



# Drought Management Policies and Institutional Mandate in Jordan

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## Abstract

Drought represents a serious challenge that affects sustainable development in Jordan. Because a drought is directly related to the water, Jordan has created many strategies and policies for different institutions; these strategies contain different aspects related to drought management and drought adaptation for agriculture, surface water, groundwater, health, land use, livestock, the environment, desertification, and rangeland. These strategies and policies are interrelated. Reviewing the existing strategies and policies shows the gaps and shortcomings with drought management. A drought monitoring and drought early warning system have been suggested by many strategies. Many projects and programs have been proposed to reduce the negative effect of droughts without any real implementation on the ground. There is a need to improve the understanding of a drought's effects on the water sector as well as to assess their underlying causes, to identify the detrimental effects, and to recommend the appropriate mitigation and response actions through effective bottom-up, multi-stake holder processes which are rooted in the "priority-setting" approach.

## Keywords

Drought • Policies • Vulnerability • Reactive measures • Proactive measures

## 1 Introduction

Jordanian water crises are being exacerbated due to the increased water demands derived from high population growth, sudden refugee fluxes, economic development, and the increased frequency of drought events (MWI 2016). Jordan implemented reactive drought management measures; some of them cope with the threatening water scarcity each summer (MWI 2018). These forces stress the urgent need to develop appropriate drought-adaptation planning based on vulnerability mapping which is correlated to prolonged weather events. Drought management strategies are needed because water shortages directly affect a great number of humans and animals as well as a significant portion of the environment. Drought often results in a shortage in water resources, crop failures, the loss of livestock, more diseases, less hydropower, increased soil erosion, more fires, and increased social stress (Al-Qinna et al. 2011), leading to human losses, mass migration, reduced security, and potential wars. Therefore, there is a great need to develop and to implement drought management strategies and action plans in order to increase societal and environmental resilience as well as to enhance drought-response and recovery capabilities (AlAdaileh et al. 2019).

During the last decades, the frequencies and severity of droughts as well as the affected area have increased (Dai et al. 2004; Dai 2013), mainly as a result of climate change. According to the Intergovernmental Panel on Climate Change (IPCC) (Smith et al. 2009), freshwater availability in some parts of Asia is projected to decrease as a result of climate change which, along with population growth and the increasing demand arising from higher standards of living,

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could adversely affect more than a billion people by the 2050s. The IPCC findings also predict dramatic changes in the temperature and precipitation conditions for the Mediterranean region as well as a likely increase in drought frequency and intensity. Rahman et al. (2009) argue that the effects of climate change, which is represented in the temperature rise for the region exceeding 2.0 °C per decade, have exacerbated Jordan's water crisis. Over the last half-century, the average annual temperatures in Amman have increased by more than 1.5 degrees and precipitation has dropped by more than 50 mm per year, along with an increase in heatwaves and an increased number of high-temperature days. The main effects of climate change on Jordan's water sector include (a) high temperature and increased heat waves, resulting in increased evaporation; (b) decreased precipitation (rainfall), resulting in under-recharge of surface and groundwater sources; and (c) increased variability and fluctuation for the temporal and spatial precipitation patterns, leading to further changes in drought severity and the intensity of floods (MWI 2016; MoEnv 2013, 2014, 2017).

## 2 Methods

There are many strategies, policies, and programs in Jordan which contain different aspects related to drought management. This work is based on a desk review of previous documents and reports about drought monitoring in Jordan, and the main findings are summarized from reviewing the past and existing strategies. Jordan has recently developed four policies and strategic documents about climate change: (a) the National Climate Change Policy (2013), (b) the Third National Communication to the United Nations Framework Convention on Climate Change (2014) (MoEnv 2014), (c) the Intended Nationally Determined Contribution (NDC) in 2015, that will be the key reference document for climate change planning in the coming years, and (d) the Climate Change National Adaptation Plan (NAP) in 2019 (MoEnv 2019).

## 3 Historical Drought

At the request of Jordan's government, a joint FAO/WFP Assessment Mission visited the country in 1999 in order to assess the effect of drought in the country. The mission reported the lowest-recorded domestic harvest: less than 1% of the domestic cereal requirement. In a normal year, the domestic production meets about 10 percent of the country's cereal requirement. The operation was managed by the Drought Relief Committee, headed by the Minister of Interior, comprising representatives from the Ministries.

