Integrated Drought Management System and measures to mitigate the impact of the climate change in Kosovo

Selection of a set of measures to mitigate the drought impacts in Kosovo

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Activity	**1.3 Portfolio of measures tailored to Kosovo conditions to mitigate drought impacts, before (preparedness, decreasing risk), during (mitigation measures) and after drought events (recovery measures).**
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Glossary

Below are definitions for terms that appear within this report. Several of these terms have other definitions that are commonly used elsewhere depending on the discipline or perspective. In this case, the definitions have been tailored to the drought issue.

Crisis Management: An approach for dealing with drought where responses and actions are made during the event with no prior planning, sometimes leading to ineffective, poorly coordinated, and untimely initiatives by individuals or governments.

Drought: A deficiency of precipitation from expected or "normal" that, when extended over a season or longer period of time, is insufficient to meet demands. This may result in economic, social, and environmental impacts. It should be considered a normal, recurrent feature of climate. Drought is a relative, rather than absolute, condition that should be defined for each region. Each drought differs in intensity, duration, and spatial extent.

Drought Management Plan: A document that identifies specific actions that can be taken before, during and after a drought to mitigate some of the impacts and conflicts that result.

Hazard: A threatening event (in this case, a drought, a reduction in water supply, or an increase in water demand) that would make supply inadequate to meet demand.

Drought Impact: A specific effect of drought. People also tend to refer to impacts as "consequences" or "outcomes." Impacts are symptoms of vulnerability.

Drought Impact Assessment: The process of looking at the magnitude and distribution of drought's effects.

Mitigation measure: Short-term and long-term actions, programs, or policies implemented in advance of drought, or in its early stages, to reduce the degree of risk to people, property, and productive capacity.

Preparedness: Pre-disaster activities designed to increase the level of readiness or improve operational capabilities for responding to a drought emergency. Preparedness is a mitigation action.

Response: Actions taken immediately before, during, or directly after a drought to reduce impacts and improve recovery. Response measures are an important part of drought preparedness but should only be one part of a more comprehensive mitigation strategy.

Risk: The potential adverse effects of drought as a product of both the frequency and severity of the hazard and corresponding vulnerability.

Risk Analysis: The process of identifying and understanding the relevant components associated with drought risk as well as the evaluation of alternative strategies to manage that risk.

Risk Management: The opposite of crisis management, where a proactive approach is taken well in advance of drought so that mitigation can reduce drought impacts, and so relief and recovery decisions are made in a timely, coordinated, and effective manner during a drought.

Vulnerability: Characteristics of populations, activities, or the environment that make them susceptible to the effects of drought. The degree of vulnerability depends on the environmental and social characteristics of the region and is measured by the ability to anticipate, cope with, resist, and recover from drought.

1 INTRODUCTION

"Unfortunately, we tend to focus on drought when it is upon us. We're then forced to react -- to respond to immediate needs, to provide what are often more costly remedies, and to attempt to balance competing interests in a charged atmosphere. That's not good policy. It's not good resource management. And it certainly adds to the public's perception that government is not doing its job when it simply reacts when crises strike. To the contrary, we must take a proactive approach to dealing with drought. ***We must anticipate the inevitable -- that drought will come and go and take an approach that seeks to minimize the effects of drought when it inevitably occurs."***

(James R. Lyons, Assistant Secretary of Agriculture for Natural Resources and the Environment, speaking at Drought Management in a Changing West: New Directions for Water Policy, a conference in Portland, Oregon, 2012.

Drought, unlike other natural disasters such as floods or earthquakes, does not occur abruptly, but it evolves over a long period of time. Such feature makes possible an effective mitigation of drought impacts, if a timely and reliable drought monitoring system is in operation and an appropriate plan, including the necessary actions to reduce the most severe damages caused by drought (in economic, social and environmental terms), are prepared. It is important to be mentioned that droughts are accelerated by the climate change effects.

The purpose of this report is to fulfil the Activity 1.3 Selection of a set of measures to mitigate the drought impacts in Kosovo. In this context some concepts related to the definition of drought mitigation measures, as well as the necessary legislative for their implementation are discussed. After a brief overview of EU and Kosovo legislation, drought types and main impacts (based on the information from the Analysis Report prepared under the Activity 1.1) (Chapter 2), different classifications of drought mitigation measures proposed at international level (including literature sources) in the last decades are presented (Chapter 3). Furthermore, selected drought mitigation measures suitable for Kosovo are summarized as well (Chater 4).

The outcomes from this activity will be used in the Activity 1.2 Preparation of the Draft Action Plan to address the impacts of drought in the Drin basin. Furthermore, as examples of the drought mitigation measures for experts from Kosovo can be used documents and information from the Activity 1.4 Establishment of a Platform for Drought Management and Adaptation in Kosovo.

2 BACKGROUND

Drought has become an important political and social issue, which received widespread media coverage.

Water is a strategic resource for the economic, social and environmental development of a region. However, droughts are current challenges to this development. Droughts are a relevant temporary decrease of the average water availability, refer to important deviations from the average levels of natural water availability and are considered natural phenomena. Although by itself a drought is not a disaster, whether it becomes one depends on its impacts on society and the environment.

It was found that the impacts produced by droughts are numerous. Water supply to populations may be affected, irrigated crops can have severe restrictions and river ecosystems may suffer the consequences of low river flows, among other problems. Categories of drought impacts are presented in chapter below.

