Background document[1]
June 2016

Informal Meeting of Environment / Climate Ministers

Session I

Questions for discussion

Ministers will discuss water management in the context of adaptation to climate change, focusing on drought, water scarcity and floods. They will be invited to debate the impacts of drought, water scarcity and floods on the quality of life of European citizens, the European economy and the environment as well as effective solutions to the challenges posed by drought and water scarcity, considering:

1. Scientific and technical knowledge about drought, water scarcity and floods in Europe, including modelling of the impact of climate change in the future, in particular the analyses and prognosis developed by the European Environment Agency and the European Drought Observatory (EDO).
2. Strategies and policy tools developed at EU level in the context of the Common Implementation Strategy of the Water Framework Directive.
3. Member States' experience in addressing the challenges posed by drought, water scarcity and floods in different parts of Europe and in particular in the international river basins.

The aim of the Slovak Presidency is to focus the discussion on effective solutions to droughts and water scarcity at EU level. **Ministers are invited to express their views on the following questions**:

1. Is the issue of water scarcity, drought and floods relevant for the Member States, Europeans regions and the EU as a whole? What impact could water scarcity, droughts and floods have on the European economy?
2. Has the EU policy on water scarcity and drought been adequate and has it delivered the expected results? Can the UN Sustainable Development Goals or the upcoming reviews of EU Water Policy and the EU Climate Adaptation Strategy create a momentum for renewed discussion on water scarcity, droughts and floods?
3. Have the Member States adopted adequate strategies and designed effective measures in the context of the River Basin Management Plans for the period 2016-2021? What policy instruments and measures are Member States going to apply to address water scarcity and drought?
4. How can the private and public sectors and NGOs be better engaged in addressing water scarcity and drought?

[1] Compiled from European Environment Agency and European Commission reports

Overview

One of the main causes of water vulnerability is climate change; it poses an additional threat to the 'flow regime' of water ecosystems. Climate change has a more indirect effect on water quantity than land use change or abstraction, and its effects are also more difficult to discern given the natural variability in the hydrological cycle. Nevertheless, the effects are increasingly visible. Since 1880, the average length of summer heat waves has doubled in Europe. It is predicted that climate change will exacerbate the frequency and severity of droughts and floods in Europe over the coming decades. The Water Framework Directive does not mention climate change or adaptation directly; it did not feature explicitly enough in the first round of River Basin Management Plans prepared by the Member States in 2009. However, the next round of River Basin Management Plans, which will be published in 2017, will consider the effects of climate change on river basins. In the EU Blueprint for Water, climate change together with land use and economic activities are depicted as the main causes having a negative impact on Europe's water status. Adapting to climate change and building resilience to disasters are presented as key activities for sustainable water management and to achieve good qualitative and quantitative status for water bodies in Europe and worldwide. The EU Strategy on adaptation to climate change has a section related to both water quantity and quality on 'increasing the resilience of biodiversity, ecosystems and water'. However, equally important is the role of water in the other sections of the strategy, which mentions agriculture (CAP reform), industry, and households.

These human-induced changes in land use, climate, and water abstraction are combining to alter the natural 'flow regimes' that exist in water bodies. For this reason, it is important that human water use seeks to avoid creating situations of water vulnerability. We can do this by respecting the local 'ecological flow' — the quantity of water needed at different times of the year to maintain a water ecosystem.

Large areas of Europe have been affected by droughts over the past 50 years, and pressures on European water resources have increased in the past decades. Therefore, future conflicts between human requirements and ecological needs are likely to increase. These conflicts are most critical and intensify during severe and extensive droughts. The primary cause of any drought is a deficiency in rainfall, but increased human demand for water is also an important factor.

Drought *is a natural phenomenon. It is a temporary, negative and severe deviation along a significant time period, and over a large region, from average precipitation values (a rainfall deficit), which might lead to meteorological, agricultural, hydrological and socio-economic drought, depending on its severity and duration.*

Water scarcity *is a man-made phenomenon. It is a recurrent imbalance that arises from an overuse of water resources, caused by consumption being significantly higher than the natural renewable availability. Water scarcity can be aggravated by water pollution (reducing the suitability for different water uses), and during drought episodes.*

Water scarcity and droughts have similar effects, but from a policy point of view — and in particular to define adequate responses — the distinction made in the working definitions above is necessary.

Droughts can be divided into meteorological droughts, agricultural droughts and hydrological droughts. The main impacts of droughts include water supply problems, shortages and deterioration of quality, intrusion of saline water in groundwater bodies and increased pollution of receiving water bodies (i.e. there is less water to dilute pollutant discharges) and drops in groundwater levels. Droughts have major economic impacts.

