XEROCHORE

An exercise to assess research needs and policy choices in areas of drought

How to deal with drought

science policy brief 1

Water Framework Directive 2000/60/EC: Characterisation of water bodies and of the analysis of pressures and impacts (Article 5)

Xerochore - An exercise to assess research needs and policy choices in areas of drought

Assessment of research needs and policy choices in the area of drought. Review of the state-of-the-art and identification of research gaps in the natural system, impact assessment, policy-making and integrated water resources management with assessment of the possible socio-economic and environmental impacts of droughts and guidance on appropriate management responses.

Policy focus

Contribution to the understanding of drought and the natural system (climate and hydrology) and how it impacts the characterisation of water bodies and pressures, including socio-economic impacts and related drought management options, environmental impacts on water bodies, freshwater habitats and direct and indirect ecosystem services.

Purpose of this science-policy brief

The 6-year River Basin management cycle requires that the characterisation of water bodies is reviewed regularly. For drought, the following issues need to be considered:

"Local water bodies" should not be considered as independent systems and their characterisation may be subject to change e.g. due to possible drought damage and the water bodies' ability of to recover. Droughts are large-scale phenomena, of over-national and over-catchment nature, with their origin in the oceans and associated large-scale climate drivers.

Changes in land use (e.g. deforestation) can have devastating effects on ecosystems but are not considered in characterisations. The characteristics of the land surface (e.g. soil moisture, snow-cover, forest cover, land use) have a considerable influence on the system's reactions to weather and climate.

A scientific basis for "land-use measures" is required, and drought risk should be taken into account in system knowledge. Land use has been determined, thtrough the years, on a "political" basis (and established interests), and is not based on (larger) system characteristics/ knowledge.

Measures and investments should take this dynamic (non-stationary) nature of the natural system into account, including trends in its behaviour/characteristics. Up to now, the characterisation of water bodies has been "stationary", whereas weather extremes and climate change are of a highly dynamic nature.

The Xerochore project contributes to a better characterisation of the water bodies and

XEROCHORE

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science policy brief 2

Water Framework Directive 2000/60/EC: Monitoring of surface water and groundwater status and of protected areas (Art. 8 - relevant also for Art. 1)

Xerochore - An exercise to assess research needs and policy choices in areas of drought

Assessment of research needs and policy choices in the area of drought. Review of the state-of-the-art and identification of research gaps in the natural system, impact assessment, policy-making and integrated water resources management with assessment of the possible socio-economic and environmental impacts of droughts and guidance on appropriate management responses.

Policy focus

Contribution towards understanding drought and the natural system (climate and hydrology) and how it impacts the characterisation of water bodies and pressures, including socio-economic impacts and related drought management options, environmental impacts on water bodies, freshwater habitats and direct and indirect ecosystem services.

Purpose of this science-policy brief

The 6-year River Basin management cycle requires continued monitoring of the status of surface and ground-water as well as protected areas. With respect to drought, the following issues need to be considered:

- Monitoring should address drought conditions. Hence, it should also be capable of detecting drought characteristics linked to the highly dynamic nature of weather and climate and enable trend analysis.
- Parameters are measurable, but relation between drought vulnerability of "water bodies" and critical threshold values for irrecoverable damage is not straightforward.
- Identification of vulnerable areas to prevent irrecoverable damage in case of drought is of specific interest for monitoring.
- Drought monitoring indicators need to be further developed to allow discerning drought and water scarcity.

The Xerochore project contributes to a better monitoring of the surface water and groundwater status and therefore, to the improvement of drought risk management through better knowledge of the system and its interactions.

Policy milestones and relevant Xerochore key outputs

The main provisions of the Water Framework Directive regarding the monitoring of surface water and groundwater status are:

A review of the monitoring programme of surface waters, particularly volume and level or rate of flow in view of the review and update of the river basin management planning (implying an actual review in December 2014 corresponding to public consultation on the draft RBMP). (22 December 2015: under WFD Article 8).

A review of the monitoring programme of ground waters, particularly the quantitative status (balance between recharge and abstraction) in view of the review and update of the river basin management planning (implying an actual review in December 2014 corresponding to public consultation on the draft RBMP). (22 December 2015: under WFD Article 8).

The Xerochore D1.2 "Extended Guidance Document on the Natural System & Drought" contributes to a better monitoring of the surface water and groundwater status through:

A wide list of single indicators (e.g. precipitation, snow depth, soil moisture, aquifer levels, streamflow, reservoir storage and outflow, physical-chemical water quality and ecological variables) which can be combined and used as a basis to identify (prolonged) drought and discern drought from water scarcity across Europe (contributes to WFD Annexes V.1.4.2 and 2.2.4).

