

## DROUGHT-R&SPI

### Aim

The DROUGHT-R&SPI (**DROUGHT - Research & Science Policy Interfacing**) project (2011-2015) transferred knowledge across scales (river basin, national, pan-European), which is paramount because vulnerability and risk to drought is context-specific (e.g. physical, environmental, socio-economic, cultural, legal, institutional), which requires analyses on detailed scales, whereas international policies and drought-generating climate drivers and land surface processes are operating on large scales. The project adopted Science-Policy Interfacing at the various scales, by establishing Case Study Dialogue Fora and a pan-Europe Dialogue Forum, which ensured that the research was well integrated into the policy-making from the start of the project onwards. The study fostered a better understanding of past droughts (e.g. underlying processes, occurrences, environmental and socio-economic impacts, past responses), which is anticipated to contribute to the assessment of drought hazards and potential vulnerabilities in the 21st C. Methodologies for early drought warning at the pan-European scale were developed, which is meant to improve forecasting of a suite of interlinked physical and drought impact indicators. This is meant to increase drought preparedness, and to identify and implement appropriate Disaster Risk Reduction measures. The project contributed through combined drought studies at different scales to the identification of drought-sensitive regions and sectors across Europe, which likely has led to a more thorough implementation of the EU Water Framework Directive, particularly by further developing of methodologies for Drought Management Plans at different scales (incl. EU level). The work was linked with the European Drought Centre (EDC), which ensured that the outcome has been consolidated beyond the project' lifetime.

The **main objectives** of Drought-R&SPI were:

1. Foster a better understanding of past droughts (underlying processes, occurrences, incl. frequencies, severities and scales) and in particular to investigate driving factors and characteristics of the most extreme historic events at the pan-European scale, which were validated against observed natural hazards at the small scale (case studies);
2. Provide an in-depth understanding of the range of pertinent environmental and socio-economic impacts triggered by past drought hazards in different contexts, taking into account economic, political, and social factors at a small scale in water-stressed regions (case studies) and considering the large-scale drivers (transfer of knowledge and information across scales);
3. Evaluate past responses to drought events at the local, river basin and national scale (case studies), and identify best practice examples and lessons learnt in alleviating drought impacts and reducing associated risks from different local environments, which are crucial for the development of methodologies for drought management planning;
4. Develop and test an innovative suite of drought indicators that integrate physical, impact and vulnerability indices, which addressed different spatio-temporal scales, interaction across scales and water-related sectors, and that built upon: (i) the comprehensive knowledge obtained in different contexts at the detailed scale (case studies), and (ii) exploration of the link between impact records (socio-economic, environmental), management factors and vulnerability thresholds across Europe. Development and testing were linked and shared with research done through the European Drought Observatory (EDO) at the EC Joint Research Centre (JRC) and WISE-RTD (European Environmental Agency, EEA);
5. Develop an innovative methodology for early warning (monitoring and forecasting) of drought at the pan-European scale using the developed European Drought Impact Inventory (EDII database) and suite of indicators, which are meant to help to: (i) to increase drought preparedness, and (ii) to identify and implement appropriate Disaster Risk Reduction (DRR) measures. Drought-R&SPI shared the obtained knowledge and information with the JRC, which are designing and developing an operational version;
6. Establish Drought Dialogue Fora at different scales, i.e. Science-Policy Interfacing, (i) to identify and evaluate, in close collaboration with the Case Study Drought Dialogue Fora, potential responses for drought risk mitigation, taking into account the drought hazard, its impacts, vulnerabilities and desired development goals, strategies and relevant trade-offs, and (ii) to recognize and assess, in close dialogue with the pan-European Drought Dialogue Forum through an iteration process with feedback loops, how EU and other international policies affect potential responses at the small scale (case studies). Finally, how these together with large-scale impact maps and vulnerabilities are meant to support design, development or implementation of drought-related international policies and planning, incl. Drought Management Plans at different scale (river basin to EU level);
7. Assess the drought hazard at the pan-European scale in the 21st Century (future climate) and identify drought sensitive regions through combining improved knowledge on past events (through the developed European

Drought Reference Database, EDR) and related long-term climate variability with projected future changes, incl. the analyses of the outcome from multi-models and multi-scenarios;

8. Assess potential vulnerabilities of the studied systems at the local, river basin and national scale in (potentially) water stressed areas (case studies), taking into account the assessment of the large-scale 21st Century drought hazard, socio-economic drivers of change and anticipated impacts of relevant EU policies, which is essential for development of drought management planning;
9. Assess changes in the modelled impacts for the 21st Century and resulting changes in risk of passing a vulnerability threshold at the pan-European scale in co-operation with the pan-European Drought Dialogue Forum to identify drought sensitive sectors, incl. their geographical location;
10. Share knowledge on drought with experts working on the 2nd cycle of WFD River Basin Management Plans and the general public through a web-based information and discussion platform hosted by the European Drought Centre (EDC)<sup>5</sup>, and to disseminate knowledge through a summer school and on the proposed 2nd Drought Conference as follow-up of the 1st Drought conference held in Brussels, February 2010.