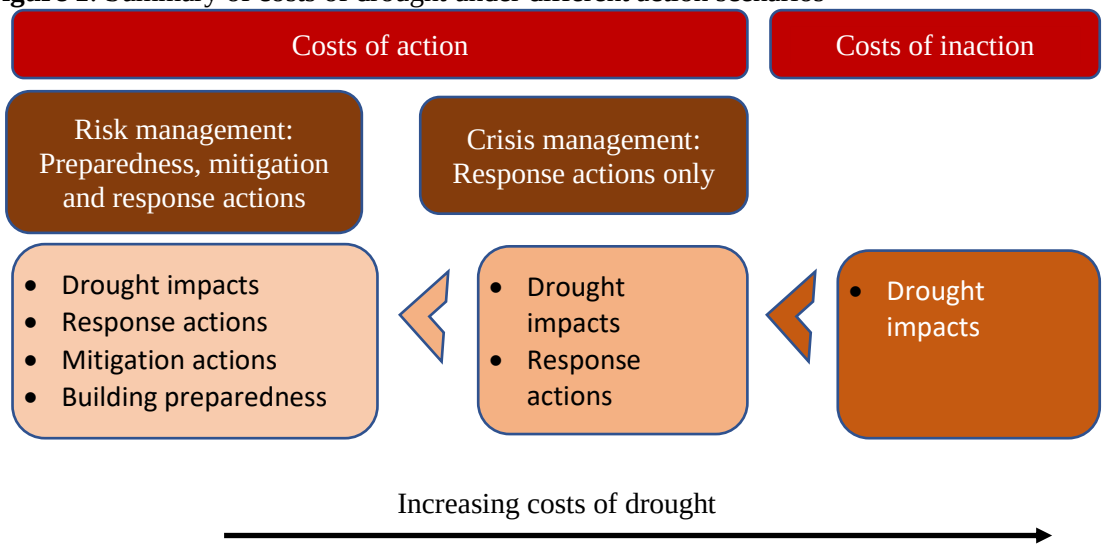
1. Purpose of the Drought Action Plan

Drought is a slow-onset natural hazard with widespread economic, health and social impacts. With precarious water security and a hot climate, Jordan is highly vulnerable to drought. This document provides a practical guide for managing drought risk by the public authorities.

The Drought Action Plan (DAP) is one of the mandated responsibilities of the Drought Management Unit (DMU). It has been prepared by the Drought Technical Committee (DTC), with representatives from the Ministry of Agriculture (MoA), Ministry of Health (MoH), Ministry of Environment (MoEnv), Jordanian Meteorological Department (JMD), National Agricultural Research Centre (NARC), and the Department of Statistics (DoS), led by the DMU at the Ministry of Water and Irrigation (MWI).

The overall purpose of the Drought Action Plan is to manage drought risk and reduce the costs of drought impacts. The Drought Action Plan is based on an integrated approach to drought risk management with three components: preparedness, mitigation, and response. As shown in Figure 1, upfront costs in preparedness and mitigation are offset by much lower costs of impacts and response actions during drought compared to the costs of inaction. Investing in drought preparedness and mitigation is therefore a responsible and cost-effective approach to managing drought risk.

Figure 1: Summary of costs of drought under different action scenarios



Source: adapted from WMO & GWP, 2017[1]

Without a drought monitoring and early warning system in place, it can be difficult to determine when drought begins and ends. The Drought Action Plan is therefore linked to a monitoring and early warning system that indicates when drought responses should be triggered.

[1]World Meteorological Organization (WMO) and Global Water Partnership (GWP) (2017). Benefits of action and costs of inaction: Drought mitigation and preparedness – a literature review (N. Gerber and A. Mirzabaev). Integrated Drought Management Programme (IDMP) Working Paper 1. WMO, Geneva, Switzerland and GWP, Stockholm, Sweden.

Drought mitigation and response actions require coordination of information and efforts among public institutions. Accordingly, the Drought Action Plan sets out procedures for coordination in preparation for and response to drought.

The Drought Action Plan is a living document which is revised and developed as drought risk management is institutionalised across the public sector. It is a learning document, which is refined following post-drought assessments and updated every five years.

Preparedness, Mitigation and Response
The objective of drought *preparedness* is to strengthen operational and institutional readiness to respond to drought events in advance. Delays with detecting and responding to drought increase the costs of drought impacts to people and the economy. The Drought Action Plan contributes to drought preparedness by clarifying the institutional and operational framework for drought monitoring and drought management (Sections 5, 6, 7 and 8) and identifying actions for drought preparedness (Section 9), mitigation (Section 10) and response (Sections 11 and 12).

Drought *mitigation* actions are implemented before drought events to reduce the impacts of drought on people, the economy and the environment. Successful mitigation actions reduce the social and economic impacts of drought and reduce the costs of response and relief efforts. The Drought Action Plan identifies a series of mitigation actions for key sectors, presented in Section 10.

Drought *response* actions are implemented during drought events to alleviate impacts on people, the economy and the environment, and enable swifter recovery. Drought response actions are less effective in the absence of drought preparedness and mitigation actions. The Drought Action Plan identifies a series of response actions for key sectors, presented in Section 12.

2. Drought in Jordan

2.1 Physical and economic context

Jordan's vulnerability to drought is rooted in water insecurity. A rapidly growing population and economic development have created demands for water that outstrip the available supplies. Climate change and increasing variability of precipitation and temperatures compound this vulnerability

The amount of renewable water available each year fell from 500 m^3 per person to less than 100 m^3 per person between 1975 and 2017. This is well below the global water poverty line of 1000 m^3 per person per year. Increasing withdrawals and exploitation from groundwater, including non-renewable fossil groundwater, have made up the gap between demands for water and the renewable supply. This is not sustainable, however. Aquifers are being depleted rapidly, leading to declining groundwater quality and the drying of wells.

In such an arid environment, water scarcity is a constraint on agricultural production, economic growth, and human health and poverty reduction. This forces difficult choices about the priorities for water allocation.

In addition to this general background of increasing water insecurity is the uneven distribution of water in space and time. The only significant river sources – the Zarqa and the Yarmouk – are in the north and west, and rainfall is concentrated in the northwest highlands. By contrast, the arid and semi-arid Badia covering most of the country receives less than 200 mm of rain a year. These rangelands are socially and

economically important for their role in livestock production, despite being sparsely populated. Unpredictable annual variations in rainfall add to water challenges in the Badia.

This context of water insecurity makes Jordan extremely vulnerable to drought. With much of the country reliant on unpredictable rainfall, water resources unevenly distributed, demand outstripping supply, and limited storage capacity in dams, public authorities face difficult choices in meeting people's social and economic needs for water in normal conditions. Drought conditions can lead to crisis situations.

2.2 Recent history of drought in Jordan

Research and studies suggest that Jordan is experiencing more frequent droughts. There were almost twice as many droughts between 1961-2012 as between 1900-1961.

Widespread drought affecting the whole country is rare, but occurred in 1933; 1958-62; 1995, 1997-2001 and 2008-2009. Drought is more usually localised. Extreme droughts have been recorded in some areas of Jordan in 1980-81, 2007-08, 2010-11, 2012-13 and 2014. Moderate droughts were also recorded in 1982-83, 1984-85, 1988, 1993, and 2001-2002.

These droughts have effects across a number of sectors, with particularly severe impacts on rainfed agriculture and pastoralist livestock husbandry. Droughts put more strain on groundwater resources, with more abstractions in drought years but less recharge from precipitation. Shortages of water affect agricultural productivity, and hence rural livelihoods and poverty. Further rationing of drinking water leads to higher costs for consumers and impacts on human health. Environmental impacts can include heightened desertification, exhaustion of natural springs, forest fires, and degradation of wetlands. Indirect impacts can include unemployment, international balance of payments, and increased social conflict.

Studies indicate that Jordan will experience more frequent and more intense droughts due to global climate change. Some studies have suggested that moderate droughts will occur every three to four years, and severe or extreme droughts every six or seven years. Higher temperatures and declining winter precipitation will increase aridity in general, increasing drought risks. Climate change may also destabilise the onset, duration, and intensity of precipitation, leading to a more variable and less predictable climate.

2.3 Drought management

Historically, drought management in Jordan has been treated as a crisis issue, with relief measures in reaction to drought impacts. No coordinated strategy, plan, institutional framework or procedures were in place. Coordinated steps were not taken to mitigate drought risks and vulnerabilities. There was no institutional memory to develop a body of good practice from the experiences and lessons of previous droughts. When droughts emerged they were detected late, time was wasted in assembling information and resources and making decisions, and responses were unplanned.

