Building resilience to drought impacts on water supplies: a comparison of approaches in Europe, the USA, and Australia

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Motivation

Drought events pose a substantial threat to water security in almost every climate zone and water use sector.
Many countries have had difficulty maintaining water supplies and mitigating user conflicts during recent droughts, for example during Australia's Millennium Drought (1998-2010) and the recent droughts in the USA (2012), Europe (2000s) and UK (2011/12).
With climate projections suggesting that droughts will intensify in many regions the magnitude of this threat is likely to increase and thus vulnerability of society to drought must be reduced through better preparedness.

Project

The Belmont Forum project DrIVER (Drought impacts: Vulnerability thresholds in monitoring and early-warning research) aims to contribute to better drought preparedness by improving links between natural (hydrometeorological) drought characterisation and environmental and socio-economic impacts.

Development of a Training Game

Social Learning Approaches

Objectives

(1) Identify and compare physical drought indicators and reported drought impacts across different geographical settings, primarily in the USA, Europe and Australia where drought M&EW systems exist

(2) Explore and define vulnerability thresholds through quantitative analysis of indicators and impacts during past drought events

(3) Engage public water suppliers and related stakeholders through a series of workshops to explore the framings, decision making and practices relating to drought (including M&EW)

(4) Develop pathways to drought resilient human communities and ecosystems based on improvement of targeted drought M&EW systems, drought management and training

driver

Data & Case Studies

Drought Indicators
Most continental or regional M&EW systems use precipitation-based drought indices.

The lower river Murray and Adelaide water supply are a DrIVER case study; it was hit hard by the "Millenium Drought" 1998-2010.

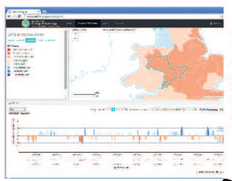
At the national scale, surface and ground water monitoring often serves for drought M&EW.

Water suppliers monitor their storage levels; they would like to have improved forecasting.

The European **Drought Impact** report Inventory (EDII) is a research database with >5000 drought impact reports.

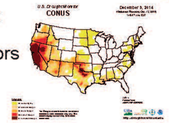
Stahl et al. (in press) for ICDrought2015

In Western Europe, the fraction of water supply impacts is highest among all impact categories.

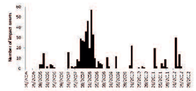


Water supply in England is one DrIVER case study; the last major drought was in 2011/2012.

The US Drought Monitor (DM) provides indicators that relate to impacts.

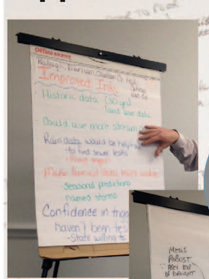


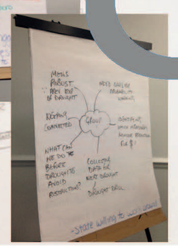
The US Drought Impact Reporter (DIR) collects real-time information.



North Carolina is a DrIVER case study; the last major drought was in 2007/2008.

Transdisciplinary Approaches





Strategy Game workshop:
Based on findings emerging from the first workshop, a simulation of various scenarios based on historical droughts

Knowledge sharing workshop:
engaging a broad range of workshop participants

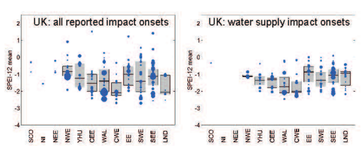
USA: North Carolina 9 Dec 2014
State Drought Task Force
Water supply focus (Triangle J, NC)
Knowledge sharing:
Understanding and improving drought plans
Design of meaningful indicators and triggers
Improving forecasting capability

UK: March 2015
Policy, practitioner & user communities
Regional focus (Lowland England)
Social learning design to explore:
Different framing and experiences of drought
Understandings of drought systems
Role and use of M&EW systems
Design of meaningful indicators

AU: Spring 2016
Regional focus (Adelaide water supply)
Social learning design to explore:
Different framing and experiences of drought
Newly required farm business risk management
Role and use of M&EW systems
Design of meaningful indicators

Data Analysis

a) Correlation
of drought indicators (SPI, SPEI) with number of impact reports (right)
b) Indicator values' distribution
at reported impact onsets (below)

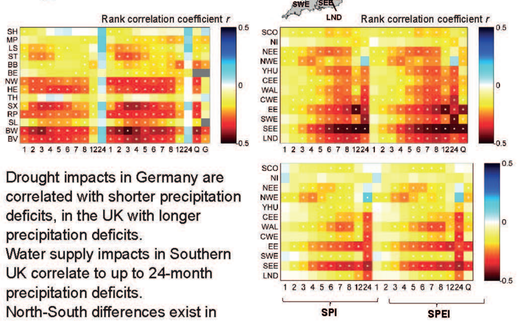


Bachmair et al. currently in NHESS-Discussions

Europe: Germany compared to UK

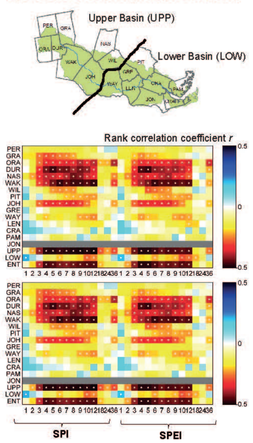
Drought impacts in Germany: predominantly agriculture, freshwater ecosystems and energy production.

Drought impacts in the United Kingdom: predominantly public water supply, freshwater ecosystems



Drought impacts in Germany are correlated with shorter precipitation deficits, in the UK with longer precipitation deficits.
Water supply impacts in Southern UK correlate to up to 24-month precipitation deficits.
North-South differences exist in both countries.
Impacts have started at a wide range of negative SPI thresholds.

The Neuse Basin, North Carolina



Significant correlation
No data

SPI= Standardized precipitation index for different accumulation periods
SPEI= Standardized precipitation evapotranspiration index

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Bachmair S., Kohn I., Stahl K: Exploring the link between drought indicators and impacts. NHESS Discussions.

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