UK drought monitoring: an impacts perspective

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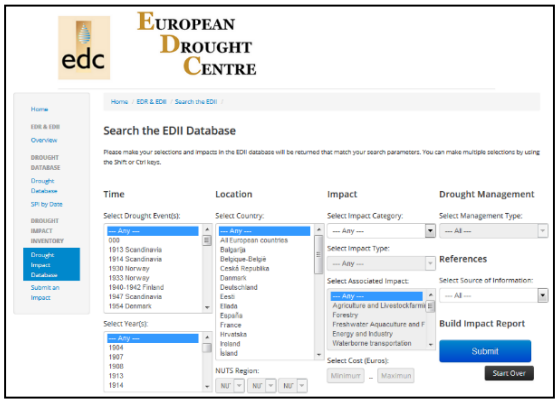
NERC SCIENCE OF THE ENVIRONMENT

From indicators to impacts

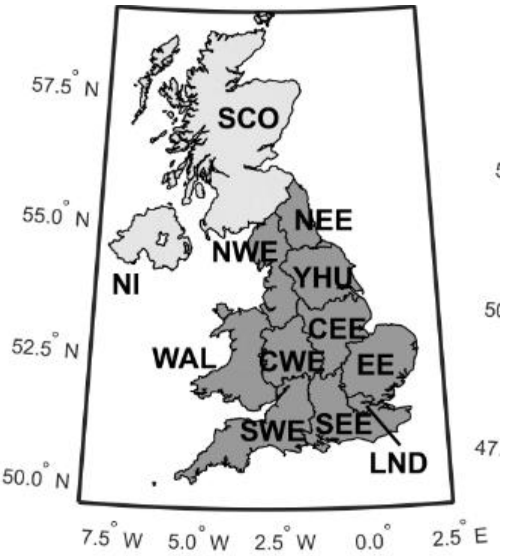


- Conflicts
- Human health
- Air quality
- Wildfires
- Soil system
- Terrestrial ecosystems
- Freshwater ecosystems
- Water quality
- Water supply
- Tourism and recreation
- Waterborne transportation
- Energy and industry
- Freshwater aquaculture and fisheries
- Forestry
- Agriculture and livestockfarming

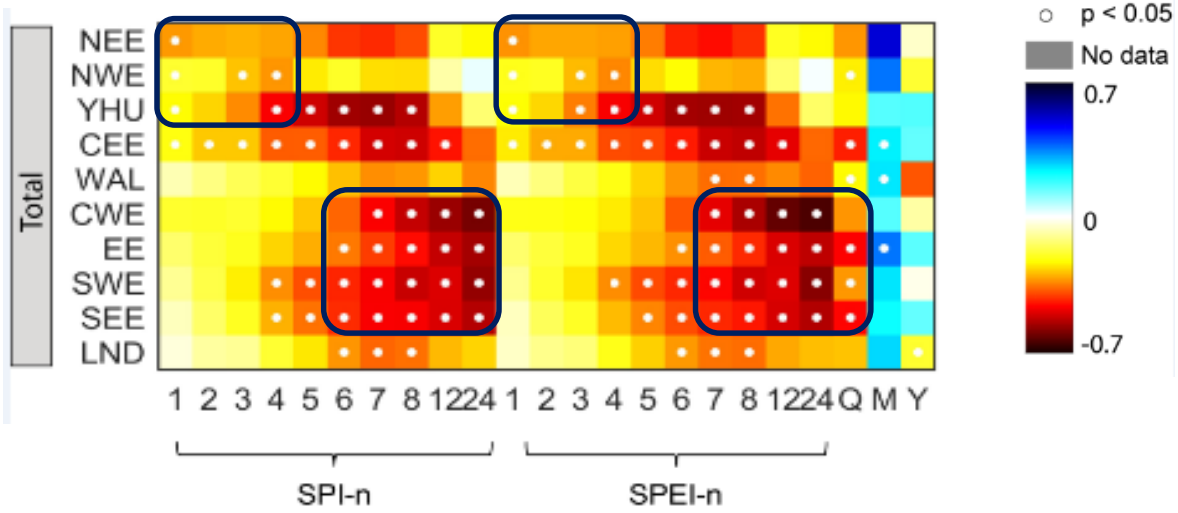
European Drought Impact Inventory (EDII)

http://www.geo.uio.no/edc/droughtdb/

DROUGHT R&SPI



A quantitative indicator – impact analysis (Bachmair et al. 2016 HESS)



These plots show strength of correlation between SPI-n/SPEI-n and number of EDII impacts for NUTS1 regions of the UK