2.1 What is a Drought?

Drought by a definition is a deficiency of precipitation from expected or "normal" that, when extended over a season or longer period of time, is insufficient to meet demands. This may result in economic, social, and environmental impacts. It should be considered a normal, recurrent feature of climate. Drought is a relative, rather than absolute, condition that should be defined for each region. Each drought differs in intensity, duration, and spatial extent.

Generally, there are five drought types as presented below:

2.1.1 Meteorological drought

A meteorological drought occurs when measurable precipitation is below normal and may or may not result in a hydrologic or agricultural drought, or both, depending on the time of year it occurs and other weather factors. Depending on the season, it may affect fire danger.

2.1.2 Hydrological drought

A hydrologic drought is characterized by low stream flow and by low reservoir and groundwater levels. Depending on the season and water demand, it may or may not affect water supplies.

2.1.3 Agricultural drought

An agricultural drought occurs when inadequate precipitation and excessive evapotranspiration deplete the soil moisture necessary to sustain crops and vegetation, resulting in serious damage and economic loss to agriculture. An agricultural drought occurs during the growing season and may worsen and recover more quickly than a hydrological drought. It is characterized by several indices. It may affect the terrestrial ecosystem. As with a hydrologic drought, it may or may not affect water supplies, although it can significantly increase demands on water systems for outdoor water uses.

2.1.4 Hydro-ecological drought

A more recent effort focuses on ecological drought, defined as a prolonged and widespread deficit in naturally available water supplies including changes in natural and managed hydrology that create multiple stresses across aquatic ecosystems.

2.1.5 Socio-economic drought

Socio-economic definitions of drought associate the supply and demand of some economic good with elements of meteorological, hydrological, and agricultural drought. It differs from the aforementioned types of droughts because its occurrence depends on the time and space processes of supply and demand to identify or classify droughts. The supply of many economic goods, such as water, forage, food grains, fish, and hydroelectric power, depends on weather. Because of the natural variability of climate, water supply is ample in some years but unable to meet human and environmental needs in other years.

2.2 Drought Policy in European Union

At EU level, drought policy objectives outline three issues: promoting risk management policies, promoting drought preparedness and mitigation and planning measures, and consideration of financial assistance tools.

EU water policy developments are essentially linked to the implementation of the **EU Water Framework Directive** (WFD), which requests EU Member States to develop a robust integrated water resources management system in Europe, built upon the principles of river basin planning. In the River Basin Management Plan within the Program of Measures also measures action related to drought impacts should be included. The WFD is very demanding in terms of the fulfilment of environmental objectives. However, a temporary deterioration of the status of water bodies will not be considered a breach of the WFD requirements if it is the result of natural circumstances or 'force majeure', such as a prolonged drought, when some conditions have been met.

In fact, droughts are not yet the subject of EU law. However, increasing drought trends in multiple EU regions over the last decades have led the European Commission, Member States, scientists and stakeholders to reflect upon specific measures that should be taken to better manage drought risks and impacts. This is particularly reflected by the **Water Scarcity and Drought Communication** and by the **Blueprint to Safeguard Europe's Water Resources**. The communication lists possible measures to cope with water scarcity and droughts and recommends the development of Drought Management Plans (DMP).

Following droughts impacts in the past few years, some EU Member States have moved from a crisis management approach to drought risk management and the associated measures often result in comprehensive drought risk management plans with water stress area mapping, alert levels, warning systems, etc.

In the context of the drought management policies, it is necessary to refer on the international organisation as WMO, FAO, UNCCD, GWPO, IDMP and others, as well. These organisations have already developed a number of strategic and technical documents related to drought mitigation measures and some of them are presented in chapter 3.

2.3 Drought Policy in Kosovo

Based on the Analysis from the Activity 1.1, it was found that there are not developed basic documents that addressing drought and water scarcity in Kosovo. However, there are documents related to the drought management as "Kosovo Drought Risk Management Framework" and "Drought Management Plan of Regional Water Company". Drought issues are also included in the technical documents and reports, such as the last report of "Integrated Drought Management Program for Drin Basin", project funded by NOAA funds via Global Water Partnership (Activity 3: Decision support on Drought).

Nowadays, there is not developed the Drought Management Strategy and subsequently the "Drought Management Plan". However, the drought and water scarcity issues are addressed through other documents, such as: Law No. 04/L-147 on Waters of Kosovo and secondary legislation that outcomes (By Laws), and strategics documents as: "National water strategy, 2017-2036", "Strategy for climate change", "Disaster risk reduction strategy and plan of action".

2.4 Common Drought Impacts

The impacts of drought are determined not only by the frequency and intensity of meteorological drought but also by the number of people at risk and their degree of risk. Increasing and shifting population, changing trends and patterns of water use, institutional fragmentation, non-sustainable natural resources management policies and growing environmental awareness and concern all define a future where water will continue to be a primary source of conflict and controversy. Demand for water and other shared natural resources is increasing society's vulnerability to water supply interruptions caused by drought. As a result, future droughts can be expected to have greater impacts with or without any increase in the frequency and intensity of meteorological drought.

Wilhite. D. A. (2000)

A detailed classification of drought impacts is a difficult task, the main impacts can be distinguished in three categories: economical, environmental and social. In each of them there are different impacts, that are connected with the affected sector. In fact, the drought impacts are closely related to climate change effects (higher air and water temperature, evaporation, higher variability of precipitation and its space distribution, etc.