Guidance on observational modelling framework (process-based and statistical) that can be applied: (i) to distinguish between water scarcity and drought, (ii) to identify trends, (iii) to attribute to causes, incl. climate change, and (iv) to further develop combined drought indicators (preliminary results contribute to WFD Annexes V.1.1 and 2).

Approaches which support the monitoring of spatio-temporal drought characteristics (i.e. the space-time dimension of duration and severity of the transnational phenomenon of drought) (initial results contribute to WFD Annexes V.1.1 and 2).

A review of comprehensive pan-European datasets with historic river flow data (e.g. European Water Archive) that exist to characterise hydrological regimes and their connectivity at EU level (contributes to WFD Annex V.1.1.1).

Stronger models and approaches for measuring low flows relative to the selection of quality elements of rivers, including general rules or coping mechanisms which apply to both the different climatic conditions and account for the effects of climate change on water quality deterioration in (but not limited to) the Mediterranean region.

Sound indicator methodologies which can support the identification of strategic, operative and administrative measures to be applied progressively according to the drought status, as recommended by the DMP report by the WS&D Expert Group.

Limitations identified by Xerochore:

River basin monitoring does not explicitly address drought conditions, adaptation to drought and distinction from water scarcity. It should incorporate climate variability in addition to average conditions (e.g. frequencies of monitoring, in particular of physico-chemical and biological elements, WFD Annex V.1.3.4).

Monitoring the state of water storages (natural and built) in a river basin (in particular recharging during pre-drought and recovery phases) is not often performed, although it is a prerequisite for drought preparedness.

Indicators (e.g. preventive, operative, management/organisational) are not sufficiently developed to address different conditions across Europe (hydroclimatic, catchment structure and ecosystem services, management) and different drought phases (pre, during and post). Single indicators are usually not combined, made intercomparable and do not deal with non-stationarity and the time dimension of droughts. Using different types of indicators requires improved integration tools, which should also explicitly address drought conditions, incl. distinct indicators for water scarcity.

River basin management plans that fail to include ecological flow assessments as a monitoring requirement for both drought characterisation and mitigation are weakening the ability of freshwater ecosystems to be managed for drought events and ultimately improve public use supplies.

As environmental impacts will depend on duration, intensity and location of a drought event, biological indicators and thresholds are a means to determine return periods and boundaries of affected areas. However, surveillance indicators as such are not required for operational management or initial characterisation of prolonged drought under the exemption regime.

Main recommendations

Focussed research is needed on the development of specific river basin monitoring plans as part of the integral monitoring efforts that explicitly deal with drought conditions, adaptation to drought and distinction from water scarcity. It should include climate variability and climate change, and take into account the dynamic state of the storages in the river basin. Benchmark catchments across Europe to understand underlying mechanisms should underpin the development.

Monitoring should be more directed at Europe's changing water cycle due to global change (i.e. non-stationarity) by applying a combined observational modelling framework that embeds both climate variability and change, and includes uncertainty propagation in the comprehensive chain of emission scenarios - climate models - hydrological models impact models management models

Current trend analysis, which is essential to evaluate the ecological status

over a long-term perspective should (i) expand on long instrumental records of water quantity and quality variables, (ii) improve data coverage across Europe, and (iii) investigate combined on-site and regional analyses for consistency in trend detection. This should make attribution studies more conclusive.

Methods to incorporate monitoring into an information system which also includes forecasting should be developed to contribute to improved preparedness for drought (early warning).

Further knowledge is required to identify and develop complex drought indicators that (i) integrate different types of single indicators, (ii) are intercomparable across EU, (iii) deal with non-stationarity, (iv) include different drought phases, and (v) allow distinction between drought and water scarcity.

Additional technical / scientific information

XERCHORE Extended Guidance Document on the Natural System & Drought (D.1.2).

D3.1. Background Document I to the environmental impacts of drought - State of the art review.

D3.2. Extension of Guidance Document by identified emerging issues from the round table discussion on environmental impacts of droughts.

Brochure "pan-European Drought Policy Framework".

Selected related projects / activities

WATCH (WATer and global Change, Work Block 4: Extremes: frequency, severity and scale) (FP6 project, 2007-2011).

ASTHyDA: Analysis, Synthesis and Transfer of Knowledge and Tools on Hydrological Drought Assessment through a European Network (FP5 project, 2002-2004).

ARIDE: Assessment of the Regional Impact of Droughts in Europe. (FP4 project, 1998-2000)

UNESCO- International Hydrology Programme (IHP-VII), cross-cutting theme FRIEND (Flow Regimes for International Experimental and Network Data), Project Groups: (i) European Water Archive, (ii) Low flow and drought, and (iii) Large-scale hydrological variation.

SyNaRMa: Development of an Information System for Natural Risk Management in the Mediterranean.

European Drought Centre (EDC).

European Drought Observatory (EDO).

