

Drought Planning and Response



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Outline

- Why do we need drought planning?
- Impacts of drought
- Flexible regulation
- Scotland Drought Management Plan
- Drought severity indices
- Sector issues
- Communication



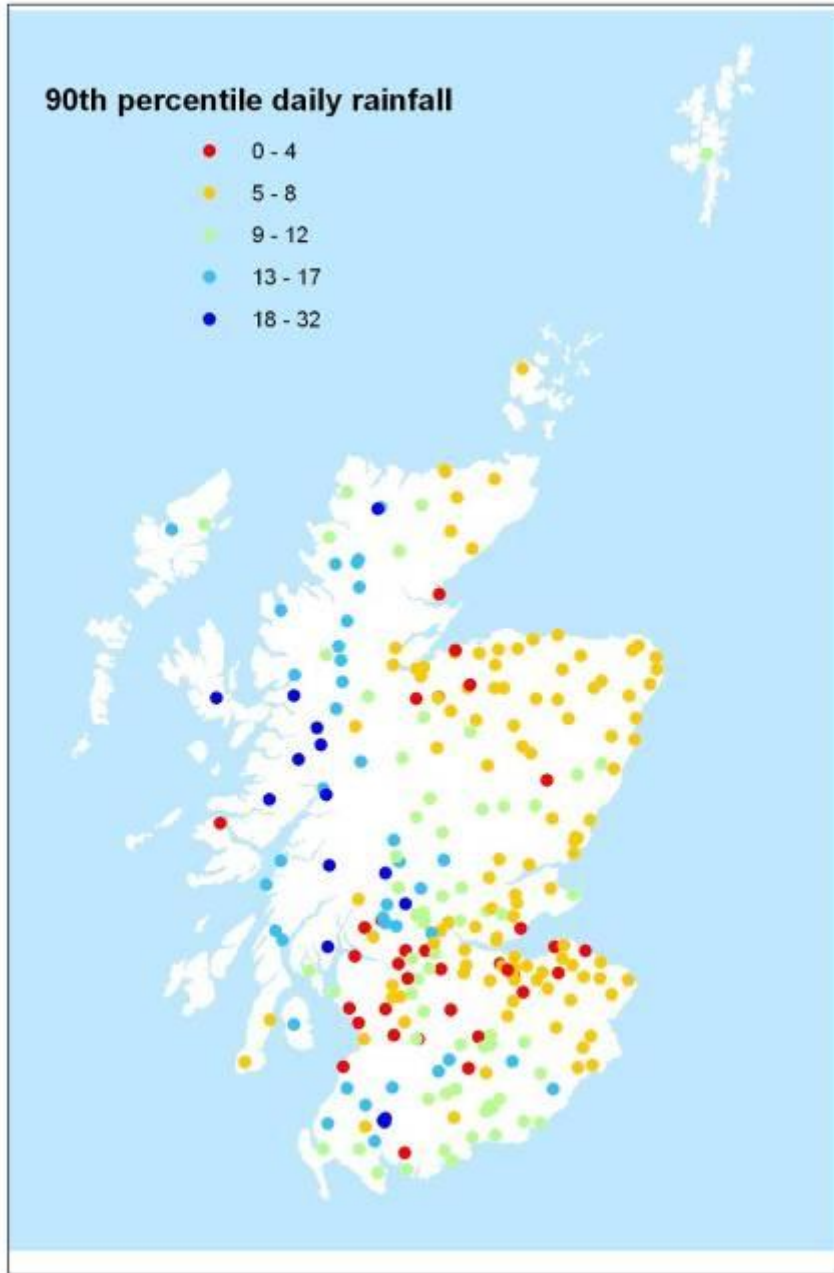


Drought Planning in Scotland?