Coordinating responses to drought crisis is now part of the mandate of the National Centre for Security and Crisis Management (NCSCM). However, the threshold for declaring such a crisis is high and without clear criteria. Also, there is no institutional mechanism for responding to localised moderate and severe droughts. Nor does the NCSCM engage in risk mitigation actions.

The National Water Strategy 2016-2025 highlighted climate risks to the water sector, and the need for proactive drought management. The Water Sector Policy for Drought Management (2018) elaborated a strategy for institutionalising drought management. The policy identified nine policy objectives and a series of clear steps for institutionalising the coordination of information, decisions and efforts to mitigate

and respond to drought. These steps included the formation of a National Drought Management Committee for inter-ministerial coordination, and the establishment of the DMU at the Ministry for Water and Irrigation (MWI). This was duly endorsed by the Cabinet of Ministers in April 2018.

3. Drought Definitions, Classes and Response Levels

Drought types, classes, and response level
Drought types are defined by types of drought impact experienced, e.g. meteorological, hydrological, agricultural, socio-economic and ecological droughts.

Drought Class refers to the severity of drought detected, and is assessed through biophysical indicators such as rainfall, vegetation health, evapotranspiration, and soil moisture levels.

Drought Response Level refers to the activities of government and other stakeholders in reducing drought vulnerabilities and impacts. More severe drought implies an escalation of the Drought Response Level, and more robust activities to address greater impacts on people, the economy and the environment.

3.1 Drought Definitions

The most commonly used drought definitions are based on meteorological, agricultural, hydrological, operational, socioeconomic, and ecological impacts.

Meteorological drought is a period of substantially reduced precipitation. It is commonly defined as an interval of time, generally on the order of months or years, during which the precipitation at a given place consistently falls below the climatic average precipitation.

Agricultural drought occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought commonly occurs after or during meteorological drought, but before hydrological drought. Agricultural drought can also adversely impact livestock and other dry-land agricultural operations.

Hydrological drought occurs when there are deficiencies in surface and/or subsurface water supplies. It is measured as reduced streamflow, snowpack, reservoir, and groundwater levels. A delay usually occurs between the lack of precipitation and later deficits observed in water measurements. Due to this, hydrological response tends to lag behind other drought indicators.

Operational drought is when water shortages happen because of failures or deficits in water supply systems. These are often issues with infrastructure or the management of infrastructure. For example, dams and reservoirs may be empty because of unintended discharges or, conversely, dams and reservoirs may be full, but water systems cannot deliver to consumers due to failures of pumping equipment or excessive network losses.

Socioeconomic drought occurs when physical water shortages affect peoples' health, well-being, and quality of life, or when the water shortages adversely impact economic activity.

Ecological drought occurs when there is a prolonged and widespread deficit in naturally available water supplies, creating stresses across ecosystems.

The Drought Action Plan includes mitigation and response actions to reduce the risks and impacts of agricultural, socioeconomic and ecological drought. Data and analysis of indicators of meteorological, hydrological and ecological drought are used to detect the onset of drought and trigger response actions.

3.2 Drought Classes

Drought Class refers to biophysical indicators of drought in a given period. The Drought Monitoring Subgroup produces assessments of Drought Class based on drought monitoring and early warning information (see Section 8.2). Four Drought Classes are proposed:

- 'Normal'. In normal conditions, i.e. the absence of drought conditions.

- 'Moderate'. Moderate drought conditions occur once in every five years, approximately. Moderate conditions early in the season can evolve into Severe drought conditions, and even Moderate drought conditions can harm poor farmers and other vulnerable groups. However, effects are unlikely to be widespread across society.

- 'Severe'. Severe drought onditions occur once in every ten years, approximately. Severe drought conditions early in the season can worsen into Exceptional or recede into Moderate drought conditions. Severe drought conditions are likely to have significant impacts, especially on poor farmers and other vulnerable groups, and can have negative effects on the water balance and the economy.

- 'Exceptional'. Exceptional drought conditions occur once every fifty years, approximately. Exceptional drought conditions are likely to have serious impacts on vulnerable groups, agricultural and livestock production, the water balance, social cohesion and the economy.

3.3 Drought Response Level

The Drought Action Plan sets out a process to recommend different actions according to current or expected drought conditions. More serious droughts require more robust responses.

The DTC makes recommendations on the appropriate Drought Response Level using the Triggers defined in Section 11 and the Drought Monitoring Subgroup's assessment of Drought Class. There are four levels of Drought Response Level:

- Level 1: 'Drought Watch'. In normal conditions, i.e. the absence of drought. At the Drought Watch level, efforts focus on implementing mitigation actions, monitoring drought and developing response capability.

- Level 2: 'Drought Alert'. At the Drought Alert level, efforts focus on sharing information between public authorities and affected groups, monitoring drought conditions and impacts, and preparing to launch more robust responses if needed.

- Level 3: 'Drought Emergency'. At the Drought Emergency level, responses may include relief actions to lessen impacts on affected social groups and economic sectors. These will usually be implemented by line ministries and agencies, often reallocating and reprioritising existing resources and finances to target affected groups.

- Level 4: 'Drought Crisis'. The level of 'Drought Crisis' implies an event with serious economic, social and political consequences at the national scale. At the Drought Crisis level, more robust

relief efforts are needed to reduce impacts and ensure a swift recovery, and these are likely to require additional resources and finance. Oversight of response implementation may be escalated to the NCSCM.

4. Priority Drought Impacts

Drought has widespread impacts on Jordan's people, economy and environment. The DTC has identified eight priority drought impacts to target in this first iteration of the Drought Action Plan. These are:

- Water resource degradation;
- Declining quality of drinking water services;
- Production losses in irrigated agriculture;
- Production losses in rainfed agriculture;
- Production losses in livestock;
- Rangeland degradation;
- Forest degradation; and
- Increasing incidence of diarrhoeal disease.

Drought can contribute to water resource degradation by increasing demand for available resources, for example for irrigation, at a time when less water is available. The Drought Action Plan includes drought mitigation and response actions targeting chronic water stress and insecurity, shortfalls in governance capacity, and increasing water stress during drought periods.

Drinking water services often deteriorate during drought conditions. Tangible impacts to consumers include supply becoming less reliable, more expensive and less equitable. Utilities and service providers also face impacts from declining customer satisfaction and declining revenues. The Drought Action Plan includes drought mitigation and response actions targeting impacts on customer service and loss of universal and equitable service delivery during drought periods.

The productivity of irrigated agriculture is, generally, less vulnerable to drought conditions than rainfed agriculture. During emergency conditions irrigation permits may be revoked or restricted, however, and water intensive crops are highly vulnerable to irrigation shortages. The Drought Action Plan includes drought mitigation and response actions to rationalise water allocations during drought periods, and to share costs and benefits between irrigators and other members of society.

The productivity of rainfed agriculture and productivity of livestock are highly vulnerable to drought impacts. Small farmers, pastoralists and those living in rural poverty are disproportionately affected by drought, which directly impacts their livelihoods and principal sources of income. The Drought Action Plan includes drought mitigation and response actions targeting drought impacts on yield losses and poverty of rainfed farmers and pastoralists during drought periods.

Drought degrades rangelands and forests, with higher temperatures and less water reducing vegetation growth and making them vulnerable to overgrazing and, in the case of forests, fire. Underlying vulnerabilities include long-term ecosystem degradation from land-use change, over-exploitation, and weaknesses in enforcement of regulations. The Drought Action Plan includes drought mitigation and response actions targeting drought impacts on the degradation of forests and rangelands and forest fires during drought periods.

Diarrhoeal disease often increases during drought periods, particularly along the Jordan Valley and in agricultural communities using treated wastewater in irrigation. Underlying vulnerabilities include shortfalls in monitoring water and food quality, access to sanitation and personal hygiene, and capacity of local health centres to respond to outbreaks. The Drought Action Plan includes drought mitigation and response actions targeting higher levels of pathogens in water and food and health impacts on children during drought periods.

Part B. Operational framework

This section documents the institutional and operational framework of the Drought Action Plan. It designates the individuals and institutions tasked with implementing the plan and the steps for activating drought responses. Keeping the operational framework updated is a key component of drought preparedness.

Drought response levels and official declaration of drought

The NDMC can raise the Drought Response Level to Drought Alert, Drought Emergency, or even Drought Crisis without necessarily making a formal declaration of drought. The Drought Response Levels are administrative mechanisms for activating and coordinating drought responses. By contrast, the decision on whether to make an official declaration of drought that could potentially trigger the release of emergency funds and compensation packages may require approval from the Cabinet of Ministers.

5. Roles and Responsibilities

5.1 National Drought Management Committee

The National Drought Management Committee (NDMC) is chaired by the Ministry of Water and Irrigation's Secretary General and formed of decision-makers in the relevant institutions, as described by the Water Sector Policy for Drought Management (2018). The National Drought Management Committee (NDMC) is responsible for executive decision-making, strategic coordination of drought preparedness and mitigation, supervision of the Drought Technical Committee, and oversight of Drought Alert and Drought Emergency drought responses.