Indicators to impacts; Large-scale to local

- Water Supply

- Agriculture

- Environment

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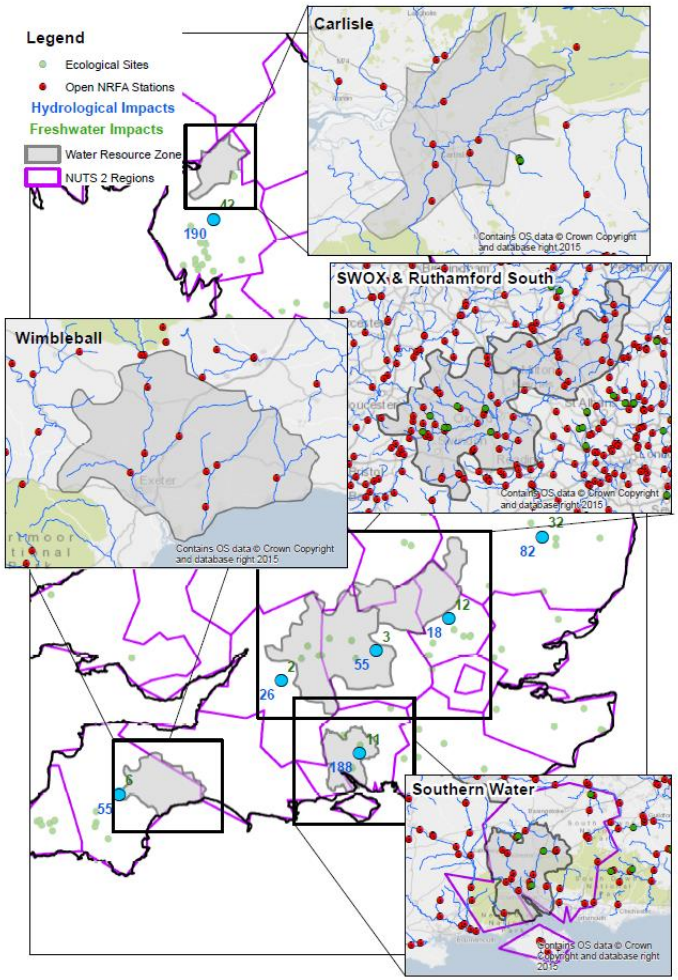
From large-scale to local: water supply

From Workshop 1: review water company drought plans in the context of proposed new indicators (e.g. SPI). Can these be related to existing triggers/thresholds?



- Aim: link outputs from monitoring and early warning prototype with local-scale triggers
- Premise: link indicators (SPI, SPEI, SSI) to water company trigger levels and observed impacts (restrictions)
- BUT: Water supply systems have changed – use contemporary system and modelled historic levels
- Data from ‘Extreme Drought’ project

