SWIM and Horizon 2020 Support Mechanism

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Presentation of the findings of the Assessment in the Focus Countries

Review of the Status of Drought Management In JORDAN

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Drought Risk Management (DRM) Mainstreaming" Regional Training

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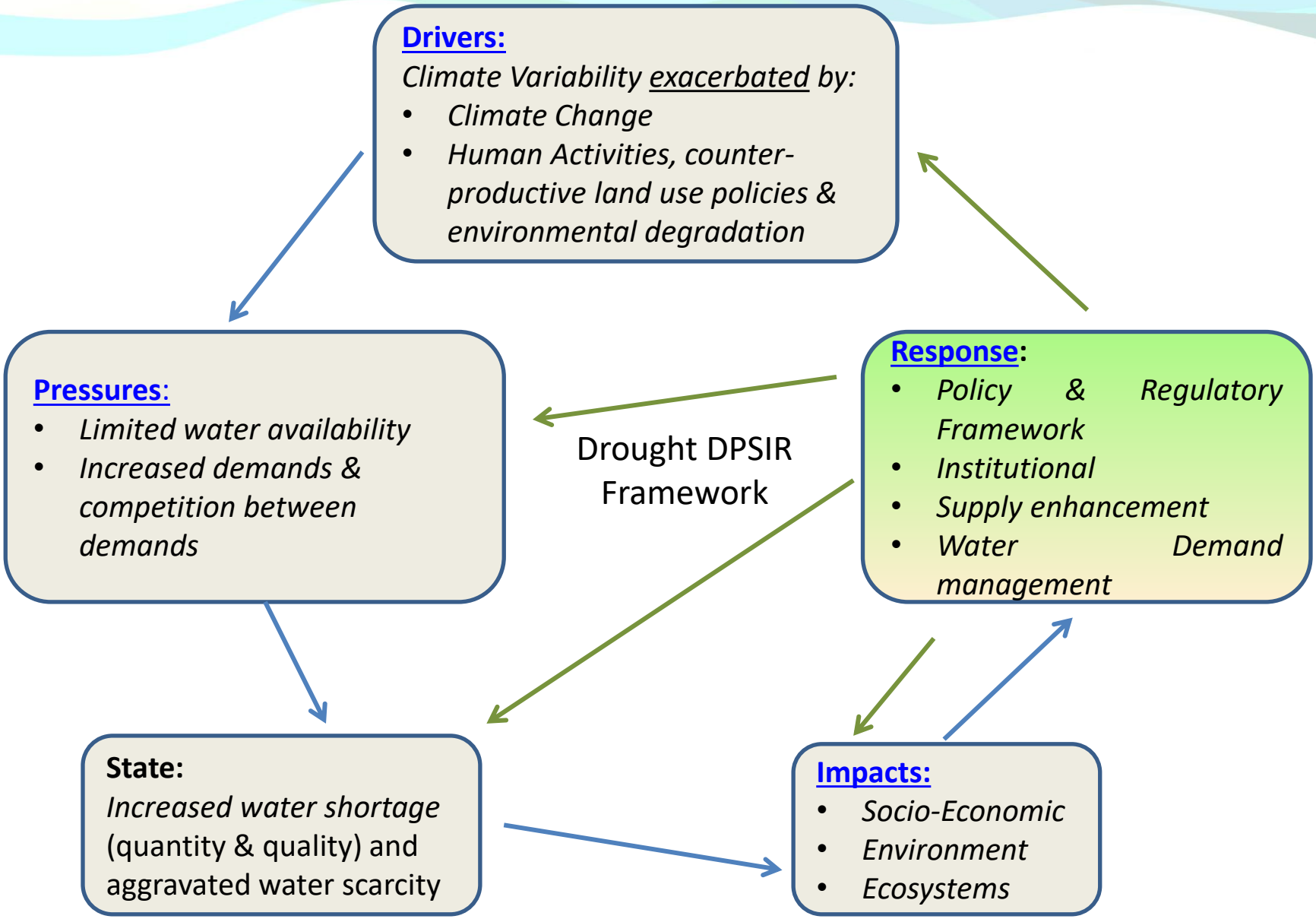
1. Importance of DRM to Jordan