Water resources

As the primary concern of drought is water shortage that can affect other sectors dependent on the water sources.

Agriculture

Drought is the most important factor limiting the production of many crops. especially cereals and fruit crops. It has an adverse effect on both yield and quality. Furthermore, the problem of feed and fodder shortage are often more difficult to cope with during drought periods that that of food for people.

Environment

Both aquatic and terrestrial biota is suffering during the drought periods. It can lead to loss of biodiversity and deterioration of the surface water quality and other impacts.

An example of some drought impacts is presented below (based on the Rossi at all, 2007).

2.4.1 Economic impacts category

- Economic damage to agricultural production (crop reduction, damage in cultivations, insects, epidemic, plants diseases)
- Economic damage to forest production (decrease of forest growth, woods fires, trees diseases)
- Economic damage to foremilk products and beef (reduction of pasture productivity, forced reduction of stock-farm, closing or reduction of public farm for pasture, increase of thefts, pasture fires)
- Economic damage to fishing (damage to river habitat and fishes caused by reduced

flows)

- Economic loss to industries connected with agricultural production (food industries, industries producing fertilizing, etc.)
- Economic damage to industries struck by hydroelectric energy reduction
- Unemployment caused by production decrease
- Economic damage to reduced navigability of streams, rivers and canals
- Damage to tourism sector due to the reduced water availability in water supply and/or water bodies
- Economic loss to entertaining (customers reduction, etc.)
- Economic damage to producers and tradesmen of amusing equipment
- Pressure on financial institutions (more risks in lending, capitals decrease etc.)
- Loss in public and local management revenue (because of reduction of taxes and taxes for hunting or fishing license, etc.)
- Income reduction for water firms due to reduced water delivery
- Additional costs deriving from integrative water resources use

2.4.2 Environmental impacts category

- Damage to animal species
  - ✓ Reduction and degradation of fish and wildlife habitat
  - ✓ Lack of feed and drinking water
  - ✓ Disease
  - ✓ Increased vulnerability to predation (from species concentration near water)
  - ✓ Migration and concentration (loss of wildlife in some areas and too many in others)
  - ✓ Increased stress to endangered species
- Damage to plant species
- Increased number and severity of fires
- Loss of wetlands
- Increased ground water depletion, land subsidence
- Loss of biodiversity
- Wind and water erosion of soils
- Reservoir, lake and drawdown (including farm ponds)
- Reduced flow from springs
- Water quality effects (e.g., salt concentration, increased water temperature, pH, dissolved oxygen, turbidity)
- Air quality effects (e.g., dust, pollutants)
- Visual and landscape quality (e.g., dust, vegetative cover, etc.)

2.4.3 Social impacts categories

- Inconveniences due to water system rationing
- Risks for health connected with increase of pollution concentration and discontinuous water system
- Impacts on way of living (unemployment, reduced saving capability, difficulty in personal care, reuse of water at home, street and cars washing prohibition, doubt on future, decrease of fest and amusing, loss of property)
- Iniquity in drought impacts and mitigation measures distribution
- Risks on public security due to more frequent fires (forests, pasture)
- Abandon of activities and emigration (in extreme cases)

Impacts should be examined for their relevance in past or recent droughts, but consideration should also be given to the question “What drought impacts will be seen in the future?” This last question is crucial as water demands change by the sectors and population. Furthermore, the effects of droughts

can be aggravated when occurring in regions already presenting low water resources levels, with imbalances between available resources and water demands.

2.5 Identified drought impacts in Kosovo

This part is based on the Detailed analysis of the state of play and the framework for addressing drought management in Kosovo (Activity 1.1). In *the Detailed analysis report impacts on the drought related sectors were presented*. However, due to lack of relevant data and information the drought impacts were presented more or less in general way.

Agriculture - Reduced crop yields, livestock losses and increased susceptibility to pests and diseases.

Water supply and quality – Reduction of the availability of water in rivers, lakes, and groundwater bodies, that affects the supply of water for domestic, industrial, and agricultural purposes. It can also lead to water quality issues, as low water flows and levels concentrate pollutants, increase the water temperature and degrade water quality in the water bodies. The nowadays cases are the operation at the minimum levels of the drinking water reservoirs in Lake Batllava, Badovci, and Perlepnice in the years of 2002, 2007, 2014, 2022.

Ecosystems – It is related to rivers, lakes, reservoirs, wetlands and forests. This can lead to increased fire risks, habitat loss and biodiversity decline and including fish die.

Socio-Economic Impacts - Various sectors of the economy are affected, including energy production, tourism and hydropower generation. Energy production in Kosovo mainly depends on coal reserves and with industrial water Termoekletrana Kosova A and Kosova B are supplied with industrial water from Lake Ujman (Gazivoda) through the Iber Lepenci irrigation channel. Nowadays, there is not registered a problem with water supply.

Human health – It is expected that drought can have indirect effects on human health due to increased dust and air pollution, as well as reduced availability of water for sanitation and hygiene, contributing to the spread of disease. Food shortages caused by drought can also lead to malnutrition and related health problems.

This information on the identified impacts in Kosovo was used in the next chapters to select the appropriate and suitable drought measures for Kosovo.

3 DROUGHT MITIGATION MEASURES

The goal of mitigation and preparedness is to reduce drought vulnerability and foster drought resilient societies.