From large-scale to local: water supply

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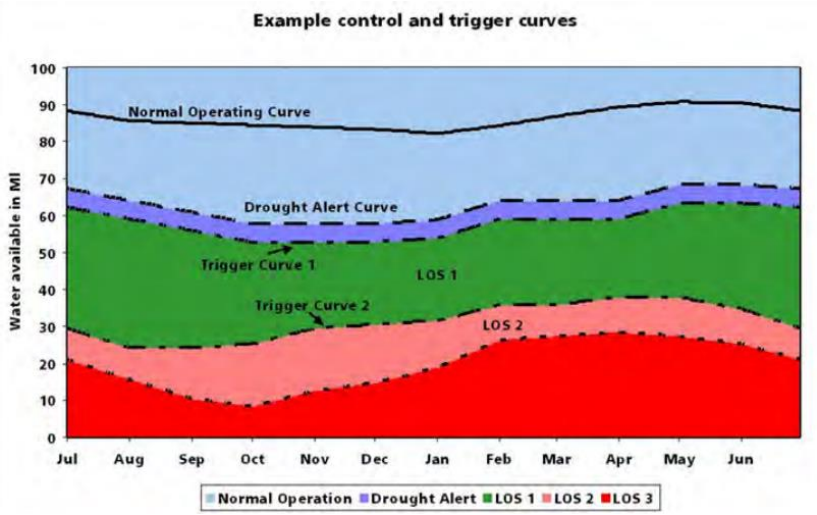
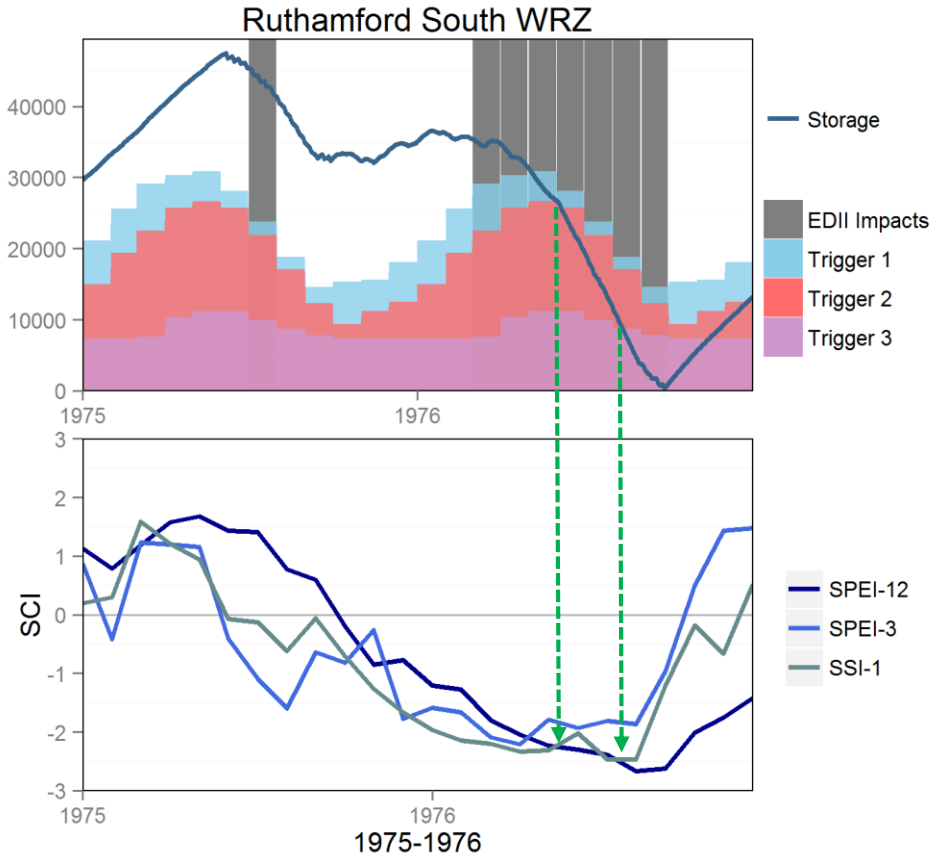
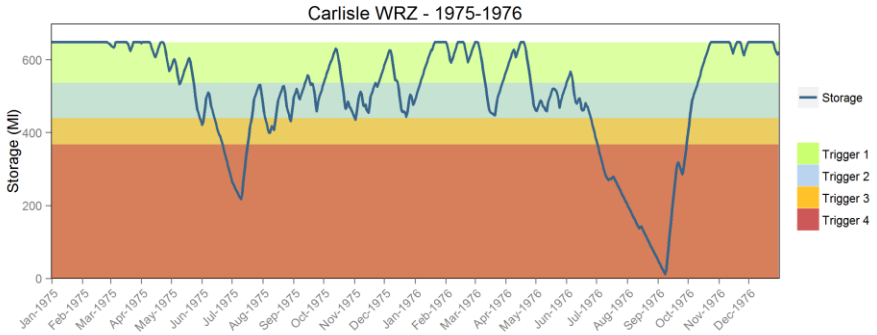
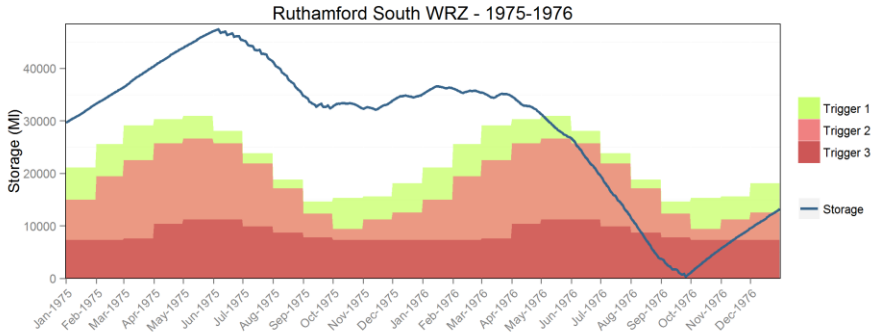