Importance of DRM to Jordan

- Over 70% of the area is arid to semi-arid with insufficient rainfall to support vegetation → wind erosion adversely impacting the ability of the land to capture and hold water
- Jordan is a drought-prone country with Likelihood of drought:
  - 77 %: 2002/03 – 2010/11
  - 46.6%: 1937/38-2010/11
- CC will exacerbate water supply and demand issues due to:
  - increasing temperatures,
  - changes in the amount and distribution of precipitation,
  - frequency and severity of extreme climatic events such as drought.
- 1998-2000 was the most severe drought in the past 30 years: serious economic, social, and environmental impacts
  - →raised the level of awareness about vulnerability to severe drought.
  - →need to increase drought preparedness.
- The current institutional setting involves scattered efforts, inadequate infrastructure, no dedicated budget to disaster response
- The lack of a proper legal framework, clear mandates and coordination mechanisms impedes the implementation of coherent and proactive drought risk management

2. Drought DPSIR Framework (Drivers, Pressures, State, Impacts & Response)

Drought DPSIR Framework



Drivers

- Climate variability: Natural phenomenon resulting in individual drought periods that can be understood as discrete weather events
- Climate change: occurs over longer periods and can be observed as changes in the patterns of weather events

FNCR & SNCR to the UNFCCC:

- ❑ increasing trend in the max. temp. & more remarkable increasing trend in the min. temp. and consequently the mean temp.
- ❑ decreasing trend in precipitation in the majority of the locations in Jordan

Future scenarios developed @ local level in the Jordanian part of the Yarmouk River Basin

- ❑ Increase in temperature of < 2°C, by 2050

Statistical downscaling model employed to generate site-scale future climate scenarios at several locations in Jordan from the coarse Global Climate Model (GCM) products for the period 2011 – 2099 reveal in the majority of the studied sites:

- ❑ Increase in temperature ranging from 1 - 4°C
- ❑ Decrease in precipitation ranging from 15 to 60%
- ❑ extreme events predicted to be more frequent and thereby increasing disaster risk potential

Drought Episodes

- Severity of drought assessed using:
  - MWI rainfall records per SW basin and for the whole country for the period **1937-2011**
- Severity of drought is expressed in precipitation deficiency. It refers to the per cent of normal (average) precipitation (1937-2011); whereby:
  - extreme drought refers to precipitation <70% of normal,
  - severe: precipitation between 70% and 80% of normal,
  - moderate: precipitation between 80% and 90% of normal,
  - mild: between 90% and 100% of normal precipitation.

Inventory of Droughts in Jordan (Water Years 2002/03 – 2010/11)

Year	Severity	Geographic Extent	Year type National Level
02/03	Ext.	W. Araba North & W. Araba South Basins	Wet
	Severe	W. Hasa, Southern Desert & Jafr Basins	
	Mild	Hammad Basin	
03/04	Ext.	Northern Ghors, Southern Ghors & Hammad Basins	Moderate drought
	Severe	Zarqa River	
	Mod.	Yarmouk River,Jordan Valley, Dead Sea, W. Mujib & Jafr Basins	
	Mild	W. Hasa & W. Araba North Basins	
04/05	Severe	W. Araba North Basin	Wet
	Mild	Northern Ghors, Southern Ghors & Zarqa River Basins	
05/06	Ext.	Azraq and Hammad Basins	Severe Drought
	Severe	Northern Ghors & Zarqa River Basins	
	Mod.	Yarmouk River, W. Hasa, North W. Araba & W. Sirhan Basins	
	Mild	Jordan Valley, W. Mujeb & Jafr Basins	
06/07	Ext.	Jordan Valley	Mild Drought
	Severe	Yarmouk River, Southern Ghors, Zarqa River & Azraq Basins	
	Mod.	Northern Ghors & W. Sirhan Basins	
	Mild	W. Araba North & Hammad Basins	
07/08	Ext.	**12/15 basins:** Yarmouk River, Jordan Valley, N. Ghors, S. Ghors, Zarqa River, Dead Sea, W. Mujeb, W. Hasi, W. Araba N., S. Desert, Azraq & Hammad Bas.	Ext. Drought (63% of long term average precipitation)
	Severe	Jafr Basin	
	Mild	W. Sirhan Basin	

Inventory of Droughts in Jordan (Water Years 2002/03 – 2010/11) - Continued

Year	Severity	Geographic Extent	Year type National Level
08/09	Ext.	W. Araba South, Southern Desert, Azraq & Hammad Basins	Severe Drought
	Severe	Zarqa River & W. Araba North Basins	
	Mod.	Jordan Valley, Northern Ghors, Southern Ghors & Dead Sea Basins	
	Mild	Yearmouk River Basin	
09/10	Ext	Jordan Valley Basin	Wet
	Severe	Northern Ghors & W. Araba North Basins	
	Mild	Yarmouk River, Southern Ghors, & Hammad Basins	
10/11	Ext.	Jordan Valley, Southern Ghors, Zarqa River, North W. Araba & Southern Desert Basins	Severe Drought
	Severe	Northern Ghors, Dead Sea, W. Mujeb, W. Hasa & Hammad Basins	
	Mod.	Jafr Basin	
	Mild	Azraq Basin	

Source: Author; based on raw data provided by MWI, 2013

Findings:

- Consecutive droughts with varying severity within the different basins/regions
- The spatial extent and severity of drought varies from year to year
- Drought was never announced during the past decade. Only in 1998/1999 (rainfall < 30% of the annual average) for two consecutive water years until 2000.