Planning of drought mitigation is the key to drought mitigation. Among the key features of planning is that it gives an opportunity for all stakeholders to discuss and reach agreements on what to do and how to do it, before the time of crisis brought about by a drought.

Mitigation was often meant actions that were taken during or after drought to rehabilitate or remedy the damage made. In the context of this report, the term is used to refer to the actions taken prior to, during and after drought to minimize its effects and the cost incurred. In this dimension, mitigation includes both proactive elements of drought preparedness and retroactive remedy actions.

It is important to be mentioned that drought mitigation measures should be interconnected on the drought phenomenon and they are fundamental part of the Drought Management Plan. For illustration see Figure below.

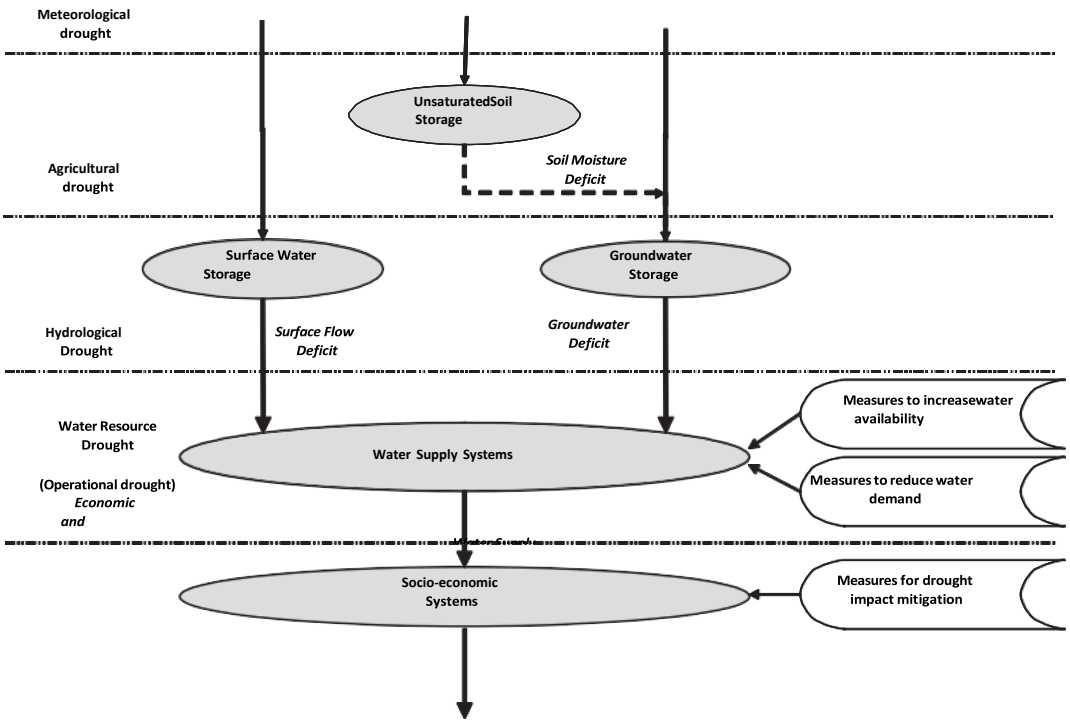

Figure 1. Drought phenomenon and role of drought mitigation measures (from Rossi, 2005)

3.1 Classification of drought mitigation measures

Based on the literature review, several classifications of drought mitigation measures are available. In this report, the most frequently used classifications and adopted in some important international meetings, and the classifications discussed in some monographs specifically dedicated to drought characteristics and drought management are presented.

3.1.1 Purpose of the measures

This classification distinguishes three categories of measures:

- measures oriented to increase water supply (include interventions that enable to improve water supply during drought through a better use of the existing water system resources),
- measures oriented to reduce water demands (to reduce the water use in order to meet water requirements regardless of reduced water supplies),
- measures oriented to minimize drought impacts (the measures oriented to minimize drought impacts and it includes drought forecasting also based on monitoring systems, public campaigns and other soft measures).

3.1.2 Implementation of the measures

This category cover two different approaches to drought measures as follows:

- reactive (those measures that are basically implemented once a drought occurs and the visible impacts are already underway),
- proactive approach (all the measures, conceived or prepared in advance, which may help in the alleviation of drought consequences).

The difference between the proactive and reactive measures is mainly in the approach: planning activity versus improvisation of various ad hoc measures.

3.1.3 Time frame of the measures

In this category, two measures are included:

- long-term measures aimed to improve drought preparedness (increase of storage facilities capacity, integrated managing of water resources in a wide area and improvement of water use efficiency),
- short-term measures oriented to mitigate drought events when they already started, with emphasis on water supply problems.

It is necessary to be noted that only an adequate understanding of the different roles of long-term preventive measures and short-term actions, can allow to carry out an efficient drought mitigation.

3.1.4 Sectorial measures

It is recommended to establish an integrated national policy that focuses on the key sectors related to drought issues. The sectors to be involved as well as the respective activities would vary in time and space. From a general perspective, the two main sectors are included in a number of literature sources. They are Water Resources and Agriculture with all its sub-sectors (Crop production. Animal Production, Pasture and Range Lands. Forestry, etc.). However. other sectors such as energy, transportation and tourism would also be involved. The economy of the country would also have to accommodate for the foreseen programs and activities. The common ground for all sectors is that all activities should aim at adopting risk management practices to promote self-reliance and protect the natural and agricultural resource base. Important part is also environment (both terrestrial and aquatic ecosystems, where biota is suffering during the drought period).

