



How to deal
with drought

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

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>

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).