No. & severity of droughts per surface water basin & Return periods of severe to extr. droughts (2002-11)

SW Basin	Mild	Moderate	Severe	Extreme	No. of Droughts in 9 years	severe & extreme Droughts in 9 years	
						No.	Return Period
Yarmouk	2	3	1	1	7	2	5
Jordan Valley	1	2	0	4	7	4	2
N. Ghors							
S. Ghors							
Zarqa							
Dead Sea							
W.Mujib							
Hasa	1	1	2	1	5	3	3
N. W.Araba	2	1	3	3	9	6	2
S. W.Araba	0	0	0	2	2	2	5
S. Desert	0	0	1	3	4	4	2
Azraq	1	0	1	3	5	4	2
Sarhan	1	2	0	0	3		
Hammad	3	0	1	4	8	5	2
Jafr	1	2	2	0	5	2	5
National	1	1	3	1	6	4	2

- In 9 years, no. of basins hit with "3-6" severe to extreme drought is 8/15.
- Due to lack of consolidated rainfall records per basin, it is not possible to compare the drought frequency per basin with that of the long term.

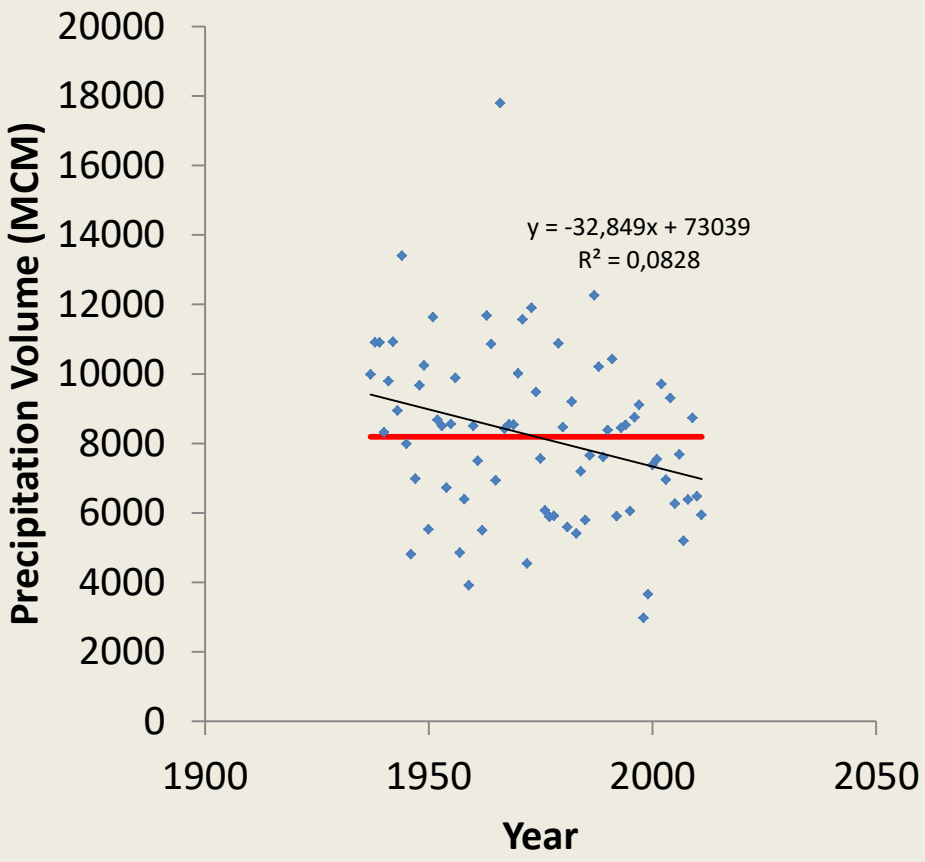
Source: Author; based on raw data provided by MWI, 2013