The NDMC also has a strategic role in drought preparedness by supporting institutional reforms that support drought policy and action plans in the relevant sectors. This includes developing frameworks that improve communication and cooperation for drought management and planning, data exchanging, and implementation of preparedness, mitigation and response actions.

Under normal (i.e. non-drought) conditions the NDMC meets once each year to review information on the water year and water budget, evolving drought risk, and progress with drought preparedness, mitigation actions and other aspects of the Drought Action Plan. Key decisions for each meeting are likely to include reviewing and approving any new or revised drought plans and recommendations from the DTC.

Under drought conditions the NDMC meets as required by the needs of the drought response (see Table 5). When notified by the DTC of emerging drought conditions, the Secretary General of the Ministry of Water and Irrigation should convene a meeting of the NDMC within 7 days. The Higher National Drought Committee should then review recommendations from the DTC and take the appropriate decisions. Key decisions are likely to include whether to increase the Drought Response Level, what response actions to approve, and whether to recommend an official declaration of drought. The NCSCM should be informed of decisions and may choose to assume supervisory responsibilities in cases of Drought Crisis Response Level.

During drought responses NDMC has an important role in ensuring the responses of different authorities are coordinated to ensure that damages are minimal, recovery is rapid, and that response target people and

areas most in need. The NDMC can form specialised *ad hoc* subcommittees, and can delegate day-to-day drought coordination to the DMU, allocating additional resources as needed.

5.2 National Centre for Security and Crisis Management

If the NDMC raises the Drought Response Level to 'Crisis' and/or there is an official declaration of drought, the National Centre for Security and Crisis Management (NCSCM) is notified. If ratified, the NCSCM may assume supervisory control of the drought response, mobilising resources and coordinating involved authorities and agencies.

5.3 Drought Management Unit

The Drought Management Unit (DMU) of the Ministry of Water and Irrigation is responsible for supporting the NDMC and for convening and chairing meetings of the DTC and its working groups. Responsibilities of the DMU are set out by the Water Sector Policy for Drought Management (2018). These include:

- Regular and timely collection, analysis and dissemination of drought information;
- Conducting drought risk and vulnerability assessments;
- Collaborating with JMD and others to monitor and predict drought;
- Providing decision-makers with information and recommendations for drought management;
- Setting the technical criteria for drought;
- Coordinating with other institutions to assess drought impacts and loss and damages in different sectors;
- Follow up with the drought action plan, including preparedness, mitigation and response actions.

The Drought Action Plan is the operational framework for implementing this mandate with the NDMC and DTC.

5.4 Drought Technical Committee

The Drought Technical Committee (DTC) is responsible for making recommendations on drought class and associated mitigation and response actions to the NDMC. DTC members also act as focal points for drought preparedness within their home institution. It is chaired by the Ministry of Water and Irrigation's Head of the DMU or their delegate.

Between December and May the DTC meet each month to review drought risk assessments from the DMS. Each month they recommend any necessary changes in Drought Response Level and/or actions to the NDMC. In the event of a drought, the DTC meets at least once a month to review the evolution of the drought and drought response, and to provide recommendations to the NDMC as needed.

Each year in June the DTC meets to review progress within implementation and needs for development of the Drought Action Plan. In October each year it meets to conduct a drought simulation exercise to strengthen preparedness, and further exercises may be held in years without reported drought impacts. Findings from these exercises should be incorporated into revisions of the Drought Action Plan.

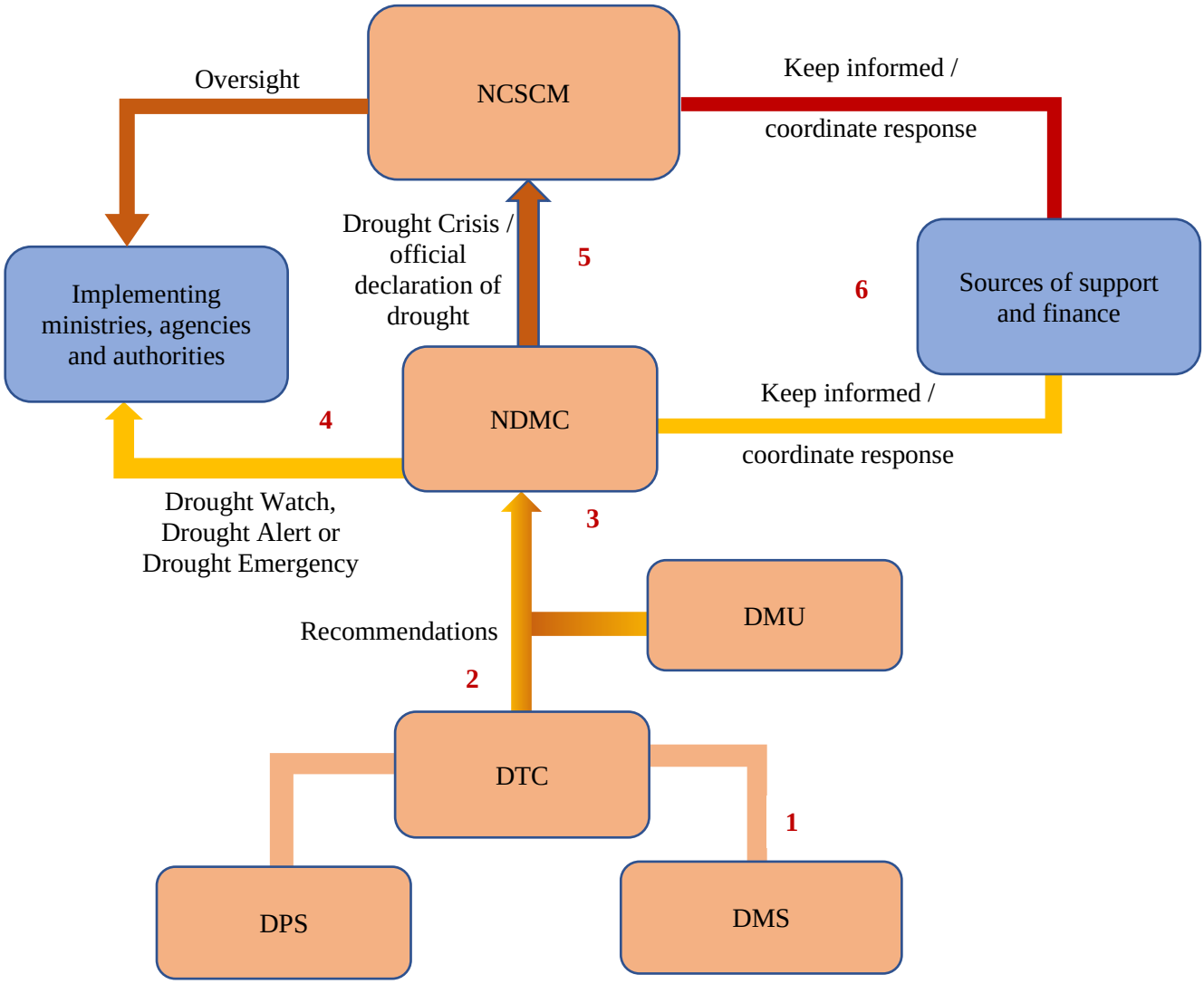
5.5 Drought Monitoring Subgroup

The Drought Monitoring Subgroup (DMS) meets each month between December and May, two days before the meeting of the DTC. It includes representatives from MWI, JMD, and NARC. It uses drought monitors including the enhanced CDI, seasonal forecasts and other data from the DMU, NARC and JMD to produce an integrated assessment of Drought Class based on current data.

5.6 Drought Planning Subgroup

The Drought Planning Subgroup (DPS) is responsible for refining and developing the Drought Action Plan in light of experience and evolving needs, and reviewing mitigation and response actions in particular. It meets on an *ad hoc* basis, as needed by the experiences of drought simulation exercises, and to revise the plan following post-drought reviews.

Figure 2. The operational framework for drought response



1. DMS produces integrated drought risk assessment
2. DTC meets within 2 days to review assessment and produce recommendations, passed on to SG of MWI
3. If recommendations are for Drought Alert, Drought Emergency or Drought Crisis, NDMC meets within 7 days to review recommendations and decide on drought response level and actions

4. If Drought Alert or Drought Emergency, NDMC enables coordination of information and response actions
5. If Drought Crisis/official declaration of drought, NCSCM assumes supervisory responsibilities
6. International agencies and donors kept informed and drought responses coordinated.

