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

K. Stahl (1), J. Hannaford (2), M. Svoboda (3), C. L. Knutson (3), S. Bachmair (1), M.C. Acreman (2), N.D. Crossman (6), I.C. Overton (6), M. Colloff (4) and K. Collins (5)

Motivation
Drought poses 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 a better drought awareness by improving links between natural (hydrometeorological) drought characterisation and environmental and socio-economic impacts.

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&E systems exist.
(2) Explore and define vulnerability thresholds through quantitative analysis of indicators of drought impact 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&E).
(4) Develop pathways to drought resilient human communities and ecosystems based on improvement of targeted drought M&E systems, drought management and training.

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 useful indicators and triggers
- Improving forecasting capability

AU: Spring 2016
Adelaide water supply
Social learning design to explore differences in framing and perspectives
Newly-regionalised indicators:
- Framing of Indicators

Data & Case Studies
Drought Indicators
Most continental or regional M&E systems use population-based drought indices.

The US Drought Monitor (DM) provides indicators that relate to impacts.
The European Drought Impact report Inventory (EDII) is a research database with >5000 drought impact reports.

In Western Europe, the fraction of water supply impacts attributed to drought varies across all impact categories.

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

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

Water supply in the United Kingdom: predominantly
- Public water supply, freshwater ecosystems and energy production.

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.

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.