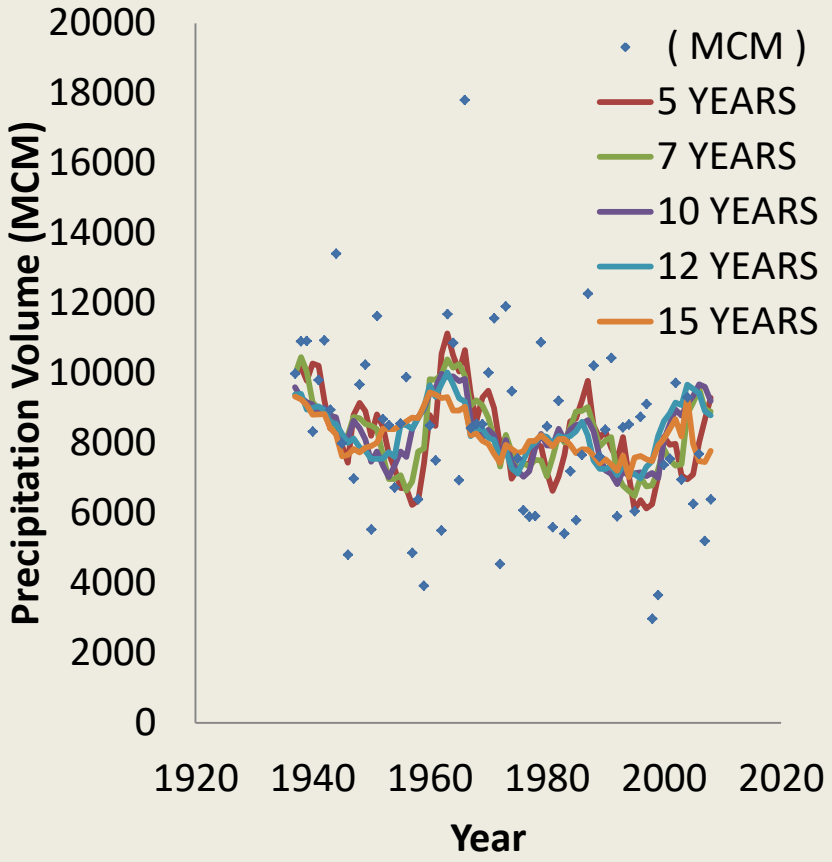
Comparison between the Number and severity of droughts at the national level during the periods of 1937/38-2010/11 and 2001/02-2010/11

Drought Severity	Number of droughts		Probability of occurrence	
	1937/38-2010/11	2001/02-2010/11	1937/38-2010/11	2001/02-2010/11
Mild	7	2	9.59%	22.22%
Moderate	6	1	8.22%	11.11%
Severe	7	3	9.59%	33.33%
Extreme	14	1	19.18%	11.11%
Total	34	7	46.58%	77.77%

Source: Author; based on raw data provided by MWI, 2013

Trends in precipitation using linear regression and moving average





Source: Author; based on raw data provided by MWI, 2013

Drivers / Continued

WEAP Model: CC impacts on the hydrological system and water resources

- ❑ expected decrease in surface runoff (especially in January, February and March).
- ❑ Surface water will be reduced by 20%-40% under different CC scenarios
- ❑ Ground water recharge expected to be reduced by ~ 32% if temperature does not change.
- ❑ if the temperature increases by 3.5◦C, reduction in groundwater recharge is 38.9%.

→ CC increases the odds of worsening droughts , especially under the prevailing water scarcity.

- Human Activities & counter-productive land use policies and environmental degradation can directly trigger exacerbating factors which contribute to changes in societal vulnerability
  - ❑ over farming
  - ❑ Urbanization (83.7% of total population (2015))
  - ❑ Increasing population: Population doubled between 2004 and 2015 (9.5 Million in 2015)
    - ➢ high natural population growth rates of 3.1%
    - ➢ Influx of Refugees
  - ❑ changes in land use

Back to DPSIR Framework

Pressures

- limited water availability
  - ❑ Absolute water scarcity: renewable fresh water resources < 60 m3/capita/year

    Whereas the threshold for scarcity is <500 m3/year/capita
- Increasing demands & competition between demands (Agr., Ind., domestic, touristic demands %)

	Municipal & Touristic	Industrial	Irrigation	Total
Use (MCM)	429	39	505	**972**
Sector's Share	44%	4%	52%	**100%**

  - ❑ Traditionally, irrigated agriculture has been the largest user of water.
  - ❑ In absolute terms, during drought, the irrigation water requirements would increase (less rainfall, higher ET).