Recent severe and prolonged droughts have highlighted Europe's vulnerability to this natural hazard and alerted the public, governments and operational agencies to the many problems of water shortage and the need for drought mitigation measures. Policy measures are needed which encourage 'soft' demand management approaches, rather than 'hard' infrastructure supply side approaches. Measures could include:

- The use of economic instruments, such as water pricing and metering
- Water-reuse and recycling
- Increased efficiency of domestic, agricultural and industrial water use
- Water saving campaigns supported by public education programmes

Flooding is a natural and not uncommon process associated with river dynamics, but across Europe and throughout the ages, floods have affected human health, the environment, cultural heritage and economic activities, as it is stated in the Water Framework Directive. Climate change is projected to change the magnitude and frequency of floods. Recent findings suggest that future flood events may be more extreme, with peaks above the average protection level of European rivers. Hence there is a high associated flood risk and a huge potential impact on society and business.

Recent numbers estimate the direct economic damage to the EU from flooding at approximately EUR 5 billion per year. The number of people affected in the EU is 160 000 people per year, but this is expected to increase to 240 000 to 290 000 people affected per year by the end of this century, according to various climate predictions (JRC, 2014).

Over the coming years, a series of updates on the state of EU waters will be prepared based on the information that becomes available from the second generation of River Basin Management Plans (RBMPs), including flood impacts and flood risk management. Currently available information on flood impacts and flood risk management at EU level is based on the reporting under the Floods Directive, which contains information on past and potential future floods, the Flood Hazard and Risk Maps (FHRMs) and the draft Flood Risk Management Plans (FRMPs).

In the context of flooding, strategic flood risk management is part of the wider integrated water management and planning approach for river basins and coastal areas. It focuses on reducing flood risks and promoting environmental, societal and

economic opportunities both at present and in the longer term to foster and maintain an adaptive approach (EEA, 2016).

Issues

Many ecosystems are able to adapt to recurrent natural variations in precipitation and stream flow; freshwater ecosystems can even be totally dependent on these variations. Nonetheless, exceptionally severe droughts or droughts in combination with man-made over-abstractions can result in irreversible ecosystem changes. Contrary to natural variations, human-induced water scarcity usually affects ecological status in a negative way, depending on the duration and relevance of the water scarcity and the sensitivity of the ecosystem.

There is growing evidence that climatic changes in recent decades have already affected the global hydrological cycle, such as by changes in seasonal river flows and increasing severity and frequency of droughts and floods in some regions. However, the detection of significant long-term trends in hydrological variables is generally difficult due to substantial inter-annual and decadal variability. Furthermore, the attribution of observed changes is complicated because of modifications to natural water flows arising from morphological changes, water abstractions and land-use change.

Annual average river flows are one of the elements describing freshwater availability in a river basin, next to groundwater sources, lakes or artificial water storage facilities. Variations in river flows are determined mainly by the seasonality of precipitation and temperature, as well as by catchment characteristics such as geology, soil and land cover. Changes in temperature and precipitation patterns due to climate change modify the annual water budget of river basins as well as the timing and seasonality of river flows. The consequent changes in water availability may adversely affect ecosystems and several socio-economic sectors including abstraction for drinking water, agriculture, industry, energy production and navigation. Extreme dry periods with low river flow events can have considerable economic, societal and environmental impacts.

Climate change will affect not only water supply but also water demand. Socio-economic factors such as population growth, increased consumption, and land use have a huge impact on water scarcity, and climate change exacerbates the problem. Water resources are expected to decrease in Europe as a result of an increasing imbalance between water demand and water availability. Water scarcity, mainly due to increased projections for irrigation, is projected to increase in many regions in Europe; studies suggest that climate change may also have some effect on household water demand. Many cities in southern and Eastern Europe, as well as some in Western Europe, are already experiencing water stress during the summer. Projections indicate deterioration and also a northwards extension of the problem in future. When cities need to overcome regional water scarcity through imported water, they become more dependent on other regions, with implications for water pricing.

The more long-term the effect, the more likely it becomes that environmental impacts will be accompanied by socio-economic impacts. In a risk assessment approach (trying to avoid the hazard or to limit its impacts), managers have to avoid making adverse climatic effects worse by additional strains like over-abstraction or flawed flood plain or reservoir management. Reduced crop and forest productivity, increased fire hazard, reduced water levels, increased livestock and wildlife mortality rates, and damage to wildlife and fish habitat are a few examples of direct impacts from drought and water scarcity.