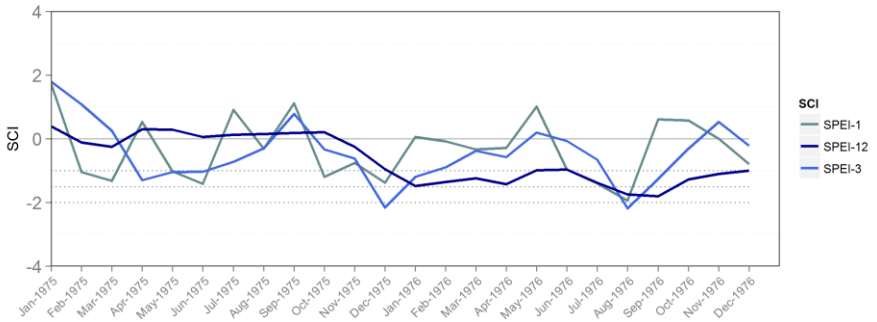


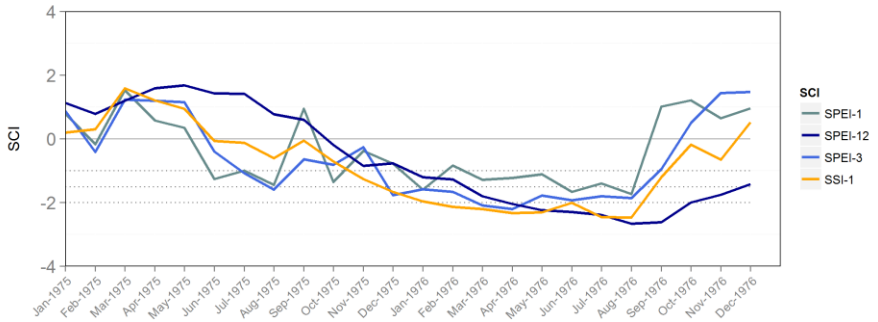
Translating SPEI/SSI to water company drought triggers

1975 - 76









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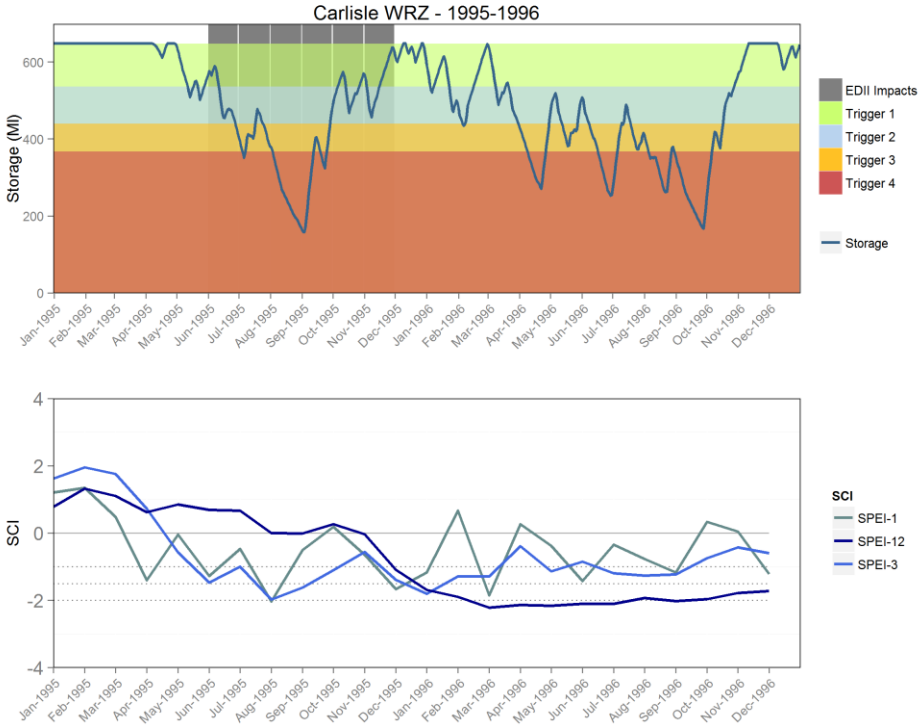
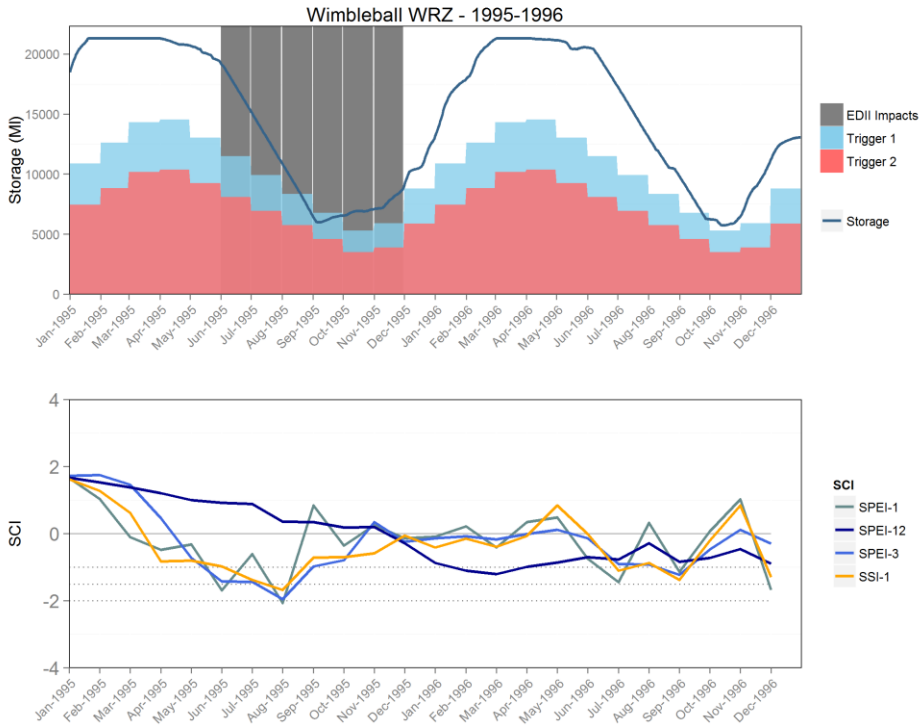
1995 - 1996