Further information on the XEROCHORE project:

Starting/Ending date of project:
1st May 2008 30th April 2010

Participating countries/institutes:

Fondazione Eni Enrico Mattei, Italy [Coordinator]

Wageningen Universiteit, The Netherlands

Water Management Center GbR, Germany

Universitetet i Oslo, Norway

Ministero dell'Ambiente, della Tutela del Territorio e del Mare, Italy

Ministerio de Medio Ambiente, Spain

Natural Environment Research Council, United Kingdom

National Technical University of Athens, Greece

EC DG Joint Research Centre, European Commission, Italy

Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, France

The International Union for Conservation of Nature and Natural Resources, Switzerland

Type of R&D:
Specific support action

Programme:
7th Framework Programme
Theme 6: Environment (Including Climate Change)

Web-Links:
Xerochore:
http://www.feem-project.net/xerochore/

European Drought Center:
http://www.geo.uio.no/edc/

European Drought Observatory:
http://edo.jrc.ec.europa.eu

therefore, to the improvement of drought risk management through better knowledge of the system and its interactions.

Policy milestones and relevant Xerochore Key outputs

The main provisions of the Water Framework Directive regarding the characterisation of water bodies are:

A review of the characterisation of surface water body types (WFD Annexes II.1.1 and 1.2) and of the characterisation of groundwater bodies (WFD Annexes II.2.1 and 2.2) needs to be performed at the latest by 22 December 2013 (under WFD Article 5.2).

A review of the impact of human activity on the status of surface waters and groundwater (WFD Annexes II.1.4, 1.5, 2.3 and 2.4) needs to be performed at the latest by 22 December 2013 (under WFD Article 5.2).

A review of the economic analysis of water use (Annex III) needs to be performed at the latest by 22 December 2013 (WFD Article 5.2).

The Xerochore D1.2 "Extended Guidance Document on the Natural System & Drought" contributes to a better characterisation of the water bodies through expanded knowledge on:

Definition of river basin characteristics (incl. hydroclimatology) that control drought propagation from the weather signal into drought in the groundwater body and surface water body (e.g. number of droughts, duration, severity) (preliminary results, contribute to WFD Annexes II.1.1, 1.2, 2.1 and 2.2).

Proposal of a combined modelling observational framework to assess the impact of pressures on drought characteristics, incl. the impact of these pressures (e.g. climate change, land use, abstractions, land drainage, urbanisation) in some selected groundwater and surface water bodies (contributes to WFD Annexes II.1.4, 1.5, 2.3 and 2.4).

Presentation of a methodology for spatial-temporal characterisation of drought (growth and decay) in groundwater and surface water bodies (initial results contribute to WFD Annexes II.1.1, 1.2, 2.1 and 2.2).

Definition of environmental variables that can enhance understanding of i) how the effects of drought are influenced by ecosystem structure such as species composition, ii) how drought alters key ecological functions for the preservation of water quality and habitat integrity, iii) what flow conditions are required for reducing ecosystem sensitivity to drought (see also D3.1 "Background Document I to the environmental impacts of drought - State of the art review").

Inclusion of drought-related economic and social impacts (see also Science Policy Brief No 3 on recovery of costs for water services).

Identification of data requirements in support of drought management (see also Science Policy Brief No 5 on river basin management plans).

Limitations identified by Xerochore:

Storage capacity (e.g. aquifers, lakes, reservoirs, wetlands, soils, bogs, riparian

areas) in a river basin, which reduces drought vulnerability, needs to be better quantified.

Responsiveness of river basins/sub-basins (i.e. presence of storage) that controls drought propagation (conversion of large-scale meteorological drought into patchy drought in groundwater and surface bodies) needs to be determined.

Importance of the interrelationship between surface water and groundwater bodies (i.e. stream-aquifer interaction) is often disregarded, although it is particularly relevant during droughts when groundwater is the only source for river flow.

A more consistent modelling approach is required to translate climate change projections into changes of droughts, incl. uncertainty assessment.

Characterisation of rivers assumes stationarity (Annex II.1.2.1), although climate change might alter the nature of the river, e.g. from a perennial river into an intermittent river (e.g. Mediterranean region) or from a snow-melt dominated river into a rainfed river (e.g. Nordic countries, Central European mountains). Non-stationarities need to be considered.

The recovery potential of biota to drought is inherent to the hydro-climatic characteristics of a region. Future drought mitigation and restoration measures will have to be informed accordingly.

Short-term deterioration of water bodies can occur as an exception as long as permanent damage is prevented. With no investigative monitoring of the environmental impacts of drought, temporary failure towards reaching Good Ecological Status is hardly detectable.

Main recommendations

Location and boundaries of surface water bodies and porous and karst groundwater bodies do not often coincide, resulting in variable groundwater boundary flow across the surface water divide which needs to be accounted for particularly during long-lasting droughts.