6. Contacts

6.1 National Drought Management Committee

- Dr. Jihad Mahamid, His Excellency the Secretary General of the Ministry of Water and Irrigation, Head of the Committee.
- His Excellency, Secretary General of the Ministry of Agriculture
- His Excellency the Secretary General of the Ministry of Planning and International Cooperation
- His Excellency, Director General of the National Center for Agricultural Research
- Representative of the Ministry of Transport - Department of Meteorology / - Assistant General Manager
- Representative of the Ministry of Health / Director of the Environmental Health Directorate
- Representative of the Ministry of Environment - Director of the Nature Protection Directorate
- Emad Karablieh, Professor in Agricultural Economics, University of Jordan, representative of Academia . Email: karablieh@ju.edu.jo

6.2 Drought Technical Committee

- Chairman: Director of the Drought Management Unit, Ministry of Water and Irrigation. Ali Ghanim, Telephone 0799007879, Email: ali_ghanim@mwi.gov.jo
- Ministry of Agriculture Representative. Eng. Bayan Alfaouri, Email: Bayanalfaourl6789@gmail.com
- National Agricultural Research Centre Representative. Maram AlNaimat, Email: maramjameel80@gmail.com
- National Centre for Security and Crisis Management Representative. Omar Atoum. Email: oatoum@ncscm.gov.jo
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- National Agricultural Research Centre Representative. Alaa Wahbeh, Email: aawahbeh@yahoo.com
- Jordanian Meteorological Department Representative. Omar Hamadin, Email: omar.hamadin@mot.gov.jo
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- Ministry of Health Representative. Dr Osama Kittaneh, Email: smkittaneh@gmail.com
- Ministry of Environment Representative. Saddam Khawaldeh, Email: Email: Khawaldeh_saddam@yahoo.com

- Department of Statistics Representative. Sudki Hamdan, Email: sudki@dos.gov.jo

6.3 Related initiatives and authorities

As the Drought Action Plan is revised and developed, the contact details of focal points in related initiatives and authorities will be incorporated. These might include focal points for humanitarian relief and social protection in the Government of Jordan, media communications, and focal points for engagement with the international system such as United Nations agencies. It is recommended to engage proactively with these international partners, and particularly to understand their interests and constraints on supporting drought responses in advance so their capacity can be mobilised swiftly if needed.

7. Funding and resourcing arrangements

Currently, no specific funding or resourcing arrangements exist to support drought preparedness, mitigation or response actions, including drought monitoring and early warning.

Actions taken to mitigate drought risk are investments made in advance of drought events. Executed through ministerial and agency programmes, these may draw on existing budgets or with funds raised from international donors or other sources of finance.

Drought Alert and Drought Emergency response actions are likely to rely on existing programmes, budgets and initiatives. Response actions may require reallocating and reprioritising resources to impacted geographic areas, communities, social groups, and programmes as needed.

Actions responding to Drought Crisis impacts are likely to require additional resources, either because actions are more robust and expensive and/or because a larger scale of response is needed.

International agencies, donors and sources of finance should be kept informed as appropriate. They should be kept appraised of changing drought class and regular assessments of the early warning system to raise readiness for any financial, technical and logistical support required in a Drought Emergency or Drought Crisis.

***Table 1**. Resourcing for drought responses levels*

Drought Response Level	Funding and Resource Requirements
Level 1: 'Drought Watch'	Projects and programmes to implement preparedness and mitigation actions
Level 2: 'Drought Alert'	Information-sharing actions with low cost
Level 3: 'Drought Emergency'	Reallocation and reprioritisation of existing budgets and resources to support drought response actions
Level 4: 'Drought Crisis'	Additional resources needed to support intensive response actions

8. Monitoring, Evaluation, Research and Learning

Upgrading, maintaining and coordinating capabilities for monitoring, evaluation, research and learning (MERL) is a key component of strengthening decision making and institutions for drought preparedness: effective decision making relies on good information; strengthening institutions for drought management relies on learning from experience. Four types of information are particularly important for the Drought

Action Plan: vulnerability assessments, drought monitoring, impact reporting, and performance evaluation.

8.1 Vulnerability assessment

Vulnerabilities are sensitivities to drought conditions which lead to the social, economic and environmental impacts of drought. Drought mitigation and response actions target vulnerabilities to reduce the severity of drought impacts. Identifying vulnerabilities is therefore an important step for identifying and targeting mitigation and response actions. This version of the Drought Action Plan draws on vulnerability assessments of eight priority sectors (see Section 4).

Vulnerability assessments start with identifying the social, economic and environmental impacts of drought, and working backwards to establish underlying causes. For example, diarrhoeal disease is a common impact of drought conditions; the many underlying vulnerabilities include greater concentrations of pathogens in treated wastewater, reduced handwashing and personal hygiene, and shortfalls in water quality testing. Mitigation and response actions therefore target improving the quality and monitoring of treated wastewater, improving access to sanitation and hygiene, and upgrading the response capacity of local health services.

As part of the ongoing process of upgrading preparedness, the DTC should update drought vulnerability assessments, maps and studies to revise mitigation and response actions, and - when appropriate - include additional priority sectors. Vulnerability assessments should be updated periodically to reflect changes in institutional, social, economic and physical systems that may affect resilience to drought conditions.

8.2 Drought Monitoring

Drought monitoring is key to implementing the Drought Action Plan. Outputs from drought monitoring are used to provide early-warning on the onset and evolution of drought, and to recommend changes in drought class and appropriate response actions. Upgrading capacity for drought monitoring is an important element of strengthening drought preparedness.

The DTC has access to drought monitoring capabilities from JMD, NARC and the DMU. Each month between December and May the DMS meets to produce an integrated assessment based on outputs from these tools.

These tools include an enhanced composite drought index (CDI) that integrates indicators for surface temperature, soil moisture, vegetation health, evapotranspiration and precipitation anomalies. The enhanced CDI has a spatial scale of 5km and is calibrated for the Jordanian context and historical drought events. It supports the early detection of drought conditions and anticipation of drought impacts likely to emerge in different places and at different levels of severity. Each month between December and May, engineers at JMD and the DMU produce drought maps that are then integrated into the enhanced CDI using data from the previous month.

Each month between December and May the DMS meets to review monthly maps of the enhanced CDI and prepare an integrated assessment of Drought Class for the DTC. The assessment exercise may also draw on other data sources, such as seasonal forecasts, and raw data from weather stations, groundwater monitoring stations, and river and reservoir gauges, and any reports of drought impacts. Upgrading existing tools and developing new analytic capabilities, such as seasonal forecasts, is an important element in building drought preparedness.

8.3 Impact reporting

While drought monitoring assesses biophysical drought conditions and risks, impact reporting documents the social, economic and environmental consequences of drought. This is essential for assessing the magnitude of drought impacts and prioritising drought response efforts. For example, statistics and field data may indicate that drought impacts are greater or less than might be expected from the current drought class, or that impacts are greater in some areas than in others.

Effective monitoring of drought impacts provides empirical information on the emergence and evolution of drought on the ground. It allows validation of the drought monitor and CDI, and supports adaptive decision making by the DTC.

The DAP's drought impact indicators use existing information collected by ministries and agencies. Representatives of the appropriate ministry or agency responsible for collating, assessing, and presenting to the DTC the appropriate information at the appropriate time.

Monthly, mid end season, and end of season indicators are presented below. For simplicity, monthly indicators use presence/absence for reported impacts. Mid-season and end of season indicators have thresholds of concern, and threshold of high concern for impact. These drought impact indicators are highly contextual, and the DTC should use them carefully and thoughtfully in decision-making.

8.3.1 Monthly Indicators

Monthly meetings of the DTC will include discussion of any drought impacts identified in official bulletins and reports or the news media. In preparation for the meeting, DTC members should review sources of information appropriate to their agency and area of responsibility.

The DTC has chosen three specific sources of information to be checked before each meeting:

- Bulletins of the Ministry of Agriculture: to be checked by the representative of the Ministry of Agriculture for reports of drought-related loss and damages.
- Reports of the Infectious Disease Unit at the Ministry of Health: to be checked by the representative of the Ministry of Health for cases of drought-related diarrhoea outbreaks.
- Newspapers and Civil Defence website: to be checked by the representative of the Ministry of Environment for reports of forest fires.