For the purpose of this report, it was decided to use the approach developed by the IDMP. This approach is based on the drought mitigation, preparedness and response and comprise the appropriate measures and actions aimed at reducing the vulnerability to drought and reducing the impacts of droughts. The long-term and short-term measures are selected for Water sector and Agriculture (without ecological drought measures). Furthermore, the measures were selected for Response and Recovery after drought period. In the Tables below the examples from the IDMP List is presented for long-term and short-term measures. The whole List is presented in the Annex of this report.

Table 1. Example of the long-term measures developed by IDMP for water resources

Water resources	Measure
Enhancing supply	• Storage capacity increase • Water transfers • Locating new potential resources • Aqueducts and canals • Groundwater recharge • Small scale water collection/harvesting • Adjusting legal and institutional framework • Artificial precipitation • Water treatment & reuse of wastewater/recycling
Improving demand management (in all sectors/uses)	• Reducing use • Reducing losses • Reviewing water allocation • Monitoring, metering, forecasting • Conjunctive use (surface-groundwater) • Reviewing education curricula • Adopting/reviewing water tariffs • Adjusting legal & institutional framework • Voluntary insurance, pricing and economic incentives

Table 2. Example of the short-term measures developed by IDMP for agriculture sector

Water resources	Measure
Crop Production	• Supplementary irrigation where water can be mobilized and made available on short-term basis • Soil water conservation practices • Early warning, information and advice to farmers • Review of fertilization program • Soil mulching and crop shading • Reducing crop density • Weeding
Livestock, range and pasture lands	• Early warning/advice to herders • Destocking/incentives for owners to reduce • Review available feed and reduce animal numbers • Livestock transfer where/when possible • Watering points/ water hauling sources • Locating potential sites of water for emergency • Constituting feed stocks • Rapid inventory of grazing potential • Protective (natural) shelters • Alternative feed (by-products, less and unpalatable shrubs, …) • Supplementary, substitute feeds

3.1.5 Ecological measures

Drought represents a disturbance to an ecosystem. In assessing drought impact, it is necessary to discriminate between the event of the disturbance (drought) and the responses by the abiotic and biotic components of the ecosystem to the disturbance. Drought reduces the volume of available

water, resulting in a loss of horizontal, longitudinal and vertical connectivity between the water body and its surroundings. In river ecosystems, the impact of drought is initially the result of wetted habitat loss when the river becomes disconnected from its riparian zone. The morphology of a river strongly influences the spatial pattern of drying and re-wetting. However, the majority of lowland rivers have been heavily modified by humans, particularly to control flood risk, creating a homogenised habitat. For this reason, sites characterised by habitat modification are often more sensitive to drought than those that are not.

Due to reason mentioned above, there are several measures to protect and prevent damages from drought on the aquatic biota. Some of the measures can be mentioned as follows:

- Develop Operation rules for headwater reservoirs to keep appropriate river flows in normal conditions during the drought periods,
- Ensure the ecological (or minimum natural) river flow,
- Ensure the river continuity for aquatic fauna mobility,
- Develop Operation rules to keep water level and volume in the reservoir to provide appropriate conditions for aquatic biota (e.g. decrease water abstraction),
- Ensure that wetlands and riparian areas (keeping buffer zones) are vegetated and sufficiently supported by water.

Note: Activity 1.4 Establishment of a Platform for Drought Management and Adaptation in Kosovo will also cover collection of the documents and information related to the Drought Management, including the drought mitigation measures. These results can be used by the experts from Kosovo, when selecting suitable measures to fit with the national conditions.

4 SELECTED DROUGHT MITIGATION MEASURES FOR KOSOVO

Development of the Action drought management plan for Kosovo condition requires the selection of the most appropriate combination of long-term and short-term measures/actions with reference to the vulnerability of the specific water supply system, agricultural system and to the drought severity and environmental systems. For this purpose, it is necessary to adopt a proper selection procedure for the choice of the best combination of the long-term and short-term measures. Due to the variety of drought impacts and in particular to the difficulty of assessing environmental and social impacts expert judgement made by both GWPCEE and Kosovo partner experts was done.

4.1 Existing Drought Measures in Kosovo

Before the process of selectin appropriate and suitable drought measures for Kosovo, the existing drought measures were identified within the Activity 1.1 and summarized in the Detailed analysis of the state of play and the framework for addressing drought management in Kosovo. These measures were used as basis for completing the drought measures to be used in the near future to mitigate the drought impacts in Kosovo. It is stated in the Analysis report "*that many of the drought measures are focused on management, determined by existing resources and determining priorities in relation to the reallocation for different uses".*

In this report the selected measures/action are allocated for water sector, agriculture and environment, as it was done for the drought impacts. However, this sector selection can be reshuffled to the approach as mitigation, preparedness and response types of the drought measures. This will depend on the agreed structure of the Action Plan (Activity 1.2).

The List of selected drought measures in this report reflects the national conditions. Furthermore, cross-cutting measures also are included as the strengthening of sectorial cooperation in the field of water management, science and research, civil protection, fire protection, agriculture and forestry, nature and biodiversity protection, and landscape planning.