Back to DPSIR Framework

Socio-Economic Impacts

- Drought almost represented the only factor affecting Jordanians bet. 1980 & 2012 (UNISDR)
  - ➢ 98.2 % of the people reported to be affected by disasters bet. 1980 & 2012 are due to droughts (UNISDR).
- Increased pressure on the urban population in the form of:
  - ❑ increased cost of living
  - ❑ dependence and pressure on water distributed by tankers.
- Negative Effects on the sanitary conditions in the households.
- Health problems - 1998: Several incidences of diarrhoea in the capital Amman, as a result of high algae loads entering the water treatment plant serving the city.
- Economic losses due to droughts represent ~ 15% of the reported economic losses during the disasters between 1980 and 2012 (UNISDR)

FAO & ESCWA

- Reduced yields & agr. production (crop failure due to incr. salinity & drop in dams water levels:
  - ❑ 88% reduction in wheat and barley production in 1999
  - ❑ Est. production loss for Yr 2000 drought: $160 million → 28% of the cultivated area during the previous years
- Decreased production of rangeland
  - ➢ In 2006: only 20-25% of the animal needs over 3 to 4 months was covered within the Badia region (from degradation of vegetative cover)

Socio-Economic Impacts / Continued

- Decreased domestic production of red meat and milk, due to loss of livestock herds to disease, malnutrition, premature slaughter and distress sales.
- Decreased income of the rural populations depending on agriculture & liquidation of asset
- Increased import of the shortfall for
  - ❑ agricultural production,
  - ❑ fodder (barley and straw) for herds,
  - ❑ wheat for the drought-affected people
- Increase in pumping and treatment costs.
- Increased treatment cost of wastewater due to decrease in hydraulic loads
- Rehabilitation in the water treatment plants

Impacts on Water & Environment

- Exacerbated water scarcity
- Reduction in SW availability & GW recharge.
- Drying of springs,
- Increased burden on the overexploited GW, resulting in:
  - ❑ depletion of water tables,
  - ❑ further loss of fresh GW due to increased salinity
- Further deterioration in the quality of the water resources including treated effluent
  - ❑ Negative impact on downstream irrigation reuse areas
  - ❑ Impact on soil and crops
- Water pollution (outbreak of algae during 1998 extreme weather condition)
- Degradation of rangeland into marginal steppe (est. at appr. 1 Mn ha in the Eastern Badia)

Impacts on biodiversity and ecosystems

Direct impact not documented or measured. Indirect Impact as a result of the compounded effect of:

- urbanization,
- overgrazing,
- deforestation,
- drought and flash floods
  - Dramatic decline in biodiversity & reduction in genetic diversity
  - Isolation of many species with high risk of extinction; influencing 200 to 250 plant species that are nationally rare and 100 to 150 species that are nationally threatened

Due to the compounded effect of water shortage, over pumping & drought: Azraq Oasis; declared in 1977 by the Ramsar Convention as a strategic station for migratory birds decreased significantly in size.

Only 5% of its previous state was restored

- → Severe impact on no. of migratory birds,
- Threat to numerous aquatic and terrestrial species (Ex: Killfish, identified as critically endangered by IUCN).

The situation will worsen with CC: which will have serious implications on the flora's growing season and fauna's favourable conditions.

Back to DPSIR Framework

Response

Policy & Regulatory Framework

- No national strategy for drought or preparedness plans that focuses on mitigation to reduce or avoid the impacts of future droughts.
- The National Strategy & Action Plan for drought management (2007, MOA & FAO) providing road map with set of recommendations for the development of a strategy, rather than strategy.
- NWSS 2016-2025: Need to address drought management & CC adaptation through proper policies and regulations
- The Agricultural Document for 2009-2014→ translated into plan of actions for drought mitigation in the agricultural sector.
- NCPED (2004 – HCCD): defines the duties of each member of the HCCD, incl. ministries, with a view to civil-defence-related actions during and post-disasters
  - ❑ Requirements for identifying the risk types, and their likelihood is spelled out in only one occasion; without reference to the role of the ministries including those implicated in drought management.
- MoEnv Strategies
  - ❑ National Climate Change Policy (2013-2020)
  - ❑ Environmental Strategy Implementation for 2007-2010 & 2011-2013
  - ❑ National Capacity Self-Assessment (NCSA)"in 2007
  - ❑ National Strategy to Combat Desertification (MOE, 2006),
  - ❑ National Biodiversity Strategy and Action Plan (2003)
  - ❑ National Environmental Strategy (NES)",
  - ❑ National Environmental Action Plan

  Several programs to mitigate drought threats were accordingly suggested and implemented.