Several studies have highlighted the severity and influence of water stress in Jordan as being partially caused by drought (MoEnv 2014; Al Qatarnah et al. 2018; El-Naqa and Al-Shayeb 2009; Margane et al. 2004; Abdulla and Eshtawi 2015; Abdulla and Al Omari 2008). Among the effects noted for the last 20 years, more than 200 springs have become dry, and the groundwater level has dropped at a rate of around 2 m per year. In some highly depleted areas, the reduction can reach 5 to 20 m per year, decreasing the magnitude of the base flow and flood flow in the main wadis (valleys) and reducing the main dams' storage to around half of their capacity. These changes have led to more food imports, increased food insecurity, more desertification trends, frequent deterioration of land productivity, increased migration from rural areas, reduced investments, and increased unemployment (Nairizi 2017; Battikhi 2013; Mohammad et al. 2015; Abu-Allaban et al. 2015; Al-Tabbal and Al-Zboon 2012).

Priority sectors for adaptation in Jordan include water and agriculture as well as ecosystem services and biodiversity (MWI 2016). The drought-relief policies, which have been largely of an ad-hoc reactive nature, have created social and economic dependencies among people in the low rainfall areas, a situation which is proving to be financially costly for governments and which is difficult to escape from Battikhi (2013). Together with broader sector and national policies, the policy encouraged an escalation of animal numbers and has had negative effects on the natural environment. The drought policies cannot be separated from the political and economic drivers, such as urbanization, population pressures, waves of refugees, development plans, and economic adjustment programs (Abu Hajar et al. 2019).

The downscaled, forecasted climate change scenario in Jordan shows that, when comparing the baseline period (1980–2010) to 2070–2100, the average temperature increases by 2.5 °C, rainfall decreases by 30% and multiple drought-type occurrences increase from ~ 8 in 30 years to ~ 25 in 30 years. There is a significant surge for the occurrence of multiple drought types along with an 80% increase for simultaneous warm and dry events. The effects of climate change will lead to precipitation variability and increased summer temperatures (MoEnv 2019, 2015).

## 4 Results

A drought in Jordan is characterized by a temporal and spatial variability regarding probability and severity. The most prolonged drought events range from mild to moderate with long periods of exposure, which may extend for up to 13 consecutive years (Al-Bakri et al. 2019). Due to high groundwater-basin sensitivity and low adaptive capacity, Jordan's groundwater systems are fragile and highly

vulnerable to drought, being subject to either a reduction in quantity and/or a deterioration in quality over time.

There are variations among public institutions concerning drought management policies and responses. Recently, Jordanian decision-makers have become more concerned with the problem of drought and some progress in dealing with this natural disaster has been achieved. Among the actions taken, there is establishing national drought committees to reduce the effects of drought on the population, crops, and livestock, hence improving the poor's livelihood. Local committees have also been created to implement the drought-relief measures that are set up by the national drought committee. With assistance from international organizations, Jordan's government has focused on drought-relief measures. As a response to recent recurring droughts, many institutions have established a drought unit or committees where different concerned ministries are represented in order to coordinate the efforts to deal with the drought crisis and its effects. This positive initiative has solved some conflicts and has addressed the lack of coordination among different administrations and agencies which are concerned with water and drought issues.

The Jordanian Ministry of Environment (MoEnv) is responsible for coordinating climate change governance at the national level and for managing its implementation. In 2013, MoEnv launched a National Policy on Climate Change. The long-term goal of Jordan's policy and the sector strategic guidance framework is to build a climate risk-resilient country with a low carbon, but growing economy. This objective is promoted with the National Strategy and Action Plan to Combat Desertification (2015–2020) (MoEnv et al. 2017) as well as the United Nations Convention to Combat Desertification's (UNCCD) 10-year strategy. The plan aligns the country's National Biodiversity Strategy and Action Plan (2015–2020) with the Convention on Biological Diversity (CBD). Following the UNCCD, Jordan initiated the process of preparing a national action plan to combat drought and desertification. The National Committee for Combating Desertification (NCCD) was established; it is chaired by the Ministry of Environment and has relevant partners participating with its goal to integrate UNCCD concerns into existing national strategies and programs which address environmental protection, water-resource management, and agriculture.

Many laws and articles in the Ministry of Agriculture (MOA) are directly or indirectly related to drought management. Article 65 of 2015's Agricultural Law No. 13 says, "In case the Kingdom or a part thereof suffers by a drought, or in case the agricultural sector was subject to a natural disaster, the Minister shall officially declare this, and he shall undertake appropriate procedures that mitigate the negative effects resulting therefrom on the agricultural sector in cooperation and coordination with the concerned entities and

in accordance with the resolutions issued by the cabinet for this purpose. The Minister shall also undertake procedures that protect consumers in such cases that may include limiting the exportation of affected agricultural products provided that relevant international entities are notified of such procedures (Official\_Gazette 2015a)."