Period	Impact	Indicator	Source	Concern?
Monthly	Production losses in rainfed and irrigated agriculture	Reports of drought-related loss and damages	Bulletin of Ministry of Agriculture	Presence
Monthly	Diarrhoeal disease	Reports of drought-related diarrhoea outbreaks	Investigations of the infectious disease unit at the Ministry of Health	Presence
Monthly	Forest degradation	Reports of forest fires	As reported in newspapers and website of civil defence	Presence

Monthly	Increased livestock feed demand	Reports of livestock subsidized feed distribution and feed sales by distribution centre	As reported monthly from Ministry of Agriculture and Ministry of Trade database	Presence

Key questions for the DTC to discuss:

- Is the reported impact unusual for the time of year?
- Is the reported impact clearly linked to drought-related causes?
- Might the reported impact be due to other causes?
- How does the reported impact compare with the seasonal evolution of drought as shown by the drought monitor?
- What are the implications for recommended drought response actions?

The conclusion of these discussions should be included in the meeting report, noting:

- The type of impact,
- It's severity (if known),
- Reported location and timing,
- The source of information,
- The DTC's level of confidence that the reported impact can be linked to drought, and
- Any implications for recommended drought response actions.

8.3.2 Quarterly Indicators

The DTC meetings in March and June will also consider indicators related to vulnerabilities in the livestock sector. In preparation for these meetings, the representative from the Ministry of Agriculture should review relevant statistics and sources of information and be ready to brief other DTC members.

The DTC has chosen two sources of information to be reviewed each quarter:

- Market data: to be checked by the representative of the Ministry of Agriculture for evidence of unusually high feed prices.
- Mortality data: to be checked by the representative of the Ministry of Agriculture for evidence of high levels of livestock mortality.

Period	Impact	Indicator	Source	Concern?	High Concern?
Mid-Season	Production losses in livestock	Increase in spring feed prices	Ministry of Agriculture market data	5% increase in feed prices from previous month	10% increase in feed prices from previous month
Mid-Season	Production losses in livestock	% of livestock mortality, by governorate	Ministry of Agriculture mid-season survey	5% increase in mortality rate from previous month	10% increase in mortality rate from previous month

Key questions for the DTC to discuss:

- Is the reported impact unusual for the time of year?
- Is the reported impact clearly linked to drought-related causes?
- Might the reported impact be due to other causes?
- How does the reported impact compare with the seasonal evolution of drought as shown by the drought monitor?
- What are the implications for recommended drought response actions?

The conclusion of these discussions should be included in the meeting report, noting:

- The type of impact,
- It's severity,
- Reported location and timing,
- The source of information,
- The DTC's level of confidence that the reported impact can be linked to drought, and
- Any implications for recommended drought response actions.

8.3.3 Seasonal Indicators

The DTC has chosen two indicators for the Drought Monitoring Unit to include in the annual report at the end of each drought season. The first is water stored in selected key dams, reflecting the potential impacts of hydrological drought. The second is the harvested area of barley, as a percentage of the area planted, reflecting the potential impacts of agricultural drought.

Period	Impact	Indicator	Source	Concern?	High Concern?
Yearly	Water Resource Degradation	Storage in Wadi Arab dam	Yearly report of MWI dam directorate	Storage level below 4 mcm	Storage level below 2 mcm
Yearly	Water Resource Degradation	Storage in Mujeeb dam	Yearly report of MWI dam directorate	Storage level below 10 mcm	Storage level below 5 mcm
Yearly	Water Resource Degradation	Storage in Kufranja dam	Yearly report of MWI dam directorate	Storage level below 2mcm	Storage level below 1 mcm
Yearly	Production losses in rainfed agriculture	Barley % harvested area by governorate (Irbid, Ajloun)	Ministry of Agriculture harvest report	<40% harvested area, barley	<15% harvested area, barley
Yearly	Production losses in rainfed agriculture	Barley % harvested area by governorate (Jerash, Balqa, Madaba, Karak, Aqaba, Tafiela, Zarqa, Ma'an, Amman & Mafraq)	Ministry of Agriculture harvest report	<30% harvested area, barley	<15% harvested area, barley

8.4 Performance evaluation and adaptive management

Evaluating the effectiveness of drought management actions supports preparedness and adaptive management. The DTC should develop a culture of performance evaluation to assess the outcomes of drought responses and identify areas for improvement.

Annual Reports

In July each year the DTC should prepare an annual report on progress with preparedness and mitigation actions for consideration by the NDMC. Each action should be assessed using a 'traffic light' rubric to indicate the progress made. 'Red' indicates no progress made, 'Yellow' indicates that work is underway, and 'Green' indicates that the action has been completed. A brief narrative should indicate where progress has not been made and why, and recommend whether to abandon the task or how to accelerate progress. The report may also include any insights from new research and updated vulnerability assessments to make recommendations to the Drought Action Plan's operational framework and/or recommended preparedness, mitigation and response actions.

Monthly Drought Reports

Each month during drought conditions, the DTC should prepare a brief report for the NDMC. This should include information on progress with the implementation of response actions. The DTC should also use drought impact reports to consider whether response actions are being effective in reducing drought impacts on people, the economy and the environment. The DTC should identify where progress has not been made and why, where response actions are not being effective and why, and recommend any relevant changes.

Drought Evaluation Reports

At the cessation of drought, the DTC should prepare a post-drought assessment report. This should include analysis of the drought's evolution, the mobilisation of response, the impacts, and an evaluation of drought response performance. It should identify recommendations for any necessary changes to the Drought Action Plan's operational framework and recommended preparedness, mitigation and response actions.

Drought Action Plan Revision

Every five years the DTC should undertake a comprehensive review to revise the Drought Action Plan in the light of evolving drought risks and vulnerabilities. This may include mitigation and response action targeting new needs and sectors, and revisions to the institutional and operational framework and existing preparedness, mitigation and response actions that reflect changing needs and capacities, including analytic capacities.

Part C. Drought Mitigation and Preparedness Actions

Drought risks and impacts can be mitigated by actions to strengthen resilience and preparedness. Responding to drought is more expensive, challenging and prone to failure if appropriate preparedness and mitigation actions have not been taken.

9. Drought preparedness actions

Drought preparedness focuses on developing and strengthening the institutional framework for drought response. The objective is to ensure that drought responses can be mobilised rapidly, targeted effectively, and that lessons are learned to improve future drought responses. Preparedness involves developing the necessary legal powers, policies, strategies, response plans, institutional arrangements and other aspects of drought management capacity. A key component is strengthening the informational and analytic capability for early detection of droughts and monitoring impacts.

***Table 2**. Drought Preparedness actions*

Drought Preparedness	
P1.	MWI to convene NDMC to oversee and hold accountable the DTC's tasks of drought monitoring and producing technical recommendations.
P2.	MWI to convene NDMC yearly to review progress with mitigation measures and response preparations.
P3.	MWI to keep drought policies and Drought Action Plan updated to reflect new knowledge and changes in economic, institutional and environmental contexts.
P4.	MWI to continue to develop the DTC with rehearsals and contingency planning for drought events.
P5.	MWI to upgrade laws and regulations to ensure water sector has appropriate powers for responding to drought emergencies.
P6.	MWI to develop drought water resource contingency plans and incorporate drought risk management into strategic and operational planning of water sector, including mobilisation of supply and allocations during drought conditions.
P7.	NDMC to work with the Ministry of Finance, Cabinet and other relevant authorities to develop a Drought Contingency Fund for resourcing Emergency relief efforts
P8.	MWI and NDMC to develop any standard operating procedures for implementing drought response actions given in Section 13.
P9.	MWI to maintain information sharing and contact lists for dissemination of drought information.
P10.	MWI to develop list of media contacts for sharing public information during drought emergencies.
P11.	MWI to coordinate GIS and remote sensing capabilities between agencies for drought risk management.
P12.	MWI, JMD and NARC to extend and network automated weather stations operating in Jordan to support drought early warning systems.

P13. MWI, MoA and MoEnv to establish a soil moisture monitoring network to support drought early warning systems.
P14. MWI to improve data and monitoring systems for climate, surface water and groundwater, and upgrade process and systems for sharing datasets.
P15. MoEnv to improve data and monitoring systems for climate, surface water and groundwater quality, and upgrade process and systems for sharing datasets.
P16. MWI, MoA and DoS to compile a list of potential drought reporting indicators relevant to priority sectors

10. Recommended Mitigation Actions

Drought mitigation actions are investments in managing drought risk, requiring resources and effort to implement. Appropriate mitigation actions, however, can **save money and effort during drought periods** by **reducing the economic impacts of drought** and **reducing the costs of relief and response** efforts.

Many mitigation actions also offer co-benefits to other economic and social goals. Reducing Jordan's water budget deficit, for example, also support environmental sustainability, broad-based economic growth, and access to drinking water as well strengthening drought resilience.

Mitigation actions include:

- Institutional development, including the formulation of legislation, policies, strategies, plans, instruments and budgets;
- Information sharing and raising awareness about managing drought risks.
- Monitoring and analysis, to support drought early warning and the design, timing, targeting, and evaluation of drought actions
- Resilience strengthening (e.g. investing in public infrastructure)

The DTC recommends the following actions to mitigate drought risks to water resources, drinking water services, agriculture, livestock, rangelands, forests and diarrhoeal disease.