Response

Institutional Setting:

- Ministry of Water & Irrigation (MWI)
- Water Authority of Jordan (WAJ)
- Jordan Valley Authority (JVA)
- Ministry of Agriculture (MoA):
- Two units also concerned with some parts of the drought management cycle:
  - ❑ Drought Management Unit (DMU) at the National center of Agricultural Research and Extension (center affiliated with MOA)
  - ❑ The Agricultural Risk Management Fund (ARMF)
- National Centre for Security and Crisis Management (NCSCM) (established in 2006)
- The General Directorate of Civil Defense (GDCD)
- The Higher Council for the Civil Defense (HCCD)

Institutional Setting:

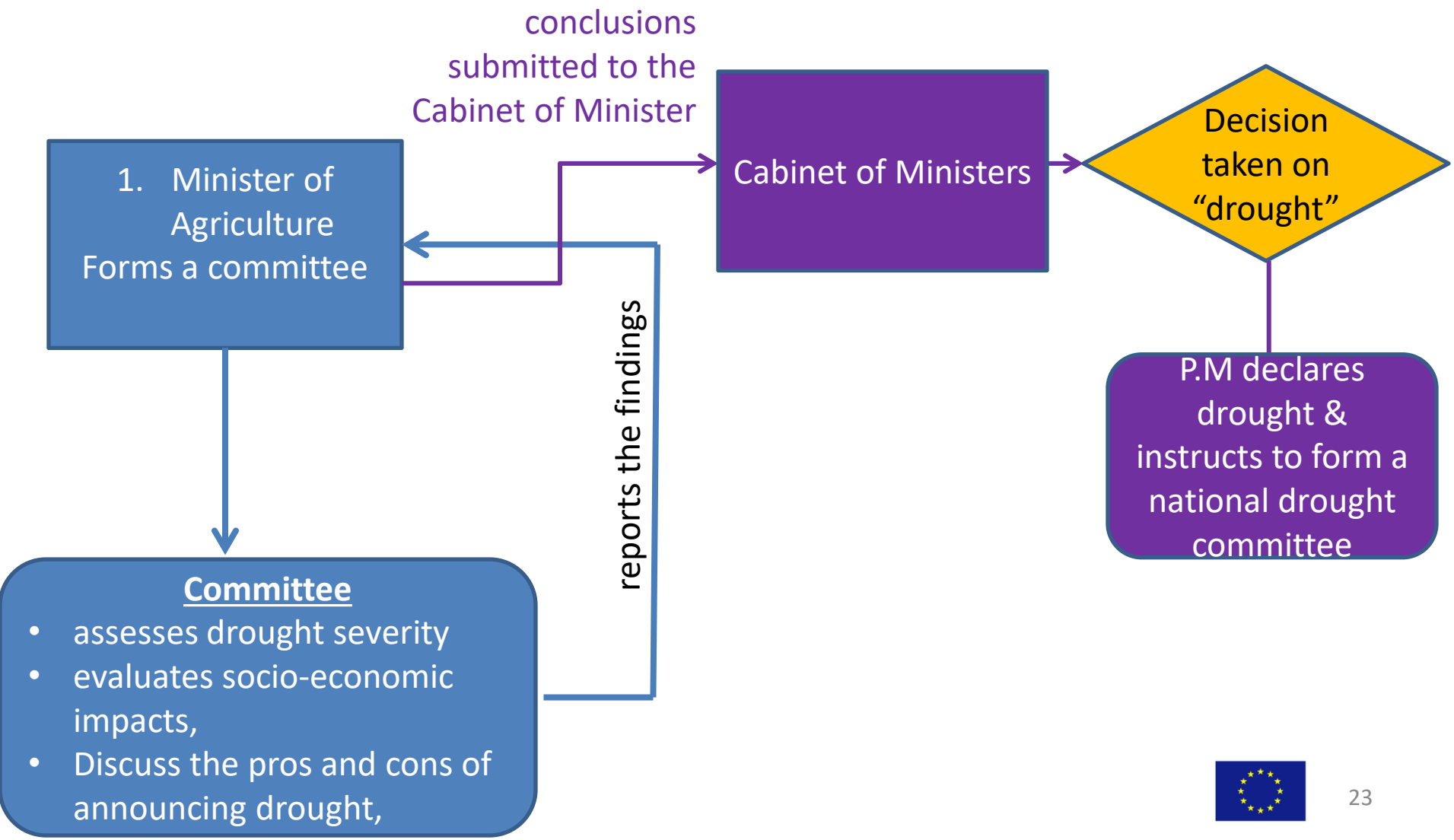
MWI	water sector & resources monitoring , planning, management, strategies & policies formulation, WIS, procurement of financial resources.	By-Law No.16 of 1988
WAJ	construction, O&M of public water supply and WW services, overall water resources planning and monitoring	WAJ Law No.18 of 1988
JVA	Socio-economic development of the JRV, Water Resources development, protection, conservation & management, distribution of irrigation water in the JRV	JV Development Law No. 19 of 1988 and its 2001 amendment
MOA	- Organizes the agricultural sector & its development. - Officially announces the fact case of drought……. - Takes the required measures (in coop. & coor. with the competent parties) to mitigate the –ve impacts on the agricultural sector ….. in accordance with the resolutions made by the Council of Ministers	Provisional Law No. 44 of 2002 - Law of Agriculture
	DMU: monitors & predict drought through satellite images; provided information about the status of vegetation in 2009/10 drought :	
	ARMF: aims to compensate the farmers during emergencies and natural disaster, acc. to **criteria and ceilings** set by the regulations. ✓ The instructions to allow farmers to subscribe and pay subscription fees under development as of 2013.	law no. 5 of 2009