Drought crosses boundaries of surface and groundwater bodies and is transnational by nature, which requires an adequate approach to describe the spatial and temporal development of drought (growth and decay) at different scales (river basin, regional, continent).

Further development of a generic approach which translates meteorological drought into drought in the groundwater and surface water bodies (drought propagation e.g. number of droughts, duration, severity) considering river basin' responsiveness is required.

Drought declaration processes often fail to detect the beginning of a drought event and usually refer to the processes that follow the initiation of a drought episode. Therefore, drought modelling and forecasting are essential parts of an integrated drought management framework, within the development of river basin management plans (see Policy brief No 5 on river basin management plans).

Further information on the XEROCHORE project:

Starting/Ending date of project:
1st May 2008 30th April 2010

Participating countries/institutes:

Fondazione Eni Enrico Mattei, Italy [Coordinator]

Wageningen Universiteit, The Netherlands

Water Management Center GbR, Germany

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Ministero dell'Ambiente, della Tutela del Territorio e del Mare, Italy

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EC DG Joint Research Centre, European Commission, Italy

Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, France

The International Union for Conservation of Nature and Natural Resources, Switzerland

Type of R&D:
Specific support action

Programme:
7th Framework Programme
Theme 6: Environment (Including Climate Change)

Web-Links:
Xerochore:
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Better understanding of the complex mechanisms (climate drivers and land surface feedbacks) involved in the formation and development of regional- and large scale droughts and associated heat waves in Europe is needed.

Non-stationarity due to global change needs to be incorporated in the characterisation of river basins.

Further knowledge is required into the impacts of drought on water quality such as increases in nutrient loads at extraction points for utility and industrial provision, and for aquatic and terrestrial life, and the ecosystem services provided directly and indirectly.

Additional technical / scientific information

D1.2 XEROCHORE Extended Guidance Document on the Natural System & Drought.

D3.1. Background Document I to the environmental impacts of drought - State of the art review.

D3.2. Extension of Guidance Document by identified emerging issues from the round table discussion on environmental impacts of droughts.

Brochure "pan-European Drought Policy Framework".

Selected related projects / activities

WATCH (WATer and global Change, Work Block 4: Extremes: frequency, severity and scale) (FP6 project, 2007-2011).

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European Drought Centre (EDC)

European Drought Observatory (EDO).

XEROCHORE

An exercise to assess research needs and policy choices in areas of drought

How to deal with drought

science policy brief 3

Water Framework Directive 2000/60/EC: Recovery of costs for water services (Article 9)

Xerochore - An exercise to assess research needs and policy choices in areas of drought

Assessment of research needs and policy choices in the area of drought. Review of the state-of-the-art and identification of research gaps in the natural system, impact assessment, policy-making and integrated water resources management, and assessment of the possible impacts of droughts and guidance on appropriate responses.

Policy focus

Contribution to the understanding of drought and the natural system (climate and hydrology) and how it impacts on the characterisation of water bodies and pressures, socio-economic impacts and related management of drought management, environmental impacts on water availability and ecosystems.

Purpose of this science-policy brief

Over the past few decades, the European Union witnessed a striking increase in the losses caused by natural, particularly hydro-meteorological, disasters.

The knowledge about the past disasters is all but erratic and incomplete. At best, only direct losses are known and only for some of the key sectors. Little attention is paid to indirect, induced and intangible effects, albeit these together may exceed the direct losses in the case of droughts, and account of a bulk of damage in the case of flood.

As a consequence, the actual losses are underestimated and policy responses which are based on such a data are insufficient or inadequate to mitigate the future disaster risks. Often the poor assessment of inflicted losses favours primarily structural policy responses which, in long run, may increase the sensitivity to disasters and further exacerbate the problem.

The Xerochore project contributed to a better recovery of costs for water services through the description of economic and social effects inflicted by droughts; social and economic vulnerability to natural hazards; key water demand management options to deal with drought and water scarcity, their advantages and possible unintended consequences; and key water supply management options to deal with drought and water scarcity, and their assessment.

Policy milestones and relevant Xerochore key outputs

By 2010: Introduce water-pricing policies that provide adequate incentives for efficient water use (Article 9).

By 2010: Determine adequate contribution of the different water uses (industry, households and agriculture) to the recovery of the costs of water services (Article 9).

Before 2015: Justify the temporary deterioration in the status of water bodies if this is the result of circumstances of natural cause which are exceptional or could not reasonably have been foreseen, including prolonged droughts

To this end, the Xerochore project collected policy relevant knowledge on:

Direct and indirect losses (ripple effects) caused by droughts. Methodologies to estimate these losses and their limits. Range of reported losses due to drought in Europe and beyond.

Economic, social, institutional and legislative factors which mediate the magnitude of droughts' impacts (i.e. community's vulnerability and resilience).