***Table 3**. Drought Mitigation actions*

Water Resources (MWI, WAJ, JVA, MoA)
M1. MWI to incorporate drought risk management into strategic and operational planning of water sector, including mobilisation of supply and allocations.
M2. MWI to develop proposals for drought risk mitigation (adaptation) in the water sector for financing from international climate change adaptation funds.
M3. MWI to identify and designate appropriate aquifers as strategic reserves for use only in national emergencies, and strictly enforce zero-abstraction in these zones.
M4. MWI to pursue the strategic objective of reducing Jordan's strategic water imbalance to net zero.
M5. MWI to work with other government departments to introduce economic and regulatory incentives for reducing water use in all sectors.
M6. MWI to introduce and enforce regulations and directives to keep groundwater abstraction within sustainable limits and prevent the depletion of aquifers.
M7. MWI to implement and enforce measures for protecting water resources quality, e.g. by updating and enforcing protection zones.

M8. MWI to ensure technologies for water efficiency are deployed only when accompanied by appropriate regulations that ensure they reduce absolute levels of water consumption.
M9. Where possible, strengthen transboundary water resources management and regional cooperation to preserve Jordan's rights to international waters.
M10. MWI to enhance surface and ground water storage to reduce water stress during drought periods.
M11. MWI to develop alternative sources of water supply including desalination, rainwater harvesting in both rural and urban areas, treated wastewater, and brackish groundwater.
M12. MWI and MoEnv to include messages about water conservation and drought management in public awareness campaigns.
Drinking Water Services (MWI, WAJ, Utilities)
M13. MWI and Water Authority to implement policies that reduce water demand and incentivise private water conservation.
M14. Water Authority to provide training to utility customer service teams on managing expectations during drought periods.
M15. Water Authority and utilities to upgrade customer service policies for water providers.
M16. MWI and Water Authority to update water rationing procedures during drought to ensure social and economic equity.
M17. Water Authority to support utilities prepare drought management plans.
M18. Water Authority to develop a process and contact list for sharing drought warnings with utilities, local authorities and appropriate media (e.g. radio and newspapers) in affected areas.
M19. MWI and Water Authority to develop infrastructure and increase network coverage allowing re-allocation from multiple sources.
M20. Water Authority and utilities to increase investment on network maintenance/rehabilitation to reduce non-revenue water network losses.
M21. MWI to increase water supply from large-scale desalination.
M22. Water Authority and utilities to prepare stockpiles of any necessary equipment.
Irrigated and Rainfed Agriculture (MoA, MWI, MoLA)
M23. MoA, NARC and MWI to introduce, implement and enforce policies incentivising $ per drop from agriculture, encouraging irrigation farmers to prioritise crops with significant economic and food security value per unit water.
M24. MoA, NARC and MWI to develop, integrate and enforce policies for agricultural water management responses to drought in different areas depending on irrigation technology (including supplementary irrigation), water source, crop type and agricultural technique.
M25. MoA and MWI to enact regulations and legislation requiring farmers accept groundwater abstraction limits if adopting drip irrigation, other 'water efficiency' technologies, and other soil-water management techniques (e.g. zero-tillage, mulching, etc).

M26. MWI to strengthen regulations, controls and enforcement governing unregulated and illegal wells.
M27. MoA and MWI to strengthen regulations, controls and enforcement to limit groundwater abstractions for irrigation.
M28. MoA, MWI and Ministry of Local Administration to upgrade and implement regulations, including for land-use zoning, to protect productive rainfed areas from pollution and land-use change, especially urbanisation.
M29. MoA to provide incentives for farmer adoption of technical measures for soil fertility and soil-water management (e.g. conservation agriculture).
M30. MoA and MWI to develop and promote drought insurance schemes.
M31. MoA to explore options with donors for developing financial services for small farmers, including debt-management advice, and access to micro-credit and rain-insurance schemes, perhaps based on frost insurance schemes.
M32. MoA to clarify a process and contact list for sharing early warnings of agricultural drought within Ministry of Agriculture, and between Department of Extension and farmers.
M33. MoA, MWI and NARC to consider developing mobile/social media applications to inform farmers in affected areas about impending drought.
M34. MoA and NARC to provide training and resources for agricultural extension staff to raise awareness and preparedness of farmers.
M35. MoA and NARC to consider options for training private sector agriculture dealers on supporting farmers in drought conditions.
M36. MoA to prepare lists and vulnerability maps identifying poorer farmers most likely to be affected by drought in each district to help target and speed up response measures.
M37. MoA and MWI to explore with donors options for technology transfer and capacity building for a remote sensing system for surveillance of groundwater irrigation perimeters and monitoring of crop water use.
M38. MoA to provide incentives for farmer adoption of technical measures for soil fertility and soil-water management (e.g. conservation agriculture).
M39. MoA Extension Department and NARC to provide farmers with technical advice on locally appropriate drought resilient agriculture.
M40. MoA and NARC to improve farmers' access to drought tolerant varieties and incentivise their adoption.
M41. MoA and MWI to expand water-harvesting and waste-water treatment schemes.
M42. MoA and MWI to continue evaluating rain enhancement (ionisation) programmes and developing based on success.
Livestock (MoA, MoEnv, MWI)
M43. MoA to enhance information flow between farmers/pastoralists, government, business, and sources of credit.
M44. MoA, MoEnv and NARC to work with community-based organisations to promote rangeland conservation programmes and support conflict resolution.

M45.	MoA and MoEnv to clarify a process and contact list for sharing early warnings of agricultural drought within Ministry of Agriculture, and between Department of Extension and pastoralists.
M46.	MoA and MoEnv to develop a strategy for communicating drought risk and condition to livestock farmers and pastoralists.
M47.	MoA to consider developing a mobile/social media application to inform pastoralists in affected areas about impending drought.
M48.	MoA to provide training and resources for agricultural extension staff to raise awareness and preparedness of pastoralists.
M49.	MoA and to conduct annual census on stocking.
M50.	MoA to prepare lists of the most vulnerable/poor pastoralists most likely to be affected by drought in each district to help target timely response measures.
M51.	MoA and NARC to provide technical assistance to farmers in the implementation of field trials for heat, drought and salinity tolerant crops and livestock species.
M52.	MoA and NARC to encourage diversification of production among pastoralists.
M53.	MoA to and MoLA to develop programmes for off-farm job creation to diversify household incomes, especially for women.
M54.	MWI, MoEnv and MoA to expand groundwater recharge schemes.
M55.	MoA and MWI to plan an emergency water-hauling scheme for livestock.
M56.	MoA and MoEnv to improve targeting of subsidies to ensure stocking of rangelands is kept within sustainable limits.
M57.	MoA to design an effective emergency compensation scheme to support recovery of small livestock producers.
Rangelands (MoEnv, MoA, MoLA)	
M58.	MoEnv to develop rangeland drought management plans based on localised drought risk assessment and studies of sustainable production.
M59.	MoEnv to strengthen stewardship institutions for sustainable co-management of rangeland areas, with agreements on sustainable limits of livestock grazing and the allocation of grazing rights.
M60.	MoEnv and RSCN to establish set-aside protected areas to allow over-grazed areas to recover.
M61.	MoEnv, MoA and MoLA to regulate land-use changes to limit conversion to agricultural land in sensitive areas.
M62.	MoEnv and MWI to restrict and monitor groundwater abstraction in rangeland areas.
M63.	MoEnv to implement soil conservation measures in at-risk areas.
M64.	MoA to promote no-till agriculture in cropping areas.
Diarrhoeal Disease (MoH, MWI, MoEnv, MoA)	
M65.	MoEnv and MoH to work with other authorities to enhance regulations and standards for and monitoring of food quality standards during droughts and heat extremes.
M66.	MoH to raise awareness of local health officials and develop contingency and response plans at appropriate levels.
M67.	MoH to clarify internal processes and contact list for sharing drought warnings.