Economic impacts relate to the different economic sectors such as agriculture, industry, energy, navigation, and tourism. Mitigation measures and short-term solutions (e.g. water transfers) to overcome water scarcity have to be included in any assessment of the costs of scarcity or drought. These economic impacts are not exclusive to the Mediterranean; they occur throughout Europe, either directly or as a consequence of rising prices. Agricultural economic damage includes losses in production of crops and livestock.

Besides agriculture, electricity production is vulnerable to climate change effects on river low flows and water temperature for cooling water. In Europe, more than 75 % of total electricity production is by thermoelectric power plants and studies suggest that by 2040, the probability of production capacity reductions of more than 50 % increases by a factor of 1.4, and reductions of over 90 % by a factor of 2.8. Short-term estimates (daily scale) are proposed as required to address the impacts of water extractions during low flows and of water temperature changes on aquatic ecosystems and the economic water uses.

Several of the social or socio-economic impacts of water scarcity and droughts are related to public water supply. A deficiency in water supply negatively affects the quality of life of individuals and communities. Depending on the frequency, duration and extent of the interruptions in water supply, public health and safety issues can arise. Moreover, the impacts of water shortages are not equally distributed and can be a source of conflict between different water users.

The inherent uncertainty in these complex issues of how changes to timing and flow will affect our socio-ecological and socio-technological systems calls for a risk-based approach to vulnerability. This risk-based approach is increasingly being adopted by climate change policy and adaptation strategies in disaster risk reduction. Such strategies require identification of the ecosystem's sensitivities and its vulnerability to pressures that could cause negative shifts in ecosystem structure.

Key messages *(EEA indicator assessment 'Use of freshwater resources', 2016)*[2]

- *While water is generally abundant in Europe, water scarcity and droughts continue to affect some water basins in particular seasons. The Mediterranean region and most of the densely populated river basins in different parts of Europe are hot spots for water stress conditions.*
- *Over the last decade, on average 15 % of the EU territory and 17 % of the EU population have been affected by droughts each year; during winter, some 30*

[2] http://www.eea.europa.eu/data-and-maps/indicators/use-of-freshwater-resources-2/assessment-1

million inhabitants live under water stress conditions, while the figure for summer is 70 million.

- *Around 20 % of the total population of the Mediterranean region live under permanent water stress conditions. More than half (53 %) of the Mediterranean population is effected by water stress during the summer.*
- *At 46 % and 35 % respectively, rivers and groundwater resources provide more than 80 % of the total water demand in Europe.*
- *Agriculture accounts for 36 % of total water use on an annual scale. In summer, this increases to about 60 %. Agriculture in the Mediterranean region alone accounts for almost 75 % of total water use for agriculture in Europe.*
- *Climate change had led to an increase in the crop water demand and crop water deficit from 1985 to 2014 in large parts of southern Europe, in particular the Iberian Peninsula and Italy; a decrease has been estimated for parts of south-eastern Europe.*
- *Public water supply is second to agriculture, accounting for 32 % of total water use. This puts pressure on renewable water resources, particularly in high population density areas with no water coming from upstream.*
- *The service sector has become one of the main pressures on renewable water resources, accounting for 11 % of total annual water use.*

Managing water sustainably — agriculture and regional policy

There are a range of different measures that can reduce water vulnerability and address the pressures currently acting on Europe's water. These measures are part of a risk management approach. Unlike a crisis approach, which seeks to deal with water-related crises when they occur, a risk management approach accepts that drought (or flooding) occurs, but tries to mitigate their effects with preventive action. These risk management measures must view water as a resource to be managed in an integrated fashion, bringing together all aspects of water management and policy areas that have traditionally been considered as separate. Preventive measures can decrease the impact of droughts (or insufficient water quality) and mostly do so at a lower societal cost compared to a crisis approach that focuses on response and recovery actions to limit damage during and after an event.

For example, agriculture is a major contributor to water abstraction, but we have not yet fully taken advantage of the synergies between water policy and agricultural policy. The CAP reforms currently under discussion propose to make receipt of certain agricultural subsidies contingent on meeting objectives in the Water Framework Directive, a measure known as 'cross-compliance'. If these proposals are implemented and strengthened, they can lead to a significant decrease in agricultural pressures caused by water abstractions or hydromorphological changes. Other agricultural measures that can support sustainable water management include the cultivation of crops that require less tillage, or crops that can be sown earlier in the year to take advantage of early spring rain.