Summary for water supply:

We can translate hydrological drought indicators from large-scale early warning prototypes to local-scale triggers

So far done in a preliminary way using modelled data – different SPI/SSI thresholds for different events, systems.

Approach could be used in drought/WRMPs: do a local scale translation from thresholds and historic benchmarks through to water resource zone triggers

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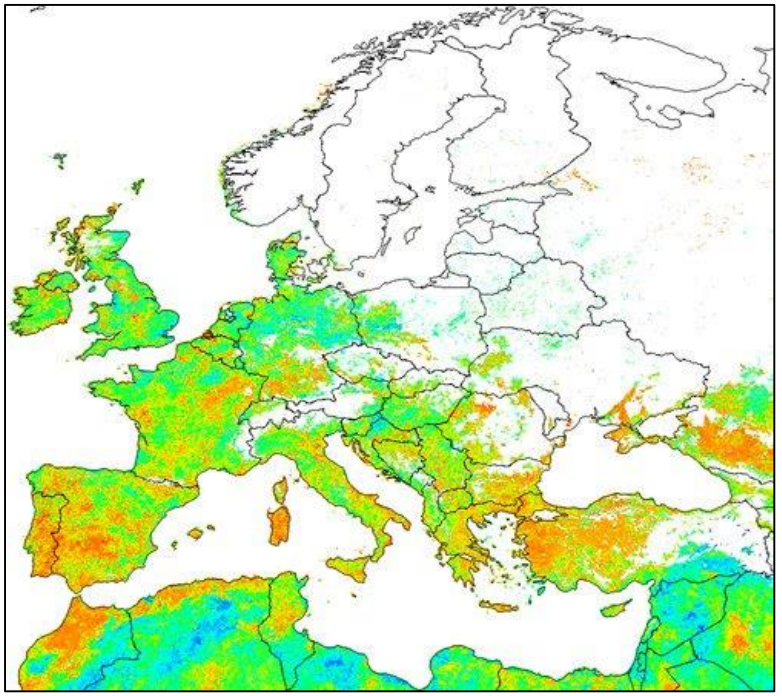
From indicator to impacts: agriculture

From Workshop 1: “Farmers often feel left to their own devices and having to respond to impacts that are already happening. Drought is seen by some as a slow-onset event, but for farmers it can become a problem overnight…”



Earth Observation Drought Indicator: Vegetation Condition Index (based on MODIS satellite)