Performance and caveats of economic instruments such as water prices, transfers, taxes, charges, subsidies or tradable permits for the management of scarce water resources. Preconditions under which economic instruments complement or perform better than other (e.g. regulatory or behavioural) instruments.

Implications of inadequate economic estimates of economic and social effects of droughts on the choices of policy to mitigate drought hazard.

Water demand and supply management options for the different water-use sectors that can be applied in addition to water pricing.

Limitations identified by Xerochore:

Economic assessment of droughts is a difficult and under researched topic, fraught with uncertainty, intrinsic complexity, methodological challenges and different conceptualisations of losses. Most studies focus on property damages and less so on higher-order, and intangible (non-market, environmental and social) impacts.

The lack of accurate estimates has two important drawbacks. First, the true challenge to sustainable development posed by droughts is understated, undermining the formulation of appropriate policy actions. Second, the undervalued costs may favour ineffective, often primarily structural and supply-led policy responses which, in long run, may increase the sensitivity to drought and by doing so further exacerbate the problem. Among the components of the cost of drought, the least well estimated are the non-market losses, arising from restrictions on water use to households, poor quality of water etc.

As droughts become more frequent and sensitivity to droughts increases, the economic effects will raise exponentially. To what extent the costs have increased over the past decades and whether climate change can be blamed remain an estimate given the current patchy empirical underpinning. Concerted actions in this respect should be taken at the European level, given the transboundary impacts of droughts.

The only available study at the EU level relies on a survey and self-reported losses that are poorly documented and rarely corroborated. Nevertheless the results from this study received prominent attention in the EC Communication on Droughts and Water scarcity.

The most effective way to address, if not to solve, the water shortages, whether permanent (water scarcity) or temporal (drought), is to increase water-use efficiency and shift to higher-value water uses. This will require considerable time to carry out, and one can expect to encounter significant resistance. Still, they are worthwhile. Essentially, efforts dedicated to mitigating impacts of droughts are investments which pay-off in terms of adaptation to climate change.

The impacts of droughts are mediated by a host of economic, social, institutional and legislative factors. As a result, the droughts of the same intensity striking different communities are most likely to lead to different damage. These factors epitomise community's vulnerability and resilience. Any prevention, relief or response action to drought disaster should take these factors into account and exploit them.

Main recommendations

A review of drought-related costs should be part of the economic analysis of water uses (Article 5 of the WFD) and monitoring campaigns (Article 8 of WFD). This should entail a comparison of the damage avoided against the costs of the measures. An urgent concerted action is to improve data collection on the economic and social costs of recent and past droughts in Europe. The study should be initiated at the level of Water Directors and in cooperation with the Civil Protection Mechanism.

Previous experience with such analysis indicates that pricing mechanisms (Article 9 of WFD) should play a significant role in encouraging water conservation and a shift to higher-value water uses). In particular, where permanent water shortages limit sustainable economic growth, the shift of water from agricultural to urban uses is likely to be cost-effective.

The water pricing schemes should include a variable 'scarcity' component which flexibly reacts to hydro-meteorological conditions, with a predetermined cap agreed beforehand.

Other instruments apart from water pricing should be exploited to address drought-contingent water shortages. These instruments, which include subsidy to modern water-conservation devices, cooperative agreement among the water users, and water transfers, should be applied in synergy with regulatory instruments and voluntary awareness-raising measures.

Further information on the XEROCHORE project:

Starting/Ending date of project:
1st May 2008 30th April 2010

Participating countries/institutes:

Fondazione Eni Enrico Mattei, Italy [Coordinator]

Wageningen Universiteit, The Netherlands

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Type of R&D:
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Programme:
7th Framework Programme
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European Drought Observatory:
http://edo.jrc.ec.europa.eu

Additional technical / scientific information

Xerochore Extended Guidance Document on the Economic and social impacts of drought (D.2.2).

Brochure "pan-European Drought Policy Framework".

Selected related projects / activities

WATER2ADAPT: Resilience enhancement and water demand management for climate change adaptation. Project funded under the 2nd Joint IWRM-NET funding initiative by the German Federal Ministry of Education and Research, Ministerio de Ciencia e Innovación (Spain), ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale (Italy), and Foundation for Science and Technology (Portugal). Project coordinated by FEEM (Italy) (IWRM-net founding initiative, 2010-2012).

Climate Adaptation modelling water scenarios and sectoral impacts. Tender DG ENV.D.2/SER/2009/0034. Project coordinator CESR Center for Environmental Systems Research (Germany) (DG Environment, 2010-2011).

CapHaz-Net Social Capacity Building for Natural Hazards: Toward More Resilient Societies. FP7 project coordinated by UFZ Centre for Environmental Research, Leipzig (Germany) (FP7 2009 2011)

CONHAZ Costs of Natural Hazards. FP7 project coordinated by UFZ Centre for Environmental Research, Leipzig (Germany) (FP7, 2009-2012).