M68.	MoH to include messages about increased risk during drought and heat waves in public hygiene awareness campaigns.
M69.	Water Authority and MoH to include messages about design and practice for safe household water storage in public awareness campaigns.
M70.	MoEnv, MoH and MWI to cooperate on monitoring groundwater and surface water quality, including rivers, dams, canals, streams and water bodies.
M71.	MoH to strengthen systems for monitoring and reporting diarrhoeal disease during drought.
M72.	MoEnv, MoA, MWI and MoH to cooperate on upgrading capacity for monitoring treated wastewater used in irrigation.
M73.	MoH to stockpile diarrheal disease treatment kits and emergency hygiene kits.
M74.	MoEnv, MoH and MWI to upgrade operating guidelines on water use and treatment from polluted and contaminated sources during drought periods.
M75.	MoEnv, MoH and MWI to upgrade operating guidelines for the use and treatment of water, particularly from polluted and contaminated sources, during drought periods.
M76.	MoEnv, MoA, MoH and MWI to upgrade operating guidelines for use of treated wastewater in irrigation during drought periods and heat extremes.
Forests (MoEnv, Civil Defence)	
M77.	MoEnv to introduce stricter regulations and penalties governing illegal activities in forest areas.
M78.	MoEnv to invest in resources for enforcing and prosecuting the regulations, especially for charcoal production, illegal logging, grazing, and conversion of forests to agricultural land.
M79.	MoA and MoEnv to invest in forest rehabilitation, replanting and reforestation.
M80.	MoA and MoEnv to legislate for heavy fines and penalties for arson in natural areas.
M81.	MoA and MoEnv to develop and implement forests fire risk management plans.
M82.	MoA and MoEnv to prepare public awareness campaigns about fire risks in forest areas.
M83.	MoA and MoEnv to invest in plans, equipment and training for fighting forest fires.
M84.	MoA and MoEnv to develop fire-watch systems with forest rangers and local communities during periods of heightened fire risk.

Part D. Responding to Drought

11. Recommendations on Drought Response Levels

The Drought Response Level defines the activities of government and other stakeholders in reducing drought vulnerabilities and impacts. More severe drought implies an escalation of the Drought Response Level, and more robust activities to address greater impacts on people, the economy and the environment.

Establishing the Drought Response Level is an important part of drought response because it defines the timing and selection of response actions. The Drought Action Plan identifies four Drought Response Levels:

- **Level 1: Drought Watch**: normal conditions, no drought detected, monitoring continues.
- **Level 2: Drought Alert**: moderate drought detected; authorities kept informed as drought conditions evolve.
- **Level 3: Drought Emergency**: drought likely to have significant impacts on people, the economy and the environment, responses actions mobilised using available resources.
- **Level 4: Drought Crisis**: drought likely to have very negative impacts on people, the economy and the environment, and response actions will need additional resources.

The DTC recommends the appropriate Drought Response Level to the NDMC. In deciding what Drought Response Level to recommend, the DTC uses Triggers and assessments of Drought Class from the DMS.

The DTC's recommendations on drought response levels and response actions should be targeted as carefully as possible to those regions and groups which are expected to be affected by drought impacts. This targeting will depend on both the spatial resolution of the drought monitor and the anticipated drought impacts, and will require careful expert judgement by the DTC.

The Triggers in Table 4 have been developed using expert judgement based on correlations of historical records of drought indicators with drought conditions and impacts. Different triggers have been identified for winter and spring months. Winter months (December, January and February) are slightly more sensitive to drought than spring months (March, April and May). In the future, these triggers should be revised and localised in the light of experience and as access to tools and data improves.

***Table 4**. Using Triggers to determine Drought Response Level*

Drought Response Level		Trigger	
		Winter (DEC, JAN, FEB)	**SPRING (MAR, APR, MAY)**
Level 1	Drought Watch	-	-
Level 2	Drought Alert	First month of Moderate Drought Class detected	First month of Moderate Drought Class detected
Level 3	Drought Emergency	At least 1 month of Moderate Drought Class and 1 month of Severe Drought Class in this period	At least 2 months of Severe Drought Class in this period
Level 4	Drought Crisis	At least 1 month of Exceptional Drought Class	At least 1 month of Exceptional Drought Class consecutive with 1 month of

		consecutive with 1 month of Severe drought in this period	Severe drought in this period

The Drought Response Level implies institutional responses from the different bodies, ministries and agencies involved in drought response. Recommendations on changes to the Drought Response Level and actions should be approved by a meeting of the NDMC, and other government stakeholders informed accordingly, including the Cabinet and NCSCM (Table 5).

***Table 5**. Escalation ladder for Drought Response Levels*

Drought Response Level		**DTC meetings**	**NDMC meetings**	**Actions**
Level 1	**Drought Watch**	Monthly between December and May, plus a review meeting in Summer.	Yearly	• DMS meets monthly (December to May) to produce Drought Class assessment • DTC meets monthly (December to May) to produce recommendations to NDMC • DTC produces annual report to NDMC
Level 2	**Drought Alert**	As for 'Drought Watch', plus as needed by NDMC	Twice per year	• DMS and DTC meet as normal • NDMC meets to decide on approving 'Drought Alert' Response Level and actions • NCSCM and Cabinet informed
Level 3	**Drought Emergency**	As for 'Drought Watch', plus monthly meetings between June and October to assess evolution of drought impacts and advise NDMC	Additional meetings as necessary	• DMS and DTC meet as normal • NDMC meets to decide on approving 'Drought Emergency' Response Level and actions based on Drought Class, duration, and likely impacts • NCSCM and Cabinet informed
Level 4	**Drought Crisis**	As for 'Drought Emergency', plus as needed by NCSCM	Additional meetings as necessary	• DMS and DTC meet as normal • NDMC meets to decide on recommending 'Drought Crisis' Response Level and actions based on Drought Class, duration, and likely impacts • NCSCM and Cabinet informed • NCSCM may assume oversight

11.1 Exiting drought and ending response actions

In most cases, actions should continue until the relevant drought class is over. This means that Drought Alert Response actions will continue during Drought Emergency and Drought Crisis Response phases, until the drought has passed. Likewise, Drought Emergency Response actions will continue during Drought Crisis responses until a return to the Drought Alert Response Level, at the earliest.

Deciding when to end a response action should be informed by

- the end of the biophysical drought, and
- the impacts still experienced by people, the economy and the environment.

It is often advisable to continue with relief efforts well after biophysical drought conditions are over, and to continue addressing the consequences of drought impacts in order to support recovery.

11.2 Season to season

Rainfall between June and October in Jordan is negligible, so drought class monitoring is suspended until December, when the DTC reviews data from November. However, in drought years, the DTC and NDMC continue to meet during the summer as required by the drought response (Table 5). During these periods, monitoring is focused on drought impact reporting and evaluating the performance of responses.

As discussed under Section 11.2, Drought Response Levels should be maintained from season to season until there are clear signals that the biophysical drought is over and the impacts of drought on people, the economy and the environment are easing.

Seasons that follow a previous season of drought should maintain appropriate Drought Response Levels until it is clear what the precipitation patterns of the new season are.

Example: Maintaining Drought Response Levels
Last year, extensive drought conditions across Jordan led to Emergency Response Levels in the Badia, and Drought Alert Response Levels across the rest of the country. These Drought Response Levels are maintained during the summer months into the next hydrological season. By January it appears that the Badia is experiencing normal conditions, and the Drought Response Level there is reduced to Drought Alert. Across the country, Drought Alert Response Levels are maintained until March, when the DTC concludes that rainfall conditions have been above average across the country for the season so far. However, any relief programmes currently underway in the Badia may continue as appropriate, and the DTC will continue to monitor for signs of severe or exceptional drought emerging during April and May.

12. Recommendations for Response Actions

Representatives of the Ministry of Water, Ministry of Agriculture, Ministry of Health, Ministry of Environment on the DTC have participated in exercises to identify appropriate actions in response to drought. These response actions are set out in Table 6.

Several of these actions depend on the achievement of preparedness and mitigation actions as preconditions. When making recommendations, the Drought Technical Committee should ensure that any preconditions necessary for a drought response action to be effective are in place.

12.1 Identifying appropriate response actions

Table 6 presents response actions for Drought Alert, Drought Emergency and Drought Crisis Response Levels, organised by impact area and responsible agencies. In the event of drought, the DTC is responsible for recommending to the NDMC response actions that are appropriate given:

- The anticipated drought response level (Drought Alert, Drought Emergency, Drought Crisis);
- The duration and evolution of the current drought;
- The location of the drought;
- The anticipated drought impacts;
- The feasibility of successfully implementing possible response actions (e.g., are necessary preconditions in place, such as achievement of essential preparedness and mitigation actions).

Drought Alert Response Level: information sharing

Moderate droughts detected early in the season may worsen later in the season. However, rainfall later in the season may also remove the threat of drought. The *Drought Alert Response Level* therefore involve regular meetings of the DTC to monitor the evolution of drought conditions, and keeping key actors informed to enable a prompt response if necessary.

Recommendations from the DTC should make clear:

- Who needs to know?
- What do they need to know?
- When do they need to know?
- How should they be informed?
- Why is the DTC sharing this information?

Drought Emergency Response Level: responding with available resources

Drought Emergencies are more likely detected later in the season, after low precipitation in several months. The *Drought Emergency Response Level* implies that a drought will have impacts, but not enough for a formal declaration of a national drought crisis and mobilisation of additional resources. This means Drought Emergency response actions must rely on existing resources and budgets being reallocated from other uses to drought-affected areas, people and impacts.