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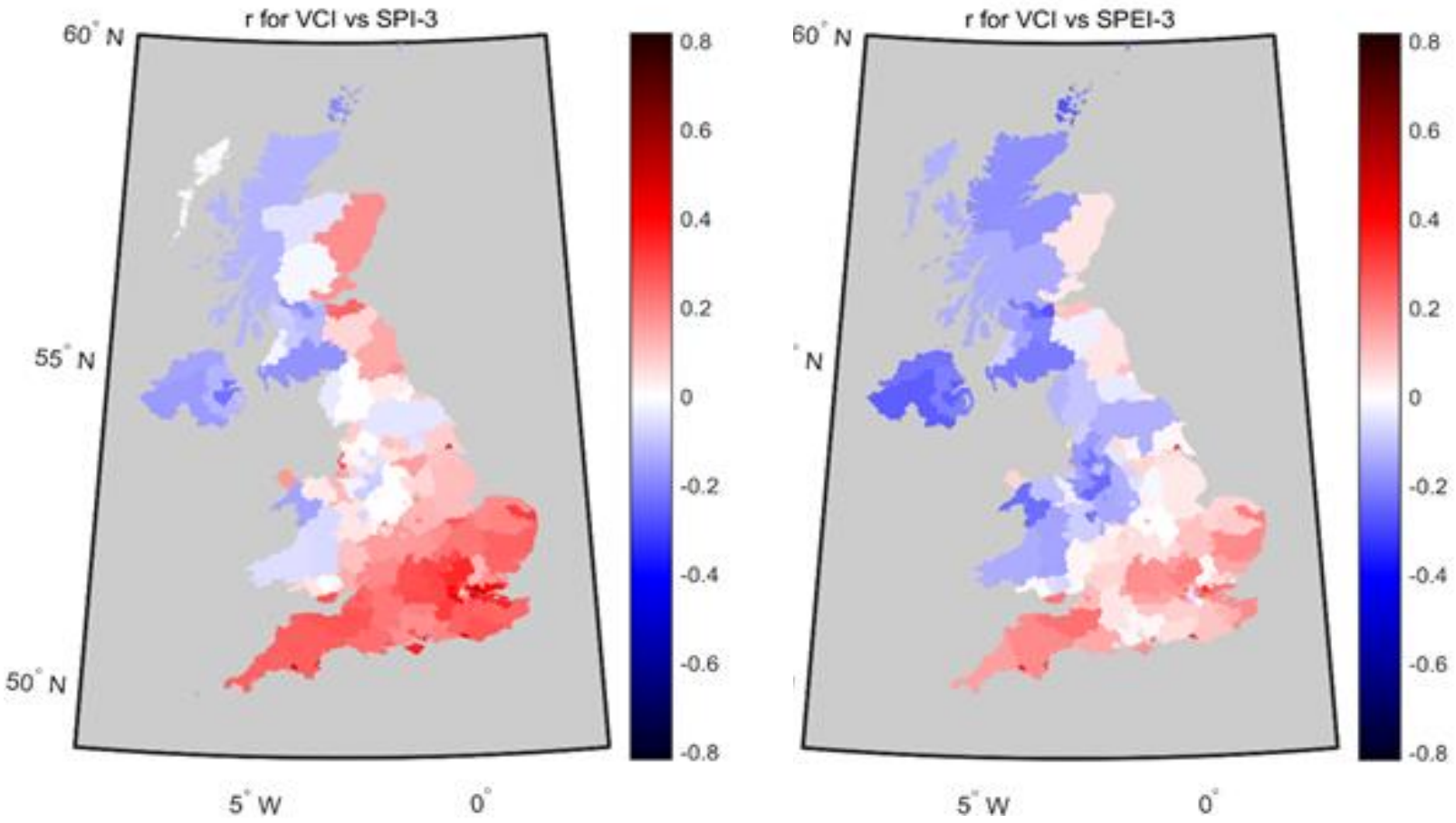
Indicators to impacts: vegetation condition

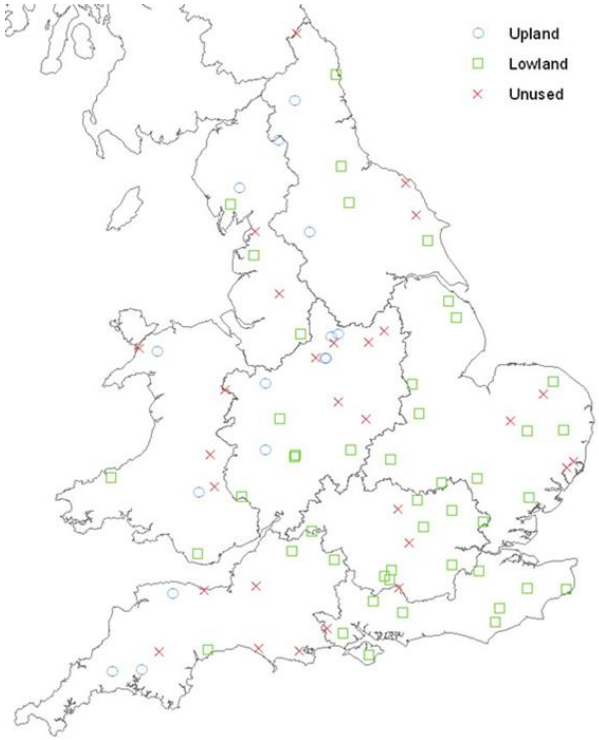


Correlation between SPI/SPEI-3 and remotely sensed vegetation (regions = EU NUTS3)