XEROCHORE

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How to deal with drought

science policy brief 4

Water Framework Directive 2000/60/EC: Implementing a programme of measures (Art. 11, including Annex VI part b)

Xerochore - An exercise to assess research needs and policy choices in areas of drought

Assessment of research needs and policy choices in the area of drought. Review of the state-of-the-art and identification of research gaps in the natural system, impact assessment, policy-making and integrated water resources management, and assessment of the possible impacts of droughts and guidance on appropriate responses.

Policy focus

Contribution to the understanding of drought and the natural system (climate and hydrology) and how it impacts on the characterisation of water bodies and pressures, socio-economic impacts and related drought management, environmental impacts on water availability for ecosystems.

Purpose of this science-policy brief

The Water Framework Directive (WFD) specifies that Member States should develop Programmes of Measures (PoMs) in order to achieve the environmental objectives and address the problems associated with the pressures set on water bodies. These PoMs should be reviewed every six years, as a part of the River Basin Management Plans, and comprehensively and consistently address the impacts of drought:

The WFD lacks explicit reference to measures for mitigating the impacts of drought and water scarcity. For surface waters, these measures are only supplementary (WFD Annex VI, part b).

If we want to achieve a good status at local level, quantitative measures against drought and water scarcity will be necessary for many water bodies (both surface and groundwater), in combination with qualitative measures,

Due to climate change, there could also be a need to integrate more measures for drought and water scarcity in the second and third PoMs.

The Xerochore project contributed to the improvement of drought management, through better knowledge on the processes and options for mitigating drought impacts.

Policy milestones and relevant Xerochore Key outputs

By 2009 Member States should establish a programme of measures for drought and water scarcity constraints, for each river basin district, or for part of an international river basin district within its territory, taking into account the results of the analyses required in Article 5, in order to achieve the environmental objectives (good ecological status) established in Article 4 (see Deliverables 5.1 and 5.2 of Xerochore).

The PoMs shall be reviewed by 2012 in order to prepare the second PoMs, at the latest 15 years after the date of entry into force of the Water Framework Directive (by 2015) and every six years thereafter. Xerochore Deliverables 5.1 and 5.2 could help by integrating mitigation and adaptation measures to drought, water scarcity, and climate change within the second PoMs.

The PoMs shall include measures to prevent or control the input of pollutants into water bodies (see Deliverables 5.1 and 5.2 of Xerochore).

Controls (through the use of monitoring and prevention tools) over the abstraction of freshwater from surface and groundwater bodies, and impoundment of fresh surface water, including a register or registers of water abstractions and a requirement of prior authorisation for abstraction and impoundment. Within the frame of the WFD, these controls shall be periodically reviewed and, where necessary, updated. Member States can be exempt from these controls, when these abstractions or impoundments do not have significant impact on the water status.

The Xerochore D1.2 Extended Guidance Document on the Natural System & Drought contributes to a better knowledge on monitoring the status of surface and groundwater water bodies through:

Impact of measures on the spatio-temporal development of drought (scale, duration, severity). Appropriate tools include combined observational - modelling frameworks (more information on the topic can be found on Deliverable 1.2 “Extended Guidance Document on Natural System”).

The processes needed for selecting drought mitigation options (measures and tools), while developing a drought plan within the RBMP (contribution to WFD Annex VI).

The list of actions that could contribute to drought mitigation (contribution to WFD Annex VI).

The tools and processes used worldwide for coping with drought (contribution to WFD Annex VI).

Limitations identified by Xerochore:

Measures for mitigating drought impacts should be selected according to the severity, duration and spatial extent of the event. The lack of drought indicators that are inter-comparable across the EU to identify e.g. large-scale, prolonged drought events on a common basis hinders the process of defining actions for each drought stage.

The WFD addresses quantitative issues in compulsory terms only for groundwater bodies (Article 17). However, these should refer to both surface and groundwater bodies and be part of compulsory actions.

Demand management strategies are not promoted as obligatory measures in the WFD. However, economic instruments have often proved successful, as a means to affect water use patterns and consumer behaviour.

An important administrative shortcoming is the overlapping of jurisdictions and responsibilities among agencies, particularly with regard to the selection and implementation of drought mitigation actions.

Main recommendations

PoMs should, when and where necessary, incorporate measures to cope with drought and climate change and particularly with the effects of additional pressures which lead to a deterioration of the status of water bodies. Emphasis should also be given to the incorporation of environmental protection actions, aimed at the protection and restoration of aquatic ecosystems during and after drought events.