In the context presented above, the following questions should be answered:

1) Does action address long-term and/or short-term solutions?
2) Is action feasible and appropriate for the sectors and/or general public?
3) Is action adequate to reduce the drought impacts?
4) Is action sensitive to the regional and/or local environment (sustainability)?
5) What are the costs of the measures?

Based on the responses to the questions above the following drought mitigation measures/actions were assessed and proposed to be developed and implemented in Kosovo on both national, river basin and local levels. The results of assessment are summarized in Table below. Detailed assessment is presented in ANNEX 2 of this report.

Note: Some of the proposed measures were used from existing List of drought measures presented in the Value of Water – National Action Plan to Combat Drought and Water Scarcity (2018) (2018).

Table 3. List of proposed drought mitigation measures suitable for Kosovo

Sector	Measure	Measure assessment	Implementing Authority
Legislation	Update and complete Law No. 04/L-147 on Waters with drought elements	Long-term; Feasible for all affected sectors; Reducing drought impacts;	Inter-ministerial Council for Waters

Sector	Measure	Measure assessment	Implementing Authority
		Sensitive and covering all space levels; Low cost	
	Develop Drought Management Strategy and Plan	Long-term; Feasible for all affected sectors; Reducing drought impacts; Sensitive and covering all space levels; Low cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI)
	Implement Drought Management Plan	Long-term; Feasible for all affected sectors; Reducing drought impacts; Sensitive and covering all space levels; High cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI)
	Establishing and operating a Future Drought Fund, to enhance drought preparedness and resilience	Long and Short-term; Feasible for all affected sectors; Reducing drought impacts; Sensitive and covering all space levels; High cost	Government of Kosovo
Water resources	Prepare Plan for increasing of the storage capacity in the basins	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin and local levels, Low cost	Department of environmental and water protection; Authority of River Basins District
	Upgrade the monitoring programmes related to drought assessment	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level; High cost	Kosovo Hydrometeorological Institute
	Develop Drought Early Warning System	Long and Short-term; Feasible for all affected sectors; Reducing drought impacts; Covering all space levels; Low cost	Kosovo Hydrometeorological Institute
	Assist in the adoption of new and existing technologies in water sector	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level; High cost	Authority of River Basins District
	Prepare Plan for reduction of the water uses	Long and Short-term; Feasible for urban, agriculture and industry sectors; Reducing drought impacts; Covering all space levels; Low cost	Department of environmental and water protection
	Review of the Operation rules of reservoirs	Long and Short-term; Feasible for all affected sectors; Reducing drought impacts; Covering all space levels; Low cost	Authority of River Basins District
Agriculture	Ensuring animal welfare and land management issues	Long and Short-term; Feasible for agriculture sector; Reducing drought impacts;	Ministry of agriculture forestry and rural development

Sector	Measure	Measure assessment	Implementing Authority
		Covering regional and local levels; Low cost	
	Ensure development Drought Early warning and provide information and advice to farmers	Long and Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of agriculture forestry and rural development
	Preparing guide for farm management practices related to drought preparedness	Long and Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and levels; Low cost	Ministry of agriculture forestry and rural development
	Ensure support to farming companies and small farmers (economic stimulus)	Long and Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering local level; High cost	Ministry of agriculture forestry and rural development
	Investigation of the options to be more water efficient (irrigation, livestock, etc.)	Long and Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of agriculture forestry and rural development; Authority of River Basins District
Forestry	Support the Forest Management in a way that minimizes soil erosion and supports the retention capacity of the soil	Long and Short-term; Feasible for forest management sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of agriculture forestry and rural development
Hydro-ecology	Support initiatives that sustain biodiversity during times of drought	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level; Low cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI)
	Ensure the ecological (or minimum natural) river flow in drought prone areas	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level; Low cost	Kosovo Hydrometeorological Institute; Authority of River Basins District
	Ensure the river continuity for aquatic fauna mobility	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level; High cost	Authority of River Basins District
	Ensure that wetlands and riparian areas (keeping buffer zones) are vegetated and sufficiently supported by water	Long-term; Feasible for water resources management; Reducing drought impacts; Covering river basin level;	Authority of River Basins District

Sector	Measure	Measure assessment	Implementing Authority
		Low cost	
Urban areas	Support of municipalities and cities to develop the measures for the capture and infiltration of rainwater	Long-term; Feasible for municipalities (large cities) and rural areas; Reducing drought impacts; Covering local level; High cost	Local governments
	Installing water meters to control amounts used	Long-term; Feasible for municipalities (large cities) and rural areas; Reducing drought impacts; Covering local level; High cost	Local governments
	Preparing Plan for Restriction of municipal water uses	Long-term; Feasible for municipalities (large cities) and rural areas; Reducing drought impacts; Covering local level; Low cost	Local governments
Research	Support research aimed at solving problems associated with water scarcity	Short-term; Feasible for all affected sectors; Reducing drought impacts; Covering all space levels; Low cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI); Kosovo Hydrometeorological Institute; Universities and Research Institutes
	Explore options to reduce the impact of pests and weeds in drought affected areas	Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of agriculture forestry and rural development; Universities and Research Institutes
	Support research and development related to new ways of farming, more efficient water use, adaptation to climate change and sustainable business models	Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of agriculture forestry and rural development; Universities and Research Institutes
Response	Prepare Plan for efficient drinking water supply (humans, livestock, wildlife)	Short-term; Feasible for all related sectors; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI); Ministry of agriculture forestry and rural development
	Elaborate the Rehabilitation/recovery programs	Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of Environment, Spatial Planning, and Infrastructure (MESPI); Ministry of agriculture forestry and rural development