The National Agricultural Research Center (NARC) is the only governmental agriculture research institution at the national level, and it is the national umbrella for applied scientific research and agricultural consultation. NARC achieves its objectives by performing tasks specified by Article 5 of 2018's Bylaw 42. NARC's goals are to adopt the latest research findings from local and other sources in order to improve agricultural production: conserve, preserve, and sustainably use natural resources; maintain an ecological balance through sustainable use of the available resources without jeopardizing environmental status; and promote the use of drought-tolerant crops. The Drought and Monitoring Unit (DMU) was established at the National Agricultural Research Center because of the agreement between NARC and The World Food Program (WFP). The WFP provided equipment and training that enabled NARC to monitor drought more efficiently. The DMU's primary objectives are to analyze climatic data with various methodological techniques in order to identify the probability of drought and return periods for different areas in Jordan and to provide information for decision-makers to implement the necessary plans in order to mitigate the effect of droughts at the country level. The DMU used remote-sensing technology to monitor drought from satellite data in order to construct the normalized difference vegetative index (NDVI). The DMU has a problem with limited climatic data and mainly relies on the vegetation index to assess drought occurrences and severities. Nevertheless, the unit is continuously testing new indices to add. In addition, the DMU contributes to different research projects which are concerned with climate change, water-shortage adaptation, and water harvesting.

In 2016, a new national agriculture development strategy was published (MoA 2016). This strategy is coherent with Jordan's Vision 2025 and the National Strategy for Food Security 2016–2025. The new agricultural strategy covers many areas, including land resources, irrigation water, horticulture (rainfed, irrigated areas in the Jordan Valley and highlands), forest and rangeland, livestock, and the marketing and supporting sectors. The document indicates that rainfed agriculture has many challenges, including desertification and climate change. The strategy proposes two projects related to drought management. The first project establishes an early warning system to predict drought. The project should set a combined trigger to declare drought, to establish a database system for rainfed and rangeland areas, and to measure the effect of a drought in those areas. The second project proposes measures to develop

drought-tolerant seed and to plant varieties as well as creating income diversification.

Article 2 of 2009's Law No. 5 for the Agricultural Risk Management Fund (ARMF) defined drought as one of the agricultural risks that the fund should handle (Official\_Gazette 2009). However, in practice, drought is not further elaborated in the law. The fund aims to compensate farmers during emergencies and natural disasters in accordance with the criteria and ceilings set by the regulations (Official\_Gazette 2012). The director reports that the ARMF has nothing to do with drought in the current time. Because drought affects large areas in different agriculture sub-sectors, the ARMF concentrates on frost damage, horticultural pests, and diseases. The MOA "activated" its ARMF in 2017, granting farmers compensation for frost damage for the first time since the fund was created in 2009. In 2018, ARMF in cooperation with the Ministry of Planning and International Cooperation (MOPIC), financed from the Adaptation Fund, conducted a feasibility study to establish a cooperative solidarity company for an agricultural insurance company to benefit the ARMF.

The Civil Defense Law includes creating a council called the Higher Council for the Civil Defense (HCCD) which is chaired by the interior minister and has representatives from all ministries, institutions, and organizations related to facing disasters, including drought (Law No 18 for the year 1999). This council is responsible for managing and facing emergency cases which are defined by law as any unordinary or sudden case the Kingdom or any part of it is facing and which are announced by the prime minister. According to Article 8, the interior minister has the prime minister's authority during emergencies and disasters; the interior minister can order actions and measures throughout the duration of the following cases: Article No. 4 authorizes the minister to regulate and to control food distribution and all materials needed to cope with emergencies and disasters as well as to ensure stability for the citizens' life and conduct. Article No. 5 regulates and controls the use of water resources and electricity, tools and all accessories in coordination and cooperation with the individuals who are responsible for management and operation.

The Ministry of Interior (MOI) established a drought committee; the HCCD is led by the minister of interior and consists of the secretary generals for the MOA, Ministry of Water and Irrigation (MWI), Ministry of Health (MOH), Ministry of Finance (MOF), and MOI. The HCCD coordinates actions between the relevant line ministries during a time of crisis. The MOI's role during a drought is to identify vulnerable groups affected by drought, securing safe drinking water for rural populations, in particular, and preserving livestock through feed distribution (Gilbert 2017).