WFD Annex VI (part b) provides a list of quantitative measures that could be included in the PoM. It would also be of value to provide guidance on the criteria used for the selection and evaluation of measures, in order to promote the analysis of uncertainty of climate change, as well as the selection of measures with cross-sectoral benefits. Furthermore, a comprehensive catalogue of measures for combating drought and water scarcity impacts should be developed, including aspects of forest management, soil management and protection of permanent grasslands.

Demand management options should be integrated as compulsory measures, in order to foster the sustainable use of water resources through the reduction of water consumption and the increase in water use efficiency. Demand management can also improve the resilience of water systems in the case of extreme events.

The list of measures for the PoM can also include “Green Infrastructure”, which is expected to contribute to adaptation to climate change and extreme climatic conditions.

The PoM should be developed in integration with the Rural Development Programme, developed under CAP.

Measures reported in the PoM, particularly for drought management, may be subject to the Strategic Environmental Assessment Directive (SEA) provisions and should be assessed according to Article 4.7 of the Water Framework Directive.

Existing decision support systems should be enhanced to incorporate the multi-faceted drought impacts and address issues such as environmental sustainability, conjunctive use of surface and groundwater, evaluation of the performance of traditional water management approaches, adaptation measures to strategic sectors (e.g. agriculture, energy

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Participating countries/institutes:

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Water Management Center GbR, Germany

Universitetet i Oslo, Norway

Ministero dell'Ambiente, della Tutela del Territorio e del Mare, Italy

Ministerio de Medio Ambiente, Spain

Natural Environment Research Council, United Kingdom

National Technical University of Athens, Greece

EC DG Joint Research Centre, European Commission, Italy

Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, France

The International Union for Conservation of Nature and Natural Resources, Switzerland

Type of R&D:
Specific support action

Programme:
7th Framework Programme
Theme 6: Environment (Including Climate Change)

Web-Links:
Xerochore:
http://www.feem-project.net/xerochore/

European Drought Center:
http://www.geo.uio.no/edc/

European Drought Observatory:
http://edo.jrc.ec.europa.eu

production).

The evaluation of different sets of quantitative measures should be encouraged and promoted in scientific research (cost effectiveness analysis of water scarcity and drought measures). In addition, measures for boosting ecosystem storage capacity for water in Europe should also be evaluated and explored.

A set of EU common agreed indicators for characterising and monitoring drought and water scarcity should be established, which consider the different nature of both phenomena.

International networks for disseminating experiences on the implementation of drought mitigation measures should be established in order to communicate success stories, as well as failures.

Additional technical / scientific information

Xerochore Working Document on "Provisions and Gaps of the Water Framework Directive 2000/60/EC regarding drought management".

Xerochore Working Document on "Pan-European Drought policy framework".

Selected related projects / activities

DSS-DROUGHT: A decision support system for mitigation of drought impacts in the Mediterranean regions (INCO-MED project, 1997-2001).

ARIDE: Assessment of the Regional Impact of Droughts in Europe (FP4 project, 1998-2000).

ASTHyDA: Analysis, Synthesis and Transfer of Knowledge and Tools on Hydrological Drought through a European Network (FP5 project, 2002-2004).

AQUASTRESS: Mitigation of Water Stress through new Approaches to Integrating Management, Technical, Economic and Institutional Instruments (FP6 project, 2005-2009).

European Drought Centre (EDC) and the European Drought Observatory (EDO).

XEROCHORE

An exercise to assess research needs and policy choices in areas of drought

How to deal with drought

science policy brief 5

Water Framework Directive 2000/60/EC: River basin management plans (Art.13)

Xerochore - An exercise to assess research needs and policy choices in areas of drought

Assessment of research needs and policy choices in the area of drought. Review of the state-of-the-art and identification of research gaps in the natural system, impact assessment, policy-making and integrated water resources management, and assessment of the possible impacts of droughts and guidance on appropriate responses.

Policy focus

Contribution to the understanding of drought and the natural system (climate and hydrology) and how it impacts on the characterisation of water bodies and pressures, socio-economic impacts and related drought management, environmental impacts on water availability for ecosystems.

Purpose of this science-policy brief

River Basin Management Plans (RBMPs) describe the processes and means to achieve the environmental objectives established by the Water Framework Directive (WFD). Drought, as a hazard, cannot be avoided and poses additional pressures on water bodies which should be examined while developing the RBMPs, following the six-year river basin management cycle:

- Drought management plans should be an essential part of river plans and reviewed on a regular basis, in order to account for advances in drought planning.
- Regions facing drought and water scarcity problems should be mapped (parallel to the delineation of river basins), in order to adjust/rationalise water management, as well as development projects, in these areas.

The Xerochore project contributed to improved drought preparedness through a state-of-art review and better knowledge on the processes of developing a drought plan, complementary to river basin management plans.