Sector	Measure	Measure assessment	Implementing Authority
	Prepare the options to support rural and regional communities respond to the drought	Short-term; Feasible for agriculture sector; Reducing drought impacts; Covering regional and local levels; Low cost	Ministry of Internal Affairs

5 CONCLUSIONS

The main objective of this Activity 1.3 was to select a set of measures to mitigate the drought impacts in Kosovo. For this purpose, the already existing drought measures in the EU and other countries were identified. Based on the expert judgement the List of the suitable drought measures was proposed to be integrated into the Activity 1.2. and subsequently into the River Basin Management Plans in Kosovo as it is required by the EU WFD (Program of measures). The selection was done by using qualitative rather than quantitative criteria.

In fact, drought measures are one of the main issues for the water resources management. In this report, the effort was concentrated on the developing an integrated strategy consisting of planning, monitoring, implementation of planned and emergency measures and recovery of drought damages.

The first step was to propose integrate the legislative related to the drought management, which is scattered in Kosovo. This will contribute to the better understanding and implementing the measures related to water shortage risk caused by drought.

The measures were based on the adoption of both long-term and short-term mitigation measures. It was supposed that, the most suitable combination of long-term and short-term measures for the water resources system may be an advantage. Furthermore, other criteria were feasibility, sustainability, reduction of the drought risk for regional and /or local environment and costs related to implement the measures.

The measures were subdivided into affected sectors as water resources, agriculture, forestry, urban areas and environment. Several measures were connected to the responses action to assist communities to cope with the drought damages.

Finally, it is highlighted that an integrated drought management strategy is a key step toward the reduction of the most adverse drought effects. It is recommended to shift from a reactive to a proactive approach, which is widely recognized in the EU countries to be the more appropriate way for a successful drought mitigation.

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ANNEX 1 LIST OF IDMP DROUGHT MEASURES

Table 1A. List of long-term drought mitigation measures (IDMP)

Water resources	Measure
Enhancing supply	• Storage capacity increase • Water transfers • Locating new potential resources • Aqueducts and canals • Groundwater recharge • Small scale water collection/harvesting • Adjusting legal and institutional framework • Artificial precipitation • Water treatment & reuse of wastewater/recycling
Improving demand management (in all sectors/uses)	• Reducing use • Reducing losses • Reviewing water allocation • Monitoring, metering, forecasting • Conjunctive use (surface-groundwater) • Reviewing education curricula • Adopting/reviewing water tariffs • Adjusting legal & institutional framework • Voluntary insurance, pricing and economic incentives
Agriculture	

Agricultural water management (complying with water resources strategy/plan)	• Irrigation expansion if/where possible
	• Improving demand management (more efficient systems)
	  ○ water loss reduction
	  ○ irrigation scheme modernization/conversion to more efficient systems
	  ○ shift to less water-demanding crops and cropping systems
	  ○ research of drought tolerant crops/species/genotypes
	  ○ adjusting cropping calendars to avoid heat stress
	  ○ use of non-conventional water resources
	  ○ deficit irrigation, supplementary irrigation
	  ○ conjunctive use of surface and groundwater
	  ○ soil water conservation practices
	  ○ adopting/reviewing water tariffs

Crop production	• Breeding for drought tolerance species & adaptation to short season
	• Cultural practices and techniques for conservation agriculture
	  ○ Proper fertilization
	  ○ No-till/reduced tillage systems
	  ○ Crop rotation/cropping systems
	  ○ Seeding rate/density
	  ○ Weeding/adapted pest management
	  ○ Mulching/adapted soil preparation
	  ○ Strip farming

Water resources	Measure
	○ Crop insurance
Livestock	• Drinking supplies • Balancing livestock in irrigated areas • Managing pasture and range supportive capacity • Use of indigenous breeds of feed and fodder • Genotypes of mammals / low water use • Early information for pastoralists • Forage reserves • Non conventional fodder sources
Other	
Municipal water Health Food security Energy Transportation Tourism/Recreation Industry Forest/rangeland fires Education Environment Ecosystem services/ biodiversity	

Table 2A. List of short-term drought mitigation measures (IDMP)

Water resources	Measure
Supply augmentation (all/specified sectors)	• Mixing fresh & low quality waters • Exploiting high-cost waters • Adjusting legal and institutional framework • Locating new standby resources (for emergency) • Providing permits to exploit additional resources • Providing drilling equipment
Demand management (all/specified sectors)	• Restricting agricultural uses (rationing, subjecting certain crops to stress, …) • Restricting municipal uses (lawn irrigation, …) • Reviewing operations of reservoirs • Diverting water from given uses • Over-drafting aquifers (temporarily) • Reviewing water tariffs • Rationing water supply • Sensitising and awareness campaign • Adjusting legal and institutional framework • Negotiating transfer between sectors • Dual distribution networks for drinking water supply • Adopting carry-over storage • Conjunctive use