90th percentile daily rainfall

- 0 - 4
- 5 - 8
- 9 - 12
- 13 - 17
- 18 - 32



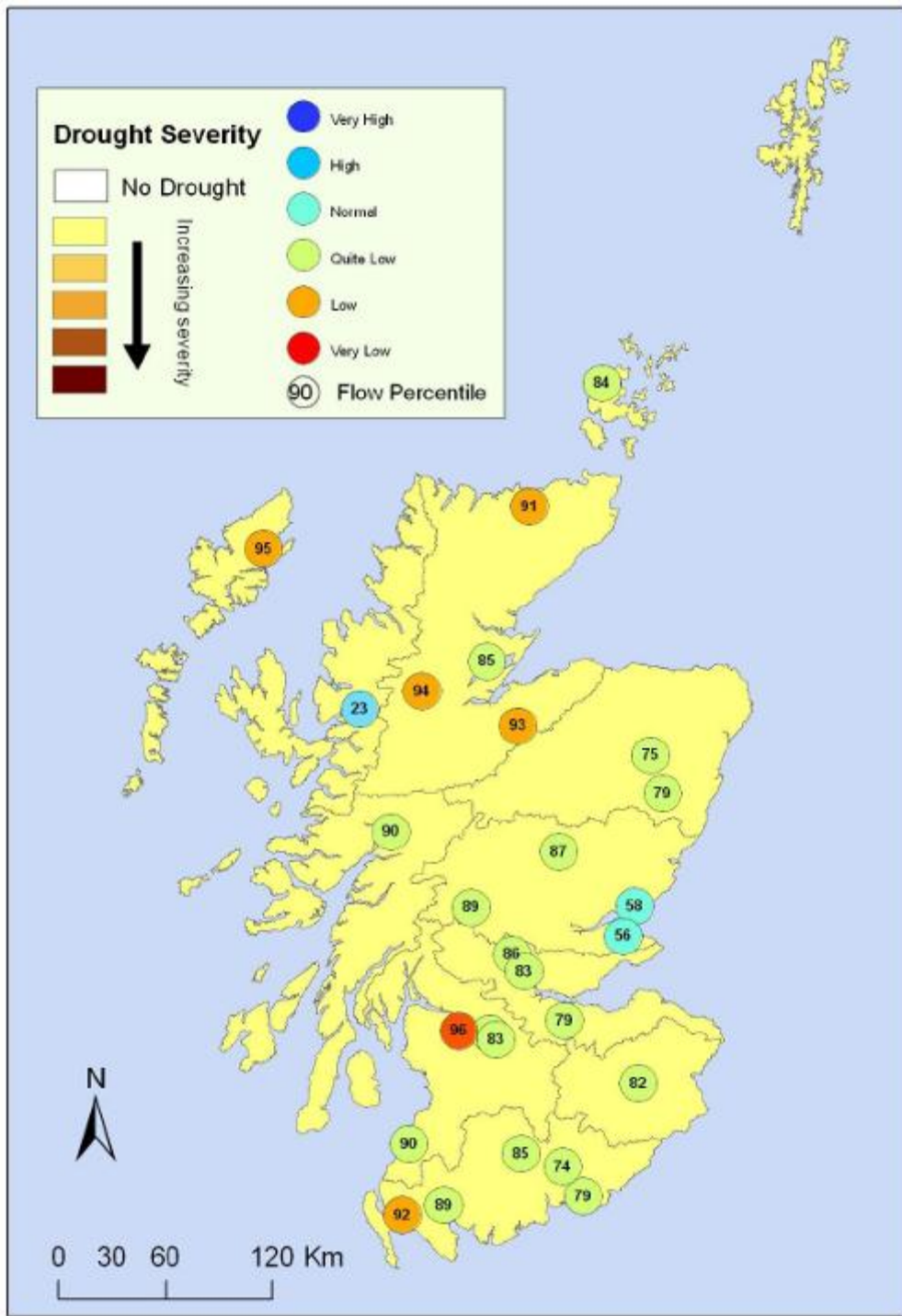
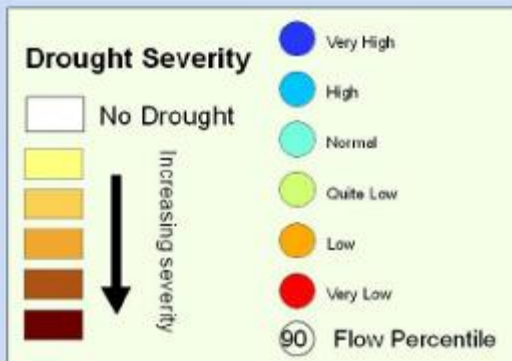


- Is that really Scotland?



The summer of 2010

- Dry winter and start to the year
- Especially dry in the South West
- Restricted by regulations
- Drought Management Group
- Weekly Hydrology situation reports
- Working closely with operators



Percentage of Long Term Average Rainfall for May 2010

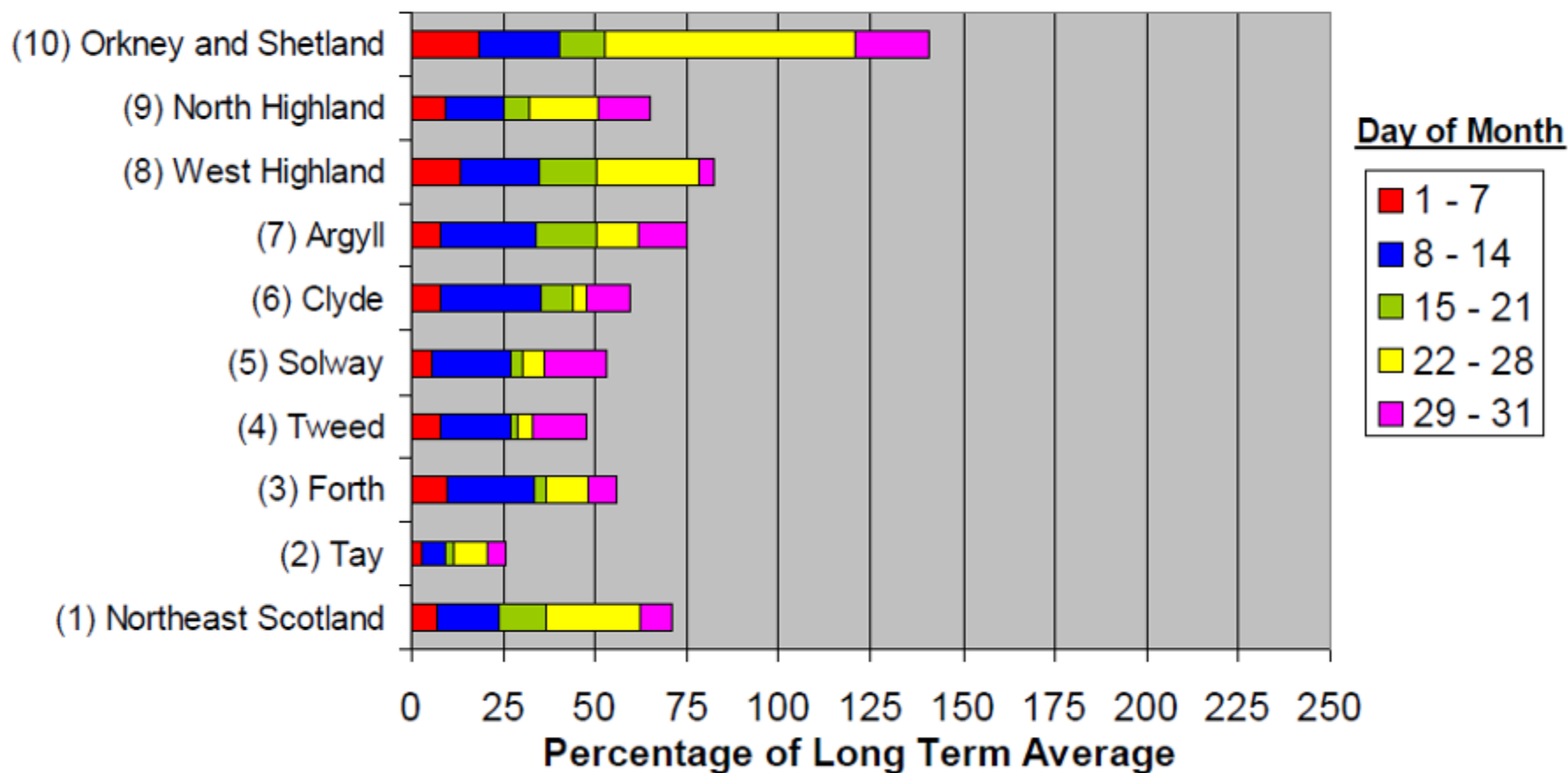


Figure 1 Percentage of LTA rainfall for May, displayed by days in month.