Policy milestones and relevant Xerochore key outputs

The main provisions of the Water Framework Directive regarding River Basin Management Plans (RBMPs) are:

Development of RBMPs for each river basin district (national and international). The first RBMPs should be published nine years after the date of entry into force of this Directive, at the latest.

RBMPs shall be reviewed and updated 15 years at the latest, after the date of entry into force of this Directive and every six years thereafter.

RBMPs may be supplemented by the production of more detailed programmes and management plans for sub-basin, sector, issue, or water type, to deal with particular aspects of water management. Implementation of these measures shall not exempt Member States from any of their obligations under the rest of this Directive.

Indicative contents of RBMPs are given in the WFD Annex VII.

The Xerochore D5.2 Extended Guidance document after Conference on Drought management and policy options addresses the issue of interlinkages between water and drought management and contributes to an improved knowledge on drought planning through:

The development of drought (growth and decay) and associated characterisation (scale, durations, severity) (more information on this topic is provided in the Science-Policy brief No 1 on drought characterisation) (contribution to WFD Annex II).

Monitoring and short-term forecasting of drought (more information on this topic is provided in the Science-Policy brief No 2 on drought monitoring) (contribution to WFD Annex V).

The processes for developing drought management plans within river basin management plans, since drought intensifies pressures set on water bodies (contribution to WFD Article 13).

The minimum required contents of drought plans, particularly under the framework of adaptation to climate change (contribution to WFD Annex VII).

The need to identify potential “drought regions”, supplementary to the identification of river basins (contribution to WFD Articles 3 & 5).

Key issues and objectives for improving drought management.

Limitations identified by Xerochore:

Processes for developing and reviewing drought plans have not been established, within the framework of drafting the river basin management plans.

Water management is performed independently of other national policies. For example, there is no linkage among water management and rural

development plans, particularly regarding the agricultural sector. Furthermore, the impacts of these plans on aquatic ecosystems have not been examined during their development (e.g. impacts of drainage systems and constructions on natural vegetation and soil saturation with water).

There is still limited political commitment on drought planning which is depicted in the absence of drought policies.

Participatory processes are not included in the decision-making process targeted to mitigating drought impacts. Important topics for the successful implementation of such processes are the use of a common language among stakeholders and conflict resolution techniques among water users.

Not all countries have established comprehensive drought declaration processes, which are based on the use of combined indicators and multi-monthly, seasonal monitoring and forecasting (including uncertainty assessment).

Existing water planning practices (mainly supply-oriented) have proven inefficient to cope with the adverse impacts of drought, leading to overexploitation of water bodies (e.g. rivers and reservoirs). As a result the survival of aquatic ecosystems is jeopardised, due to the increased stress set on them.

Global change (non-stationarity) pressures and impacts on European's water cycle have not been thoroughly studied.

Main recommendations

There should be a requirement for the development of a specific Drought Management Plan (DMP) linked to the RBMPs described in the WFD, for each river basin (not only for water stressed regions), which is affected or is expected to be affected by drought and water scarcity issues, within the Member States, and on international grounds.

Climate change aspects, particularly aspects of uncertainty (emissions, propagation in modelling chain), should be integrated in planning for the second and third RBMP (2015-2027).

Analysis of holistic response and recovery frameworks, especially targeting highly-impacted areas by drought, including vulnerable aquatic ecosystems, should be promoted.

Short-term drought forecasts can already be integrated in the planning and decision-making process and in the long run multi-model and seasonal forecast should be included.

The use of participatory tools and methods (e.g. role-playing and conflict resolution tools) can improve drought management efforts. Furthermore, participatory ecosystem-based management can ensure the sustainable use of water resources while protecting the aquatic ecosystems.

Aspects of ecosystem preservation should be integrated in drought

planning. The establishment of "minimum flows" highly influences the water use rates during drought and can contribute to the maintenance of the "good status" of groundwater bodies, as well as surface bodies.

Additional technical / scientific information

Xerochore Working Document on "Provisions and Gaps of the Water Framework Directive 2000/60/EC regarding drought management".

Xerochore Working Document on "Pan-European Drought policy framework".

Selected related projects / activities

MEDROPLAN: Mediterranean Drought Preparedness and Mitigation Planning (EU MEDAWATER, 2003-2007).

PRODIM: Proactive Management of water systems to face drought and water scarcity in islands and coastal areas of the Mediterranean (Interreg IIIB ARCHIMED, 2006-2007).

WAM-ME: Water Resources Management Under Drought Conditions: Criteria and Tools for Conjunctive Use of Conventional and Marginal Waters in Mediterranean Regions (INCO MED (2), 2000-2003).

MEDDMAN: Integrated water resources management, development and comparison of common transnational methodologies to combat drought in the MEDOCC regions (Interreg III, 2006-2008).

European Drought Centre (EDC) and the European Drought Observatory (EDO).

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