The National Center for Security and Crisis Management (NCSCM) started operating in 2015 after the approval of

2015's Bylaw No. 20 (Official\_Gazette 2015b). The center's mission is to deal with all types of crises throughout the management cycle (prediction, prevention, and mitigation) in order to oversee a coordinated response and recovery across government departments, the private sector, non-governmental organizations (NGOs), and international humanitarian aid agencies. In 2015, the center became fully operational. The NCSCM ranked drought as the fourth-worst national disaster that can hit Jordan after earthquakes, floods, and landslides. However, it is worth mentioning that there is a potential overlap of duties for the NCSCM and the HCCD; when a drought becomes a crisis, the NCSCM takes over the role of managing the crisis. The NCSCM nominates a crisis commander to coordinate and facilitate cooperation between related institutions. The NCSCM operates as a policy direction but not as a technical unit related to drought.

The MWI is responsible for the overall national leadership on policy, strategic direction, and planning for Jordan's water sector; this task is done in coordination with Water Authority of Jordan (WAJ) and Jordan Valley Authority (JVA). Under 2014's Bylaw No. 14, the MWI assumes full responsibility for water and public sewage as well as all related projects in the Kingdom. The MWI aims to upgrade, develop, and regulate the water sector and to enhance the quality of water services. It has a mandate to develop sectoral policies and strategies; to endorse plans and programs related to water-resource protection; to implement international agreements; to develop laws, by-laws, regulations as well as normative and technical standards; to develop private sector partnerships; to supervise the implementation of strategic plans and programs; and to follow up on the water companies' and utilities' performance. Since its establishment, the MWI has been supported by several donor organization projects that have assisted with the development of water policies and water master planning as well as restructuring the water sector.

The water strategy (2016–2025) adopted by the MWI aligns with the royal initiative for economic change in all sectors that were formulated in the nationally adopted document "Jordan Vision 2025" (MWI 2016). It considers the United Nations' Sustainable Development Goals (SDGs) from September 2015. The MWI recognized the need to introduce an updated water strategy to ensure that national goals and priorities are realigned with the country's changing needs. The ongoing risks and threats to Jordan's renewable water resources include a growing population and an expanding economy where water is highly vulnerable to risk, including the effects of climate change; an increased frequency of drought spells affects Jordan's social, economic, and environmental development. Mitigation and adaptation measures are proposed in the Climate Change National Adaptation Plan (MoEnv 2017, 2019). For the plan to be adopted, it is necessary to ensure that there is institutional

response capacity, community education, and awareness about the drought risks.

The Climate Change Policy for a Resilient Water Sector (2016) (MWI 2016) is one document for the new water strategy (2016–2025) and provides the background, concept, solutions, and implementation mechanism to build resilience. The implementation is described in more detail in the policy's accompanying action plan. The three main levels of resilience are persistence, adaptability, and transformability.

The policy's rationale is to provide a framework and methodology for strengthening the resilience of the Jordanian water sector based on existing Integrated Water Resource Management (IWRM) approaches. The climate policy does so in a systematic way by prioritizing solutions according to a combination of climate-specific and other criteria as well as mainstreaming climate adaptation and mitigation measures into the existing institutional framework.

This policy stresses that the water sector is the most heavily affected by drought. A drought's effect on the water sector includes reduced total water availability, an increasing intensity of droughts during which the reservoirs are not refilled and the groundwater not recharging. The drought-adaptation measures mentioned in this policy are water harvesting, the reuse of treated wastewater, and virtual water through importing water-intensive products (MWI 2016).

The MWI has a mandate to develop sectoral policies and strategies, and to endorse plans and programs related to water-resource protection. The by-law enables the minister to initiate a unit that can serve the ministry's objective and mandates. In May 2018, the MWI approved the Water Sector Policy for Drought Management.

The Water Sector Policy for Drought Management sets clearly defined rules to manage the scarce water resources efficiently and sustainably, taking into account the risks of drought on the water sector. The policy describes the measures and actions which are required to achieve the national goals for long-term water security. This policy is built on previously adopted strategies, policies, and plans as well as water sector legislation to support national efforts to manage drought or to address its effects within appropriate timeframes.

The following facts are used to justify the approval of a drought management policy for water:

- There is a lack of legislation dealing with drought compared to other natural disasters even though drought has been ranked fourth priorities of the natural crises by the NCSCM.
- Drought is not treated as a crisis or disaster; it is an emergency or water-shortage condition.

