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

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

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

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).

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.

European Drought Centre (EDC)

European Drought Observatory (EDO).