Regional policy is another sector that can benefit from integrating a water management perspective. Regional policy — including the EU's cohesion policy— is potentially a very powerful tool to influence decisions on land use and changes in

land use, one of the main causes of water vulnerability. Together with development policy, regional policy can favour changes in land use that introduce natural water retention measures (NWRMs) to our landscapes. Natural water retention measures aim to safeguard the landscape's natural storage capacity by restoring or enhancing the natural characteristics of the water body. NWRMs include the restoration of wetlands, increases in forest cover, and enhancements of the natural features of floodplains. In cities, NWRMs include sealing surfaces with permeable materials or creating areas of unsealed land where water can seep to the ground. Many of these natural water retention measures are already cost-effective in that they are cheaper to implement than dealing with the effects of drought. Any future climate change scenario will only make the implementation of NWRMs even more cost-efficient.

No-regret measures are those that are beneficial (cost-efficient) whether the predicted climate change scenario actually occurs or not. Many of the natural water retention measures, and elements of green infrastructure, are no-regret measures, in contrast to classic engineering ('grey infrastructure') measures, which often don't work in harmony with the ecosystem and are less able to evolve and adapt to subsequent changes. Promotion of NWRMs as a valuable alternative requires further knowledge-sharing and examples of good practice on different scales: from local measures that can be taken individually, all the way up to large river restoration projects.

Managing water sustainably — coherence, innovation, economics and information

Measures to encourage water efficiency are critical. New technology can play an important role, allowing for more efficient daily water use in the home, in industry, and on farms. But efficiency on its own is not enough. Often, gains in efficiency are cancelled out by changing styles of consumption, a process known as the rebound effect. To avoid this, it is important to introduce water pricing and water metering to manage water demand. Other economic instruments such as taxes and subsidies can help discourage water use in certain places and times, and incentivise sustainable water use at other places and times. These instruments are a necessary complement to ordinary regulation, and in addition to helping reduce water scarcity they can also help allocate water resources between competing sectors.

Perhaps most important of all in managing water sustainably is knowing at any given time exactly what water is available for human use, and what water is needed for ecosystems. That is why the creation of a system of water accounts is so critical. Like financial accounts, water accounts will help water managers to better control water resources in their area. Current water account systems are compiled largely on a country-wide basis and presented yearly. This must change to present water data in a more detailed way, at least at the level of river basin districts and preferably on the level of sub-basins. Water account data also has to be more detailed in terms of time. Instead of annual data, water accounts should be updated monthly to take into consideration the seasonal variations in water flow. More work needs to be done to ensure that the basic scientific data that goes into providing these accounts is of high quality and comparable across countries to get an

accurate picture of the conditions of Europe's water resources. However, compared to the knowledge of trends in temperature and rainfall, much less is known about the evolution of river discharges. In climate projections, more is known on the annual trends of river flows than about the evolution of high flows (floods) and low flows (droughts), even though these extreme states are likely to have the largest impacts. Over the next decades, natural climatic variability makes the frequency and extent of extreme water events uncertain.

In general, under scenarios with an increased variability and intensity of rainfall, both flood and drought risks are projected to increase in Europe. This may not prevent the inclusion of additional measures in the RBMPs, as these programmes of measures are revised (at least) every six years. No-regret and flexible measures that can be adapted when new knowledge evidence becomes available are preferred. Those measures that irreversibly prevent the improvement of natural water retention have to be avoided.

The coordinated implementation of the different water legislation and policy measures has several advantages over a more separate, individual approach. Not only does it allow more cost-efficient sets of measures to be defined, coordination of objectives also gives more attention to environmental flow regimes and the sustained management of ecosystem services. But equally important is the challenge of coordinating — where necessary — with other sectorial policies, most notably the CAP and Cohesion Funds. Here the 'Blueprint for safeguarding Europe's water resources' gives an opportunity to place greater emphasis on a more coordinated implementation of sectorial policies. The Blueprint also gives guidance on which issues have to be developed in more detail for a better implementation.

The shifts in the extremes, rather than the trends in the averages are likely to be the biggest challenge for adaptation and also likely to be the cost drivers for adapting the infrastructure. Strategies for disaster risk management developed within the context of climate change require measures that are specific to the local circumstances, including sustainable land management and spatial planning. The river basin approach avoids passing on negative consequences further downstream, and for international river basin districts it has to be ensured that relevant information is exchanged and the plans are coordinated across countries.

As almost all elements that define the status of water bodies are sensitive to climate change, the European Commission recommends a planning horizon that includes scenarios for climate change and socio-economic developments that look further into the future than the next six-year cycle of the Water Framework Directive and the Floods Directive implementation. It is also considered useful to integrate the additional pressures, impacts and constraints caused by climate change into the economic analysis for the Water Framework Directive. The Water Blueprint Communication reviewed the most important water policy processes in the light of resource efficiency, including the water-related part of Europe’s climate change vulnerability and adaptation policy.