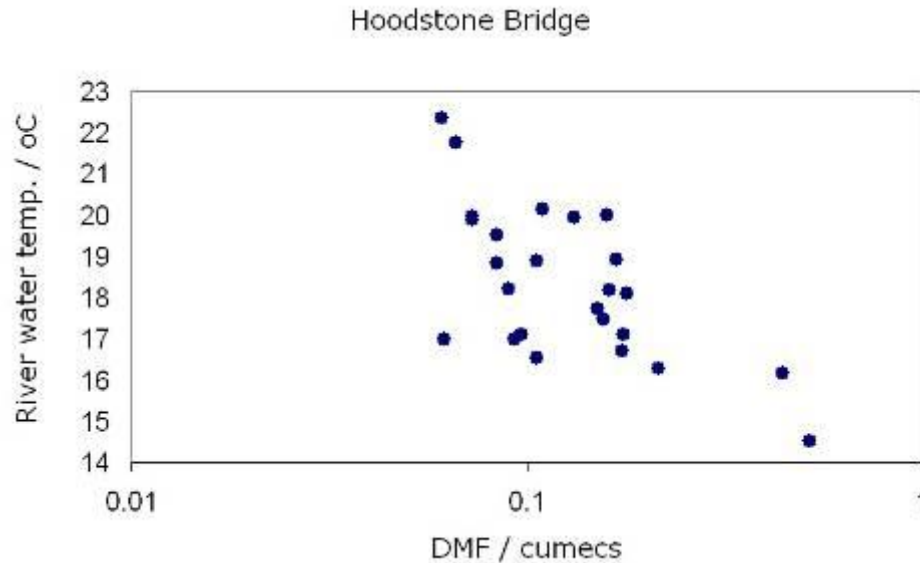
Drought impacts on the water environment.

- Dry weather conditions and low flows are natural but where the water environment is under stress, impacts may occur
- Drought impacts are dependant upon the type and severity of drought.
- 2 types of drought:-
 - ‘acute’, where little or no rain has fallen for a number of weeks and;
 - ‘chronic’, where the effective rainfall has remained below a long term average for a number of months.

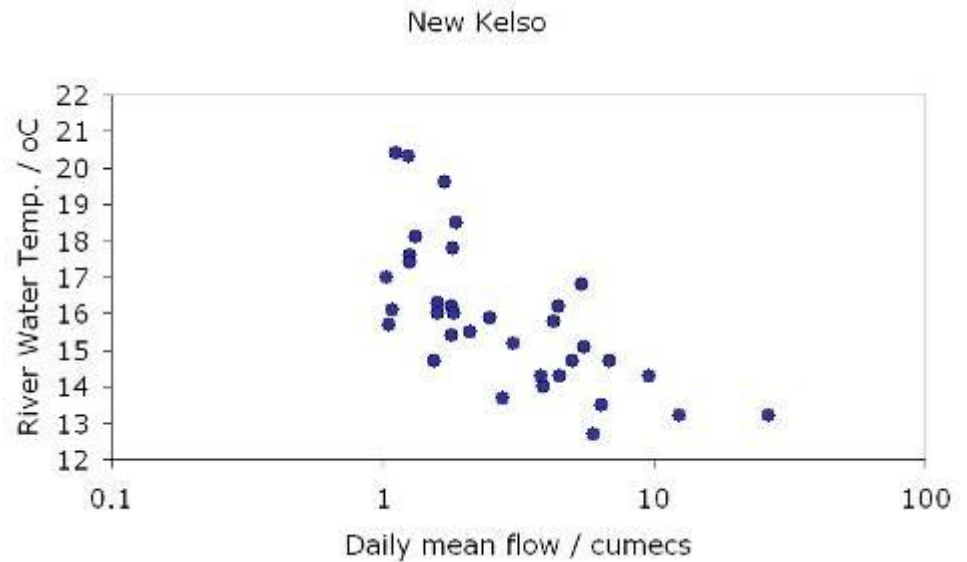
Acute Droughts

- Acute droughts will typically have the greatest effect upon water sources with little storage such as rivers with a low baseflow and ponds.
- Where such water courses are also sources of water for irrigation, impacts will be greater as the supply/demand balance shifts
- Pressures include:
 - Reduced habitat space e.g. wetted width and depth
 - Fragmentation of the river system
 - Lower flow velocities
 - Higher water temperatures
 - Low dissolved oxygen levels
 - Less dilution of pollutants
 - Lowering of water table in wetlands
 - Saline intrusion in coastal streams

Low flows and high river water temperatures



Air temperature
 18 - 20 °C



Chronic drought

- Chronic drought will be most evident in parts of the water environment where storage is a key factor e.g. groundwater and standing waters.
- Chronic drought may not be evident in smaller watercourses which are not heavily dependent upon water storage e.g. river flooding during a drought episode
- Additional pressures include:
 - Loch / reservoir level drawdown
 - Reduced spring flows
 - Large soil moisture deficits

Drought impacts upon SEPA business

- Increased reporting of environmental impacts by public
- Media attention
- Pressure from water users to relax environmental flow requirements e.g. to meet public water supply
- Requirement for quick response monitoring e.g. investigative flow monitoring in irrigated catchments or evidence gathering at fish kill sites.
- Ministerial enquiries and increased reporting to Scottish Government