Institutional Setting:

National Centre for Security and Crisis Management	**Aim**: to deal with all types of crisis throughout its management cycle (prediction, prevention, mitigation) - to manage coordinated response and recovery across the government departments, private sector and NGOs, international humanitarian aid agencies. - As of 2013: The centre not fully operational, due to potential overlap of duties with the HCCD. - No information regarding the role of the centre in committing the line ministries (including those responsible for drought) towards preparedness, prevention and mitigation	
General Directorate of Civil Defense	Focal point for implementing the five priority areas of HFA for DRR .	
Higher Council for the Civil Defense (HCCD)	- Puts general civil defence policy for facing emergency cases and their results, - approves the plans to take the necessary procedures - determines the duties and responsibilities of each formal or domestic authority, - tracks their execution.	the Civil Defense Law No.18 for 1999 and its amendments

Response

Declaration of State of emergency



Response

- The Committee is headed by the Minister of Interior and consists of the secretary generals of:
  - ❑ MOA
  - ❑ MWI
  - ❑ MoH
  - ❑ MoF
  - ❑ MoI
- It coordinates actions between the relevant line ministries during the time of the crisis.
- Programs involving relevant line ministries are jointly formulated with the aim to ease the impact of droughts on the agricultural sector and the economy.

Response

MOA Role

- Carry out detailed investigation of impacts on animal & food production
- Request allocation of emergency funds in the government budget and compensation of farmers→ to be implemented by MoF
- Request technical and advisory services from the FAO and aid from donors and NGOs
- Coordinate with relevant line ministries to increase imports and emergency storage of grains and fodders.
- Provide subsidies and soft loans to farmers and livestock breeders, Re-schedule loans and/or exempt farmers from interest rates on Credit loans.
- Intensify agricultural extension and promote the use of drought tolerant crops and BPs to deal with the increase in pests and plant diseases
- Increased environmental awareness campaigns targeting the public
- Provision of free drinking water for livestock breeders,
- Free veterinary services
- Regulation of grazing and protection of the range lands

Response

Response in the Water Sector:

1. Supply Enhancement

MWI, WAJ and JVA & the water utilities, develops an emergency water management program which comprises the following measures:

- Increased pumping from the groundwater resources; including drilling of additional wells
- Distribution of water by tankers;
- Identification of potential observation wells for use during drought;
- Mixing of treated wastewater with fresh surface water for the irrigation of the areas in the JRV that are affected by the increased transfer of fresh water to the main cities. The actual mixing ratios would depend on fresh and treated waste water availability, irrigation water quality provisions and types of crops
- Desalination of brackish water
- Inter-regional transfer of water

Response

2. Water Demand Management (WDM)

Water Supply restrictions:

- Rationing in water distribution below what is normally practiced of once a week (except for Aqaba city, water supply is intermittent in the country and is distributed once a week
- Banning of summer plantations in the Jordan Rift Valley and compensation of farmers;
- Water for municipal purposes is given priority, followed by industrial and touristic
- Provision of irrigation water for trees to survive and not to produce;
- Reduction in water allocated for irrigation; (Agreement with WUAs in the JRV on the rationing measures)
- Reallocation of water between the irrigation sector and the municipal sector. This includes:
  - ❑ Renting of privately owned agricultural wells;
  - ❑ Increasing transfer of fresh water resources from the JRV - to meet MIT demands of Amman & Irbid - which would otherwise be used for irrigation within JVA mandated area.

Tariffs

- ❑ Fining waste of water (Car washing with hoses, washing of sidewalks, driveways, & streets);

Awareness

- ❑ Public awareness campaigns for the promotion of water conservation and saving;
- ❑ Alert farmers to any degradation in water quality to enable them plan the use of such water for the suitable farming purposes.