- Drought management in Jordan is still based on a crisis management, not risk management approach. In other words, actions are not proactive, other than being targeted primarily for relief. This approach is due to the absence of a national drought management policy that supports action plans at the sector level.
- Current drought-response procedures lack coordination and are usually managed by different departments and sections of the relevant institutions. Therefore, there is a need for policy and legislation in the water sector in order to support national efforts to manage drought or to address its effects within appropriate timeframes.
- Resources for drought preparedness, mitigation, response, and recovery are not available in a manner which is commensurate with the challenge posed by these disasters.

## 5 Discussion

The existing governance structure of Jordan's drought management is under development and lacks clear institutional and legal arrangements. At the same time, the MWI has a mandate to handle the country's drought issues from the water-scarcity perspective related to domestic and irrigation water. Drought management is a multi-disciplinary approach and should engage a wide spectrum of stakeholders. A drought is regarded as a slow-onset, natural disaster that causes inevitable damage to water resources and to farm life. Currently, crisis management is the basis of drought-mitigation plans; however, studies (Al-Qinna et al. 2011; Al Adaileh et al. 2019; Törnros and Menzel 2013) indicate that effective drought management strategies are based on risk management.

The results show that there are some institutional weaknesses for all drought-related issues (exposure, impact, vulnerability, sensitivity, mitigation, and adaptive capacity). There is a lack of real coordination among different water-related actors, which can constrain successful adaptation. Currently, many activities pertaining to adaptation in the water sector are undertaken by different institutions in an ad-hoc manner and without proper coordination. For example, many climate change adaptation projects for the water sector and irrigated agriculture were implemented by the MOA, NARC, MOPIC, and other institutions without real coordination based on the adaptation priorities and vulnerability. This situation cannot be considered favorable; therefore, an appropriate institutional mechanism to coordinate different actors is needed.

The analysis found that institutional weaknesses, a lack of coordinated governance, and conflicting objectives among different actors can constrain adaptation. Enhancing the

awareness of individuals, organizations, and institutions about drought and climate change vulnerability, effects, and adaptation can be a starting point to build individual and institutional capacity for planning and implementing changes. Each public entity has its own laws and regulations that define its roles and responsibilities. There is an urgent need to establish an entity with responsibility for the overall coordination and implementation of the plans, strategies, and policies regarding drought management. In addition, a national drought committee should be established by utilizing the relevant entities (government entities, NGOs, the private sector or other key stakeholders) to coordinate and implement activities on the ground. An institutional mechanism to monitor and evaluate the implementation of the drought-adaptation plan should be structured to ensure that there is an annual review to validate the performance. The drought adaptation is interlinked with the climate change strategy, and the policies different institutions have prepared with little synergy from other institutions. The current institutional setting lacks a proper and clear mandate, and coordination mechanisms impede the implementation of coherent and proactive drought risk management.

## 6 Conclusions

There are many agencies dealing with drought management which have overlapping responsibilities; there is weak cohesiveness, little cooperation and a lack of integrated efforts. Non-existent teamwork and limited communication among agencies inhibit the implementation of an effective and proactive drought management policy. Drought management in Jordan is known as post-event measures, not proactive actions.

The institutional weaknesses, lack of coordinated governance, and conflicting objectives among different actors can constrain a proactive drought management system. Enhancing the awareness of individuals, organizations, and institutions regarding drought vulnerability, effects, and adaptation can be a starting point to build individual and institutional capacity for planning and implementing change. Each public entity has its own laws and regulations which define its roles and responsibilities.

There is no integrated, national drought management policy that supports action plans at different sectoral levels. Therefore, it is necessary to design and implement a drought management plan, considering both the risk and proactive drought procedures. Create the required institutional setup for implementing, co-coordinating, and monitoring the plan's execution. Additional factors that may contribute to a larger effect for a drought in Jordan are as follows: (a) high population growth (2.5% per year) and large refugee influxes; (b) water demand doubling and reaching 1,550 MCM

compared to the current 1,050 MCM; (c) limited funding and private sector participation to implement water projects; (d) limited energy sources available for water projects with Jordan being highly dependent on foreign energy sources [about 96% of the country's energy comes from imported oil and gas (MWI 2015)]; (e) a lack of coordination with neighboring countries regarding the management of water resources (surface water, groundwater, and wastewater); and (f) over extracting groundwater above the safe yield from vulnerable groundwater basins.

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