(Bachmair, Tanguy et al. in prep; DOI dataset coming soon)

From indicator to impact: ecosystems

From Workshop 1: Can we develop flow indicators that are meaningful environmentally/ecologically?



Environment Agency

Environment Agency National Drought Surveillance Network Priority sites for ecological monitoring in drought

ASPT: based on macroinvertebrate samples

Premise: link drought indicators to macroinvertebrate datasets

Data

86 biological sites matched to 76 gauging stations (1950 data-points; approx. 1990-2012)

3minute kick samples – twice a year

Biological indicator

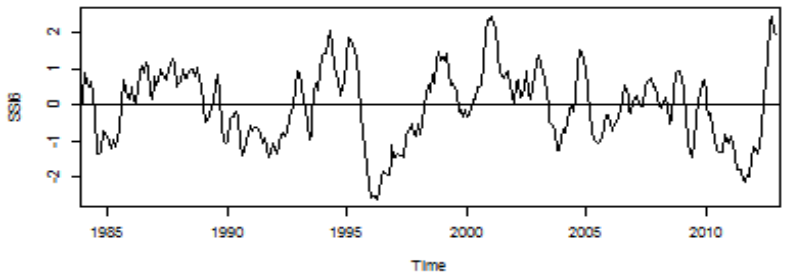
ASPT: average score per taxon

Captures community structure

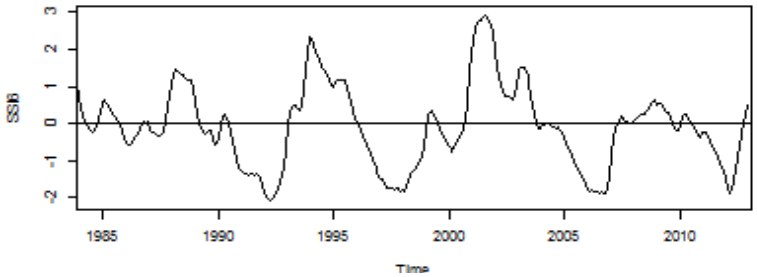
The higher ASPT, the better the river ecology

Biological response to drought: it's complicated!

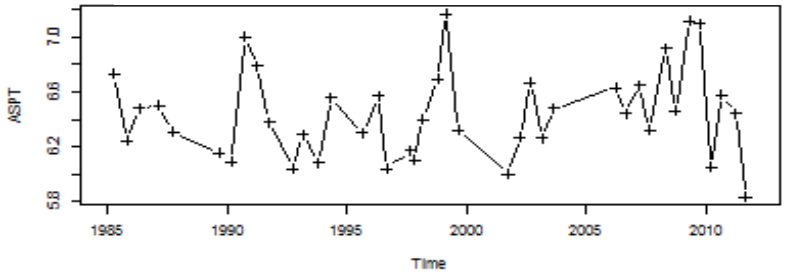
SSI6



SSI6



Average Score per Taxon (ASPT)