Response

Water scarcity coupled with recurrent drought is business as usual, which led to the following adaptation policies and measures:

- WDM policies (2008) and programs,
  - ❑ water saving devices in the MT sectors
  - ❑ industrial recycling
  - ❑ grey water reuse and rainwater harvesting
- Requirements for rain water collection systems in the construction of new residences;
- Desalination of brackish GW for domestic purposes
- Treated waste reuse (of ~ 90% of Treated Effluent)
- Minimisation of losses (drip, water loss reduction programs, conversion of surface water canals into pressurised pipe network)
- Structuring of municipal water tariffs to motivate efficient water use;
- Metering of wells and charging for GW abstractions for Irrigation and Industrial purposes
- Construction of retention structures including dams, earth dams and bunds
- Implementation of local mitigation measures to reduce drought vulnerability
  - ❑ use of subsoil irrigation,
  - ❑ protected agriculture,
  - ❑ soil-less culture,
  - ❑ soil conservation projects, etc.)

Analysis of DRM - Gaps

- Absence of legal framework which mandates one single entity with strong institutional & technical capacity to initiate, coordinate and follow up the efforts of developing sectorial DRM policies and plans (at all levels).
- No national drought strategy/policy to:
  - ❑ guide the development of sectorial, regional and local strategies and plans, or
  - ❑ initiate the shift from a reactive approach towards drought risk prevention, mitigation and preparedness within the context of sustainable development
- Sectorial approach by the relevant ministries in addressing DRM challenges
- Absence of permanent institutional linkages:
  - ❑ Coordination between the sectors is not institutionalised
  - ❑ Committees established for coordination during the event and dissolved later
- Reluctance to declare drought due to:
  - impact on summer tourism
  - absence of a national criterion for drought
  - limited financial resources
  - absence of an operational agricultural risk management fund
- DRM approach is reactive
  - ❑ No drought plans:
    - ➢ No drought characterisation
    - ➢ Shortage of qualified/experienced staff, in the public sector, in risk and vulnerability assessment.
    - ➢ Fragmented data banking ; scattered on sectorial basis (reliability ??)

Analysis of DRM - Gaps

- hydro-meteorological data's quality and availability (too short time series, missing data at some stations, data inconsistency, and validation problems)

❑ No drought early warning system in operation

❑ No official guidelines indicating the criteria for announcing drought and the different levels of drought alerts.

- Lack of organised documentation of drought impacts → Not conducive to conducting vulnerability assessments in the various sectors.
- Absence of national insurance fund aimed at protecting/compensating farmers and livestock production from drought.

❑ financial aid to farmers is only provided if drought is declared by the Cabinet (only once despite its recurrence)

Underlying the above is

- Lack of awareness about integrated multi-sectorial approach in DRM.
- Lack of financial resources & access to funds that would support the shift to risk based approach
- Weak linkages between research and policy making.

Recommendations

- Establish an adequate legal framework
  - ❑ clear definition of roles and responsibilities of institutions at the national, regional and local levels
  - ❑ mandate one entity to initiate the development of sectorial DRM policies and plans, and to coordinate and follow up their implementation.
- Establish drought monitoring and early warning system. Opportunities include:
  - ❑ Several drought relevant information systems in place,
  - ❑ Reasonable no. of automated weather and agro-climatic stations
  - ❑ MWI is extending its Telemetric Water Resources Observation Network (TeWaRON) including hydro-meteorological network
- Agree on a national definition of drought
- Develop sound indicators and criteria for announcing drought and ending it.
- Revise the indicators as more information on drought impacts becomes available and/or organised and consolidated.

Recommendations

- Operationalize, the "Agricultural Risk Management Fund" → should contribute to improved management of agriculture-related disasters including drought.
  - ❑ Resolve pending issues (legal, institutional)
  - ❑ Link compensations with drought risk reduction practices (to promote use of techniques to mitigate impacts on famers).
  - ❑ Build the capacity of the relevant staff in insurance and risk management
- Systematically revive the indigenous conservation practices in the country through demonstration sites at the local level under responsibility of NCARE and MOA and with the assistance of NGOs & CBOs.
- Conduct coordinated campaigns (with NGOs and CBOs) to increase awareness of the local communities on drought recurrence and mitigation
- Tap the knowledge of the elders.

Recommendations

- Ensure synergy and learning between drought risk reduction and CC adaptation:
  - ❑ Advances made in CC adaptation agenda in the country can provide a good source of tools and approaches that are directly supportive of Drought Risk reduction:
    - ➢ vulnerability assessments
    - ➢ sector and national planning
    - ➢ capacity building
    - ➢ response strategies

Thank you for your kind attention