Water resources	Measure
Measures other than supply and demand	• Temporary reallocation of water (on basis of assigned use priority) • Decreasing transport and distribution costs • Banning/restricting uses • Providing emergency supplies • Elaborating set-aside regulations • Inventory private wells, negotiate purchase of water rights for public use • Elaborate regulations on water markets • Assess vulnerability & advise water users • Elaborate alert procedures
Agriculture	
Crop Production	• Supplementary irrigation where water can be mobilized and made available on short-term basis • Soil water conservation practices • Early warning, information and advice to farmers • Review of fertilization program • Soil mulching and crop shading • Reducing crop density • Weeding
Livestock, range and pasture lands	• Early warning/advice to herders • Destocking/incentives for owners to reduce • Review available feed and reduce animal numbers • Livestock transfer where/when possible • Watering points/ water hauling sources • Locating potential sites of water for emergency • Constituting feed stocks • Adjusting water salinity to tolerable levels • Rapid inventory of grazing potential • Protective (natural) shelters • Alternative feed (by-products, less and unpalatable shrubs, …) • Supplementary, substitute feeds

Table 3A. List of response and recovery drought measures (IDMP)

Response and recovery
• Drinking water supply (humans, livestock, wildlife) • Insurance compensation • Public aid to compensate loss of revenue • Tax relief (reduction or delay of payment deadline) • Rehabilitation/recovery programs • Food programs • Feed programs • Fire control programs • Resolving conflicts • Postponing payment of credits

Response and recovery
• Implement set-aside regulations

ANNEX 2 ASSESSMENT OF PROPOSED DROUGHT MEASURES

The following questions were answered during the assessment process:

1) Does action address long-term and/or short-term solutions (symbol: long, short)?
2) Is action feasible and appropriate for the sectors and/or general public (symbol: yes, not)?
3) Is action adequate to reduce the drought impacts (symbol: yes, not)?
4) Is action sensitive to the regional and/or local environment (sustainability)(symbol: yes, not)?
5) What are the costs of the measures (symbol: high, low)?

Table 4A. Assessment of proposed drought mitigation measures suitable for Kosovo

Sector	Measure	1Q Long/Short	2Q Yes/Not	3Q Yes/Not	4Q Yes/Not	5Q High/Low
Legislation	Update and complete Law No. 04/L-147 on Waters with drought elements	Long	Yes	Yes	Yes	Low
	Develop Drought Management Strategy and Plan	Long	Yes	Yes	Yes	Low
	Implement Drought Management Plan	Long	Yes	Yes	Yes	High
	Establishing and operating a Future Drought Fund, to enhance drought preparedness and resilience	Long and Short	Yes	Yes	Yes	High
Water resources	Prepare Plan for increasing of the storage capacity in the basins	Long and Short	Yes	Yes	Yes	Low
	Upgrade the monitoring programmes related to drought assessment	Long and Short	Yes	Yes	Yes	High
	Develop Drought Early Warning System	Long and Short	Yes	Yes	Yes	High
	Assist in the adoption of new and existing technologies in water sector	Long and Short	Yes	Yes	Yes	High
	Prepare Plan for reduction of the water uses	Long and Short	Yes	Yes	Yes	Low
	Review of the Operation rules of reservoirs	Long and Short	Yes	Yes	Yes	Low
Agriculture	Ensuring animal welfare and land management issues	Long and Short	Yes	Yes	Yes	High
	Ensure development Drought Early warning and provide information and advice to farmers	Long and Short	Yes	Yes	Yes	High
	Preparing farm management practices for drought preparedness	Long and Short	Yes	Yes	Yes	Low
	Ensure support to farming businesses (economic stimulus)	Long and Short	Yes	Yes	Yes	High

Sector	Measure	1Q Long/Short	2Q Yes/Not	3Q Yes/Not	4Q Yes/Not	5Q High/Low
	Investigation of the options to be more water efficient (farmers)	Long and Short	Yes	Yes	Yes	Low
Forestry	Support the Forest Management in a way that minimizes soil erosion and supports the retention capacity of the soil	Long and Short	Yes	Yes	Yes	Low
Hydro-ecology	Support initiatives that sustain biodiversity during times of drought	Long and Short	Yes	Yes	Yes	Low
	Ensure the ecological (or minimum natural) river flow in drought prone areas	Long and Short	Yes	Yes	Yes	Low
	Ensure the river continuity for aquatic fauna mobility	Long and Short	Yes	Yes	Yes	High
	Ensure that wetlands and riparian areas (keeping buffer zones) are vegetated and sufficiently supported by water	Long and Short	Yes	Yes	Yes	Low
Urban areas	Support in municipalities and cities measures for the capture and infiltration of rainwater	Long and Short	Yes	Yes	Yes	High
	Installing water meters to control amounts used	Long and Short	Yes	Yes	Yes	High
	Preparing Plan for Restriction of municipal water uses	Short	Yes	Yes	Yes	Low
Research	Support research aimed at solving problems associated with water scarcity	Long and Short	Yes	Yes	Yes	High
	Explore options to reduce the impact of pests and weeds in drought affected areas	Short	Yes	Yes	Yes	Low
	Support research and development related to new ways of farming, more efficient water use, adaptation to climate change and sustainable business models	Long and Short	Yes	Yes	Yes	High
Response	Prepare Plan for efficient drinking water supply (humans, livestock, wildlife)	Long and Short	Yes	Yes	Yes	Low
	Elaborate the Rehabilitation/recovery programs	Long and Short	Yes	Yes	Yes	Low
	Prepare the options to support rural and regional communities respond to the drought	Long and Short	Yes	Yes	Yes	Low