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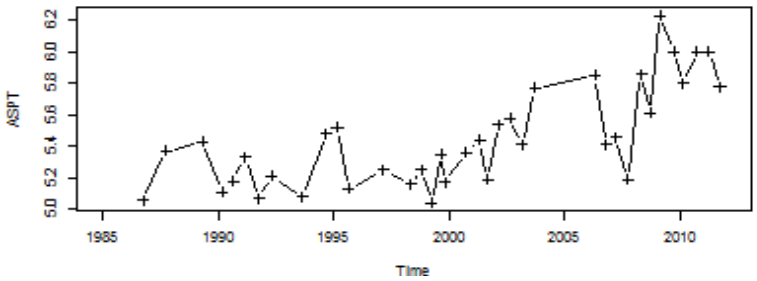
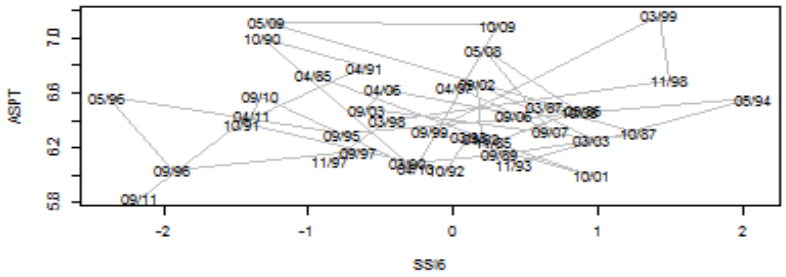
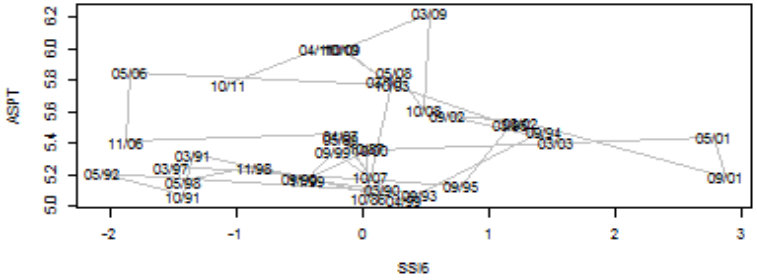


SSI vs ASPT



SSI vs ASPT



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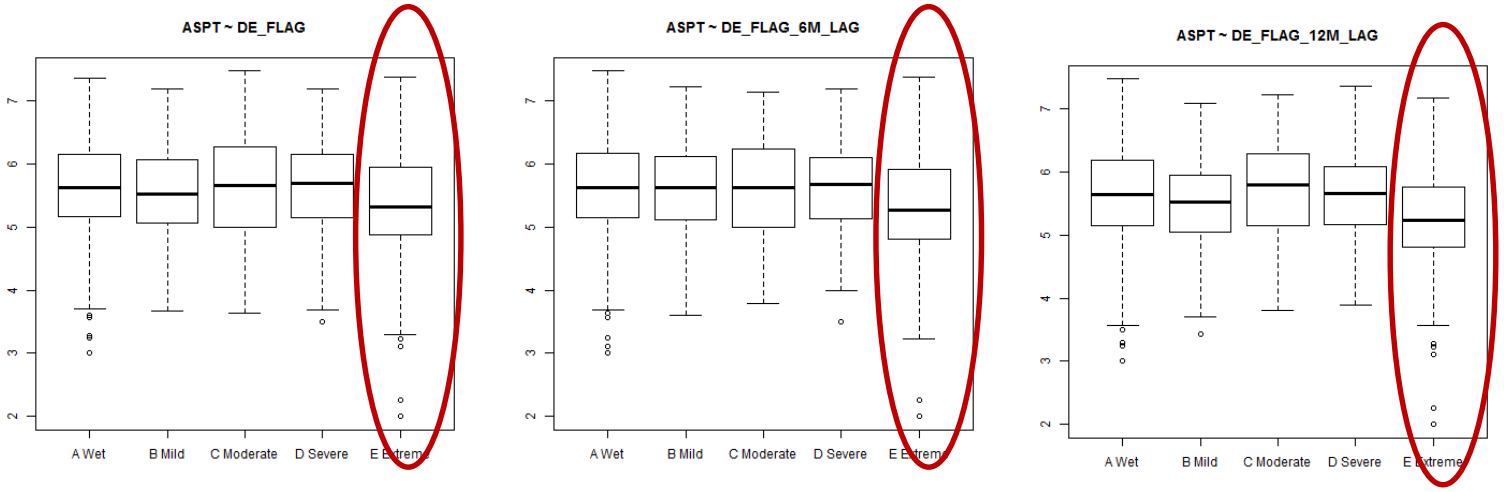
Relationships are confounded by many other factors (e.g. water quality)

Biological response to drought



Summary: ecological impacts

- Ecological datasets are very noisy
- Unsurprisingly, the relationships are weak – but the ecologists are excited!
- More work is being done to explore the links for certain geographies, types of catchment

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Summary

- DrIVER is all about linking indicators to impacts – can we find validate indicators, or find thresholds that correspond to impacts (***what does an SPI of -2 really mean….?***)
- We have been doing this at the broad scale and also for particular sectors
- We have had some success but this is a challenging endeavour: relationships are complex and non-linear
- Perhaps the biggest limiting factor is impact data – what can we do to improve our understanding of impacts? What data is out there?
- Can we actually incorporate impacts INTO monitoring?