Changes included in CAR 2011

- The normal determination process
- New Emergency provisions
- Only applies to circumstances resulting from accidents, natural causes or force majeure
- All appropriate mitigation must be included
 - Reg 48 – Defence
 - Reg 18 – Accelerated authorisations
- Temporarily:-
 - authorise;
 - vary;
 - suspend

National Drought Plan

- River Basin Management Plan
- High level principles
- Sector/ Area specific plans
- What action we will take in a drought
- What methods we'll use to determine action
- What action we expect others to take

Scope and develop
drought planning
framework

2011

Draft national plan

Develop fast track
approach

Consult on national
plan

2012

Deliver high priority
sub plans

2013

Deliver lower priority
sub plans

Manage any droughts

Work with SW on Drought Plans

enhancing... improv
changing... tackling
creating a better pla
inspiring... advising

Managing droug Wales

March 2008

ea/tr/w/st/1

enhancing... improving...
changing... tackling...
creating a better place...
inspiring... advising... m

Drought Plan for He

April 2010

ea/tr/w/st/1

- Water Company Drought Plans

- EA National and Regional Plans

- Ability to limit irrigation demand

- Ability to allow increased abstraction

enhancing... improving... cleaning... restoring...
changing... tackling... protecting... reducing...
creating a better place... influencing...
inspiring... advising... managing... adapting...

Regional drought plan for North East region

ea/tr/w/st/1

1996
2008



England and Wales

- Driest March for 50 years
- March
 - 30% of long term average
 - 13% of LTA in Anglian Region
- Rainfall in Anglian during March and April was lowest since records began in 1910
- SMD in April were largest since records began in 1961.

Potential SEPA responses to drought

- SEPA can progressively control allowable abstractions to mitigate impacts on flows:
 - Stage 1 : Put out warning notice to abstraction licence holders
 - Stage 2: Reduce allowable abstraction limits or implement water management agreements
 - Stage 3: Issue stop notices on licences
- Possible through changes to CAR 2011
- Make provisions within drought management plans for any of the above or, where drinking water supply is at risk, permit reduced environmental flows

Why does SEPA want to use drought indices?

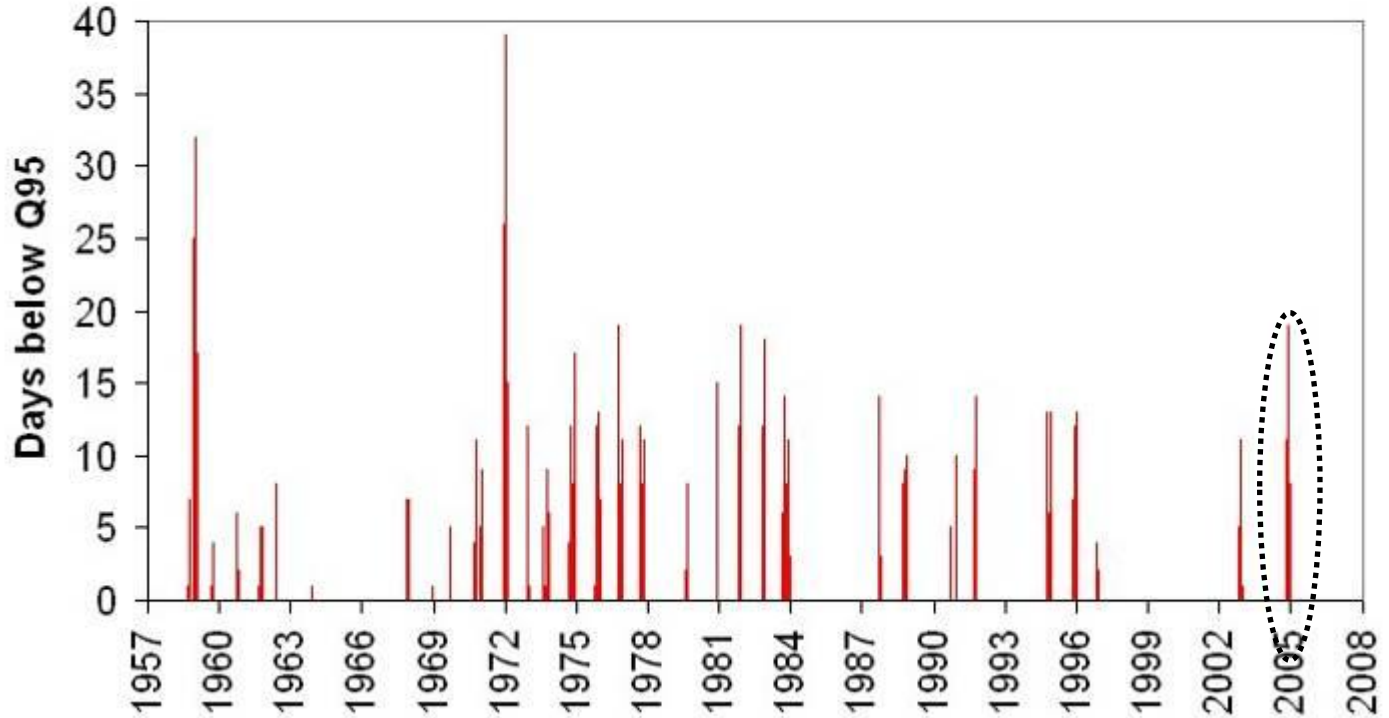
- Trigger levels for action
 - Each action to mitigate the impact of abstractions on low flows could be triggered by drought thresholds.
- Assess severity and act accordingly
 - A measure of severity can inform action e.g. responding to requests for fast-track licensing
- Early warning of drought impacts
 - An index can be used as a metric to assess the risk of environmental impacts
 - E.g. Environmental risk = fn (Drought index, Vulnerability, Meteorological forecast)
- Consistency of message

Types of indices

- Ideally, drought indices would measure impacts directly e.g. reductions in river and pond depth, decreases in soil moisture content and changes loch/reservoir levels.
- However, such data are relatively sparse and may not be able to provide a measure universally.
- Flow and meteorological indices are more likely to be available nationally and can be standardised to allow comparison between regions
- Acute drought. Indices need to be sensitive to quick response mechanisms e.g. river flows.
- Chronic drought. Indices need to measure cumulative impacts e.g. changes in loch storage, SMD or departures from long term rainfall averages.

Flow-based indices

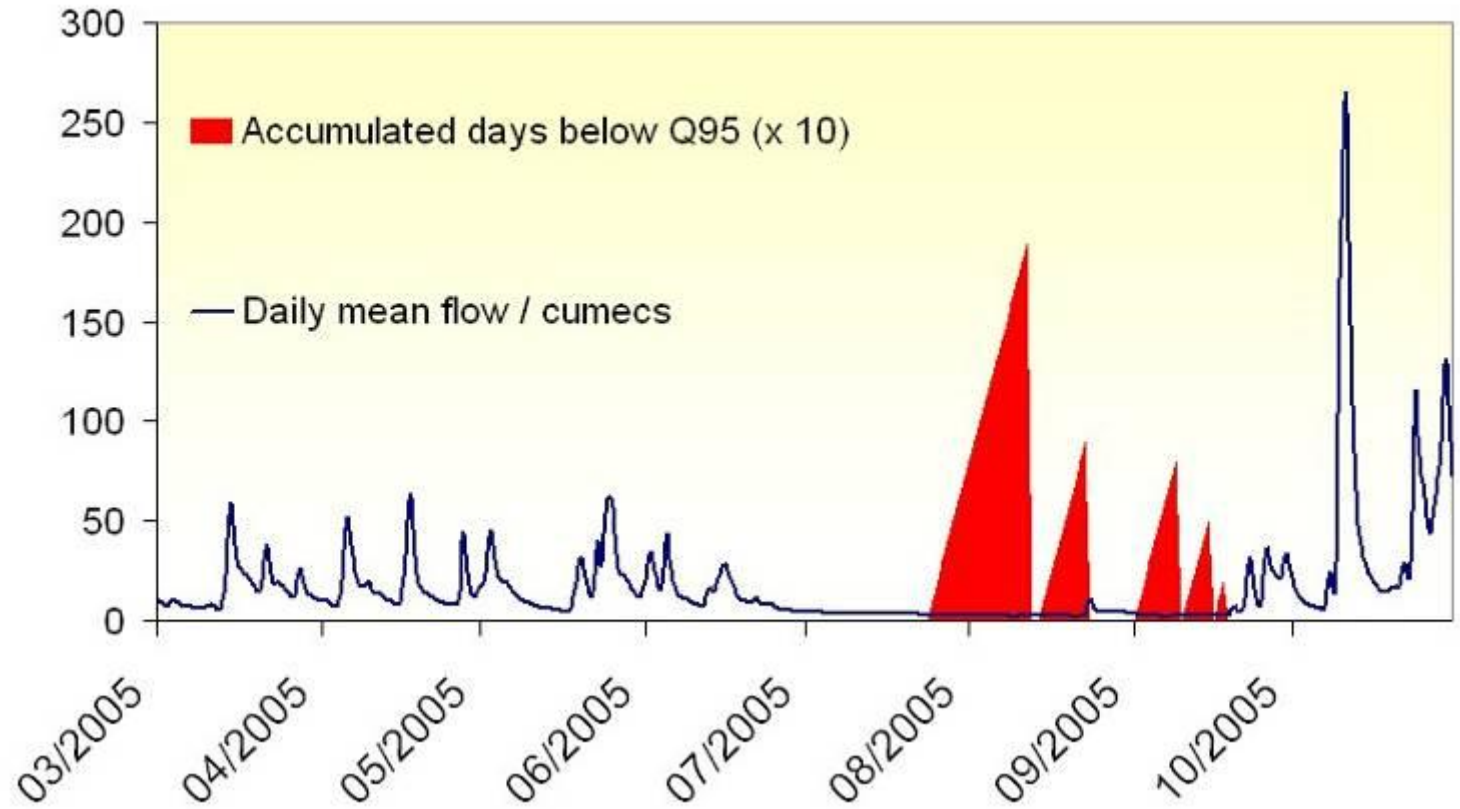
Friar's Carse



- Easy index to put across e.g. “River has been extremely low for 15 days. This is the longest period of low flow since 1972”.

Flow-based indices

Friar's Carse



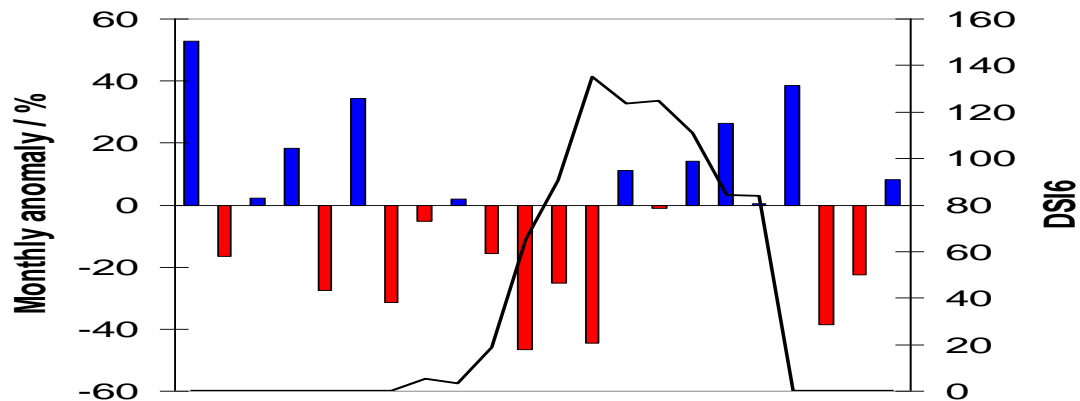
- Needs a few conditions to work well, which may make it harder to put across.

Meteorological indices

- SPI, PDSI, DSI, CMI
- Standardised Precipitation Index (McKee *et al* 1993)
- Palmer Drought Severity Index (Palmer 1965)
- Drought Severity Index (Philips and McGregor 1998)
- Crop Moisture Index (Palmer 1968)

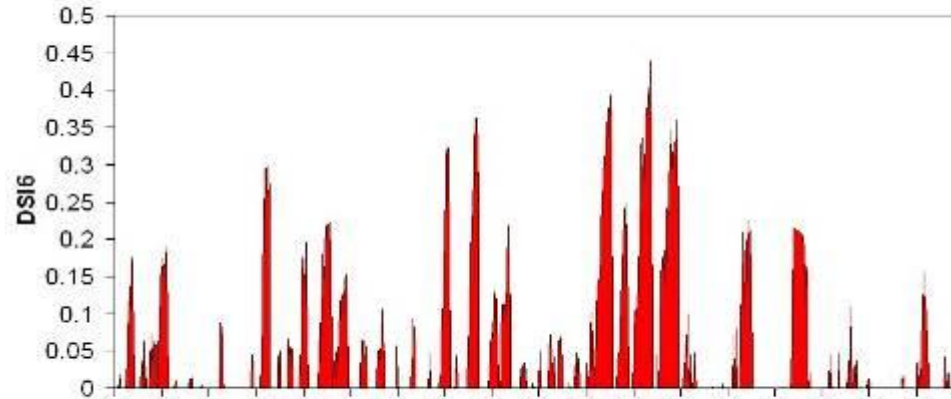
6 month Drought Severity Index

- A drought begins when the current monthly rainfall is below the long term average and the precipitation over the preceding 6 months is below its mean.
- The DSI6 value is the absolute value of the precipitation deficit and accumulates until the 6 month mean exceeds the long term average.
- The DSI6 value can be expressed as a percentage of the annual mean to allow comparison between sites.

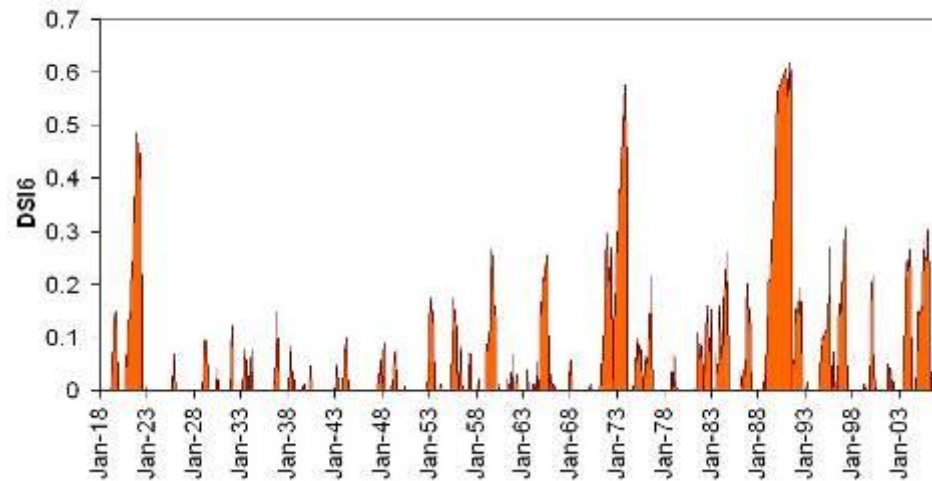


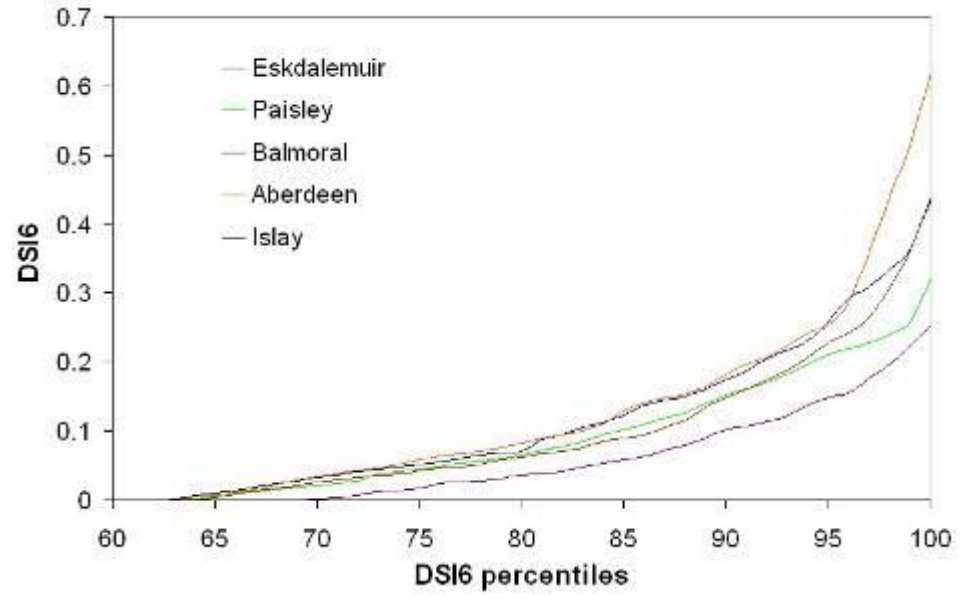
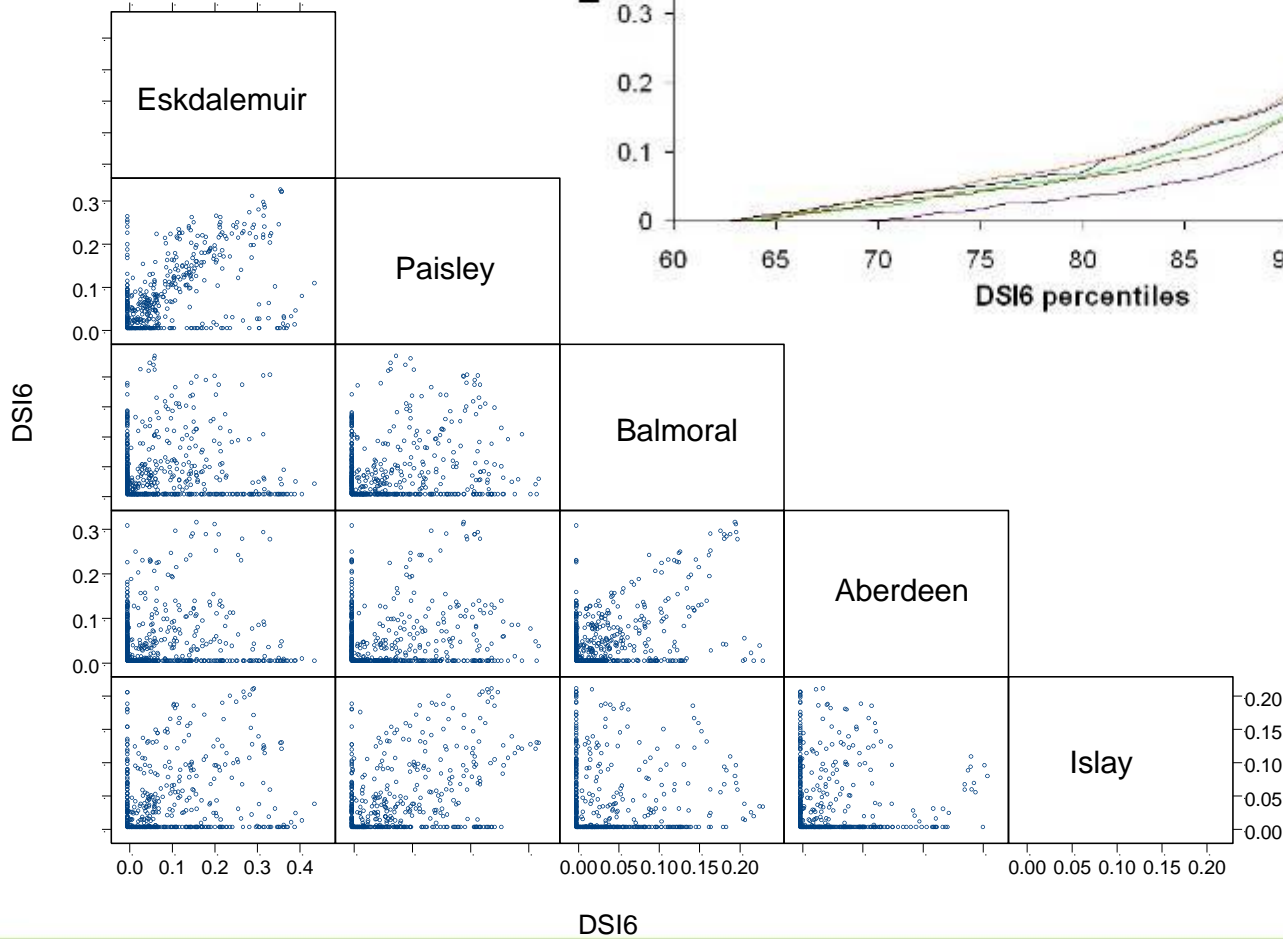
6 month Drought Severity Index

Eskdalemuir

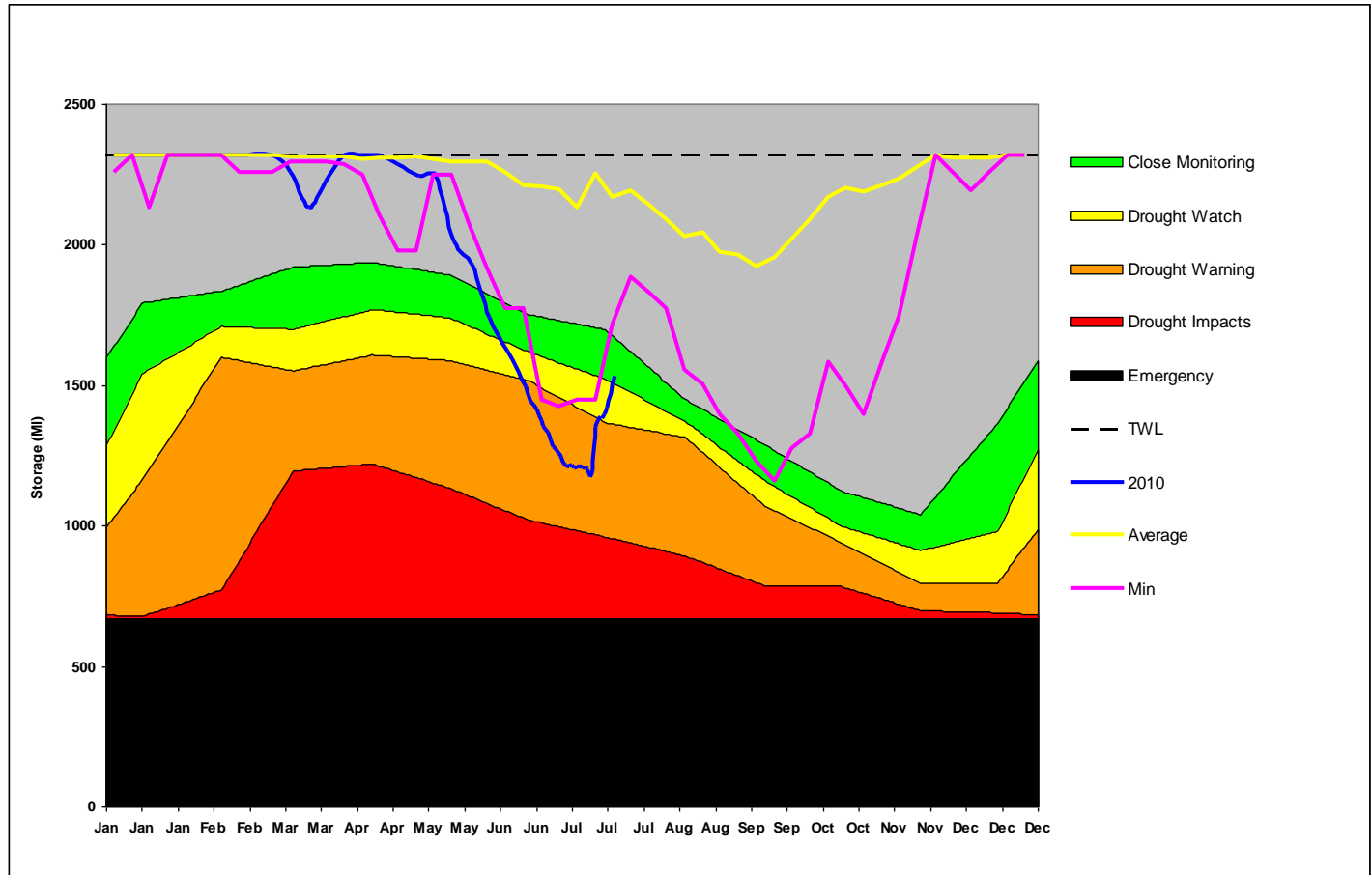


Aberdeen

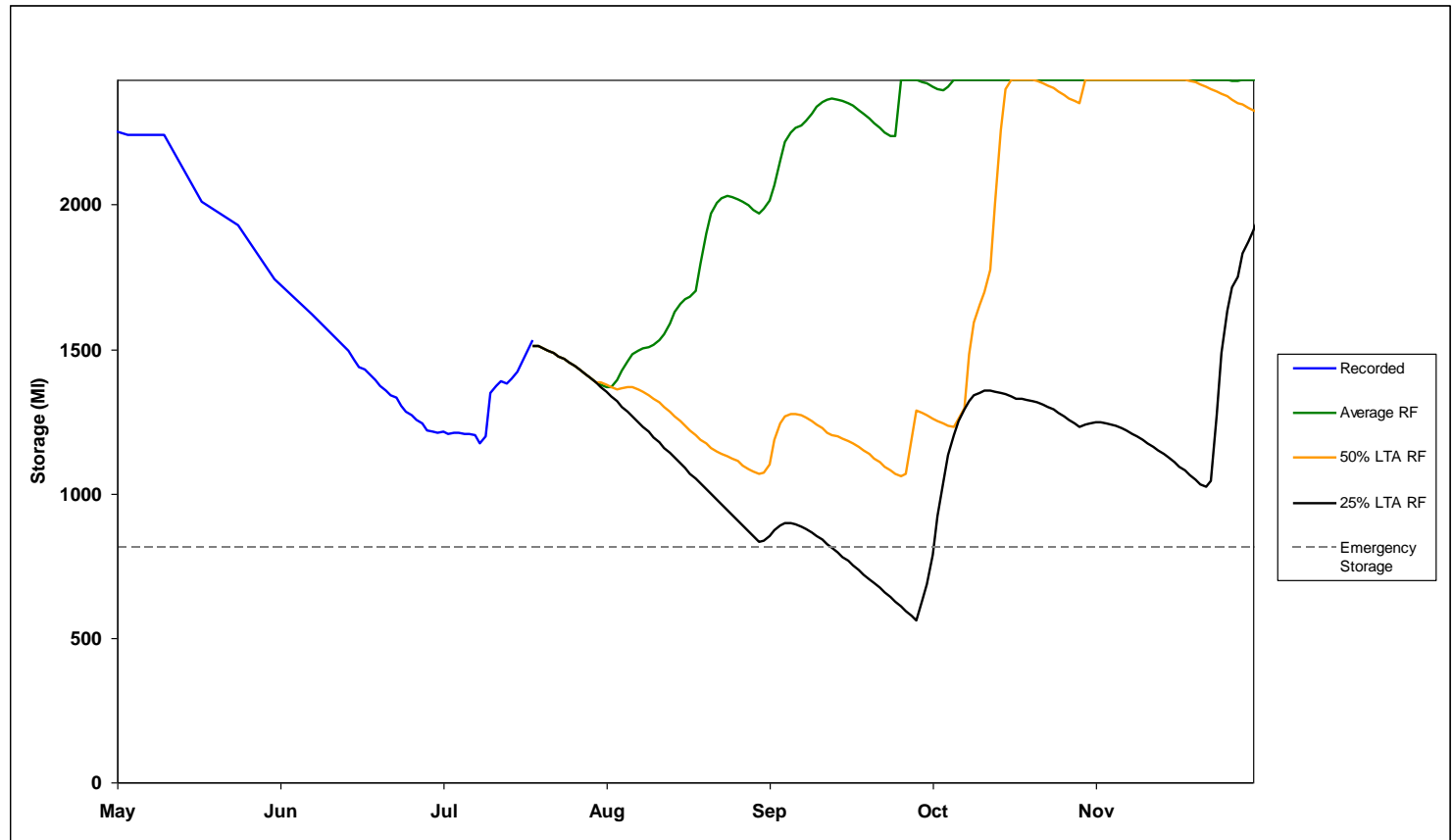




Operational control curves



Using indices for forecasting



Application of UKCP09 to drought indices?

- With a set of drought indices which are regionally comparable, the impact of climate change on drought duration and severity could be investigated.
- Previous studies using UKCIP02 have shown that little change was projected for droughts in Scotland (e.g. Fowler and Kilsby 2004)
- Some differences are evident in UKCP09 and, in particular, there are areas in the central highlands where summer and winter rainfall is projected to decrease.