This may be a challenging period, as available resources are unlikely to be sufficient to offset the serious impacts of a severe drought. Careful prioritisation of actions, target areas and people will be needed. Records should be kept of how choices are made, so that they can be evaluated after the drought and the Drought Action Plan revised accordingly.

Recommendations from the DTC should make clear:

- What should be done?
- Who should be involved?
- Where and when should it be done?
- What is action expected to achieve?

Drought Crisis Response Level: responding with additional resources

The *Drought Crisis Response Level* implies conditions are severe enough for an official declaration of drought by the government. This is likely to mean the NCSCM assumes oversight for coordinating the response and mobilises additional resources. Recommendations for Drought Crisis Response should consider what might be done with additional resources and budgets.

Recommendations from the DTC should make clear:

- What should be done?
- Who should be involved?
- Where and when should it be done?
- What is action expected to achieve?

12.2 Recommended drought response actions

Table 6*. Drought response actions*

Water Resources (MWI, WAJ, JVA, MoA)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R1. Share drought warnings and updates on evolution of the drought season within MWI, Water Authority and Jordan Valley Authority.
Increasing water stress	Drought Emergency or higher	R2. Ensure water allocations meet agreed priorities; R3. Consider restrictions /withdrawing allocations to water-intense uses; R4. Enforce restrictions on groundwater pumping in designated areas; R5. Enforce restrictions on irrigation in affected areas depending on crop types and source of irrigation water (different areas may require different interventions); R6. Consider permitting additional pumping in designated areas where reserves permit.
	Drought Crisis	R7. Enforce stricter restrictions on irrigation in affected areas depending on crop types and source of irrigation water (different areas may require different interventions); R8. Mobilise strategic water reserves and allow additional pumping for drinking water and other agreed priorities.
Drinking Water Services (MWI, WAJ, Water Utilities)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R9. Issue drought early warnings and monthly updates to senior Water Authority of Jordan officials; R10. Issue drought advisories to water utilities; R11. Issue public drought notices through appropriate media (e.g. radio and newspapers) encouraging reduced water demand.
Declining customer satisfaction	Drought Emergency or higher	R12. Keep public in affected areas notified about expected shortages and periods of service;

		R13. Hire / reallocate temporary staff to customer satisfaction teams in water utilities.
Loss of universal / equitable access	Drought Emergency or higher	R14. Implement a socially fair rationing system; R15. Provide water supplies using tanker trucks to the most vulnerable.
	Drought Crisis	R16. Reallocate supplies from less affected areas and other uses (e.g. irrigation) to ensure supplies of drinking water; R17. Mobilise additional water supplies for affected areas, sinking emergency boreholes if necessary; R18. Provide emergency supplies using tanker trucks to the most vulnerable R19. NCSCM to provide cash transfers/subsidies for affected areas and poor / vulnerable households to offset higher water costs.
Irrigated Agriculture (MoA, MWI)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R20. Share drought early warning outputs through the drought information systems with Ministry of Agriculture, agricultural extension system, private inputs dealers, and farmers in affected areas;
	Drought Emergency or higher	R21. Public information and awareness campaigns about drought conditions and restrictions on irrigation in affected areas;
Production / yield losses	Drought Emergency or higher	R22. Consider permissions for additional abstractions in affected areas depending on crop types and source of irrigation water, and subject to ability to meet needs of higher priority water users (different areas may require different interventions).
Rainfed Agriculture (MoA, MWI)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R23. Share drought early warning outputs within Ministry of Agriculture, agricultural extension system and farmers; R24. Provide Ministry of Local Administration and Ministry of Social Development with information about likely drought locations and possible impacts.
	Drought Emergency or higher	R25. Public information campaigns in affected areas to raise awareness about recommended farmer responses to drought conditions; R26. Conduct survey of drought impacts on production.

Production / yield losses	Drought Emergency or higher	R27. Consider permitting supplementary irrigation in appropriate areas with sufficient irrigation areas; R28. Issue timely advice over planting appropriate crops, particularly vegetable crops.
Increasing poverty of farmers	Drought Emergency or higher	R29. Inform international donors and relief agencies to heightened risks; R30. Use Agricultural Risk Fund to ensure minimum income (or, where possible, compensate for crop losses), targeted at poorest rainfed farmers.
	Drought Crisis	R31. NCSCM coordinate implementation of cash transfers targeted at the poorest farmers, so they don't have to sell crucial assets to survive the drought R32. Initiate procurement and subsidy programmes for seed stock and cereal seeds to help affected farmers recover production quickly. R33. Emergency food program to ensure food security of poorest farming households and reducing price/supply volatility in local food markets; R34. Implement public works/infrastructure schemes to provide rural employment opportunities and improve water harvesting, drainage and logistics performance.
Livestock (MoA, MoEnv)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R35. Share drought early warning forecasts through the drought information systems with Ministry of Agriculture, agricultural extension system and pastoralists; R36. Provide Ministry of Local Administration and Ministry of Social Development with information about likely drought locations and possible impacts.
	Drought Emergency or higher	R37. Public information campaign.
Production/yield losses	Drought Emergency or higher	R38. Reallocate veterinary care resources to livestock in affected areas prioritising Mafraq, Irbid and Karak; R39. Reallocate / prioritise feed subsidies to affected areas; R40. Intervene to regulate prices in feed market.
	Drought Crisis	R41. Implement emergency water-hauling scheme for livestock in affected areas;

		R42. Issue emergency water pumping permits in affected areas; R43. Implement emergency livestock feed provision scheme for livestock in affected areas.
Increasing poverty of pastoralists	Drought Emergency or higher	R44. Make pastoralists aware of government aid programmes; R45. Use Agricultural Risk Fund to compensate poorest pastoralists for livestock losses.
	Drought Crisis	R46. NCSCM to coordination implementation of cash transfers targeted at the poorest pastoralists, so they don't have to sell crucial assets to survive the drought; R47. Emergency food program to ensure food security of poorest pastoralist households.
Rangeland degradation (MoEnv)		
Impact condition	**Drought level**	**Recommended response actions**
Risks of over-exploitation	Drought Alert or higher	R48. Share drought early warning forecasts with Ministry of Environment, protected areas, pastoralists and NGOs and community groups.
	Drought Emergency or higher	R49. Implement rangeland drought management plans where available.
	Drought Crisis	R50. Limiting and controlling herd movements in sensitive areas.
Diarrhoeal disease (MoH, MWI, MoEnv)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R51. Share drought alerts with Ministry of Health departments and local health officials in affected areas; R52. Ministry of Health to check preparedness of contingency and response capability.
Higher levels of pathogens in water and food	Drought Emergency or higher	R53. MWI, MoH & MoEnv to implement standards for using and monitoring treated wastewater quality during droughts; R54. MWI & MoEnv to implement standards for using and monitoring groundwater quality during droughts; R55. MoH, & MoEnv to implement standards for food quality testing during droughts.
Health impacts on children	Drought Emergency or higher	R56. Ministry of Health to distribute diarrhoea disease treatment kits to affected areas if necessary;

		R57. Ministry of Health to distribute emergency hygiene kits to affected areas if necessary; R58. Ministry of Health to redeploy equipment, staff and materials, including mobile care facilities, to affected areas.
Forests (MoEnv, Civil Defence)		
Impact condition	**Drought level**	**Recommended response actions**
All	Drought Alert or higher	R59. Share drought early warning outputs with Ministry of Environment, protected areas, civil defence, Royal Society for the Conservation of Nature.
Forest fires	Drought Emergency or higher	R60. Implement fire-watch systems in affected areas; R61. Implement public awareness campaigns with media (radio, newspapers, etc.); R62. Enforce bans on smoking and open fires in forests; R63. Consider bans on recreational visits to forests; R64. Conduct readiness drills for fire-fighting responses.
	Drought Crisis	R65. Ban recreational visits to forest areas; R66. Conduct readiness drills for fire-fighting responses with armed forces / civil defence.
Forest degradation	Drought Emergency or higher	R67. Zero-tolerance policy towards cutting and grazing in forests.

Appendix

Recommendation Template

Drought Technical Committee Meeting
Date:
Present:

Data sources reviewed:

Drought Response Level Recommendations
The Drought Technical Committee recommends that the Drought Response Level be set as:

Drought Watch ☐
Drought Alert ☐
Drought Emergency ☐
Drought Crisis ☐

Response Level	Areas
Drought Alert	
Drought Emergency	
Drought Crisis	

Recommended Response Actions

- What should be done?
- Who should be involved?
- Where should it be done?
- When should it be done?
- What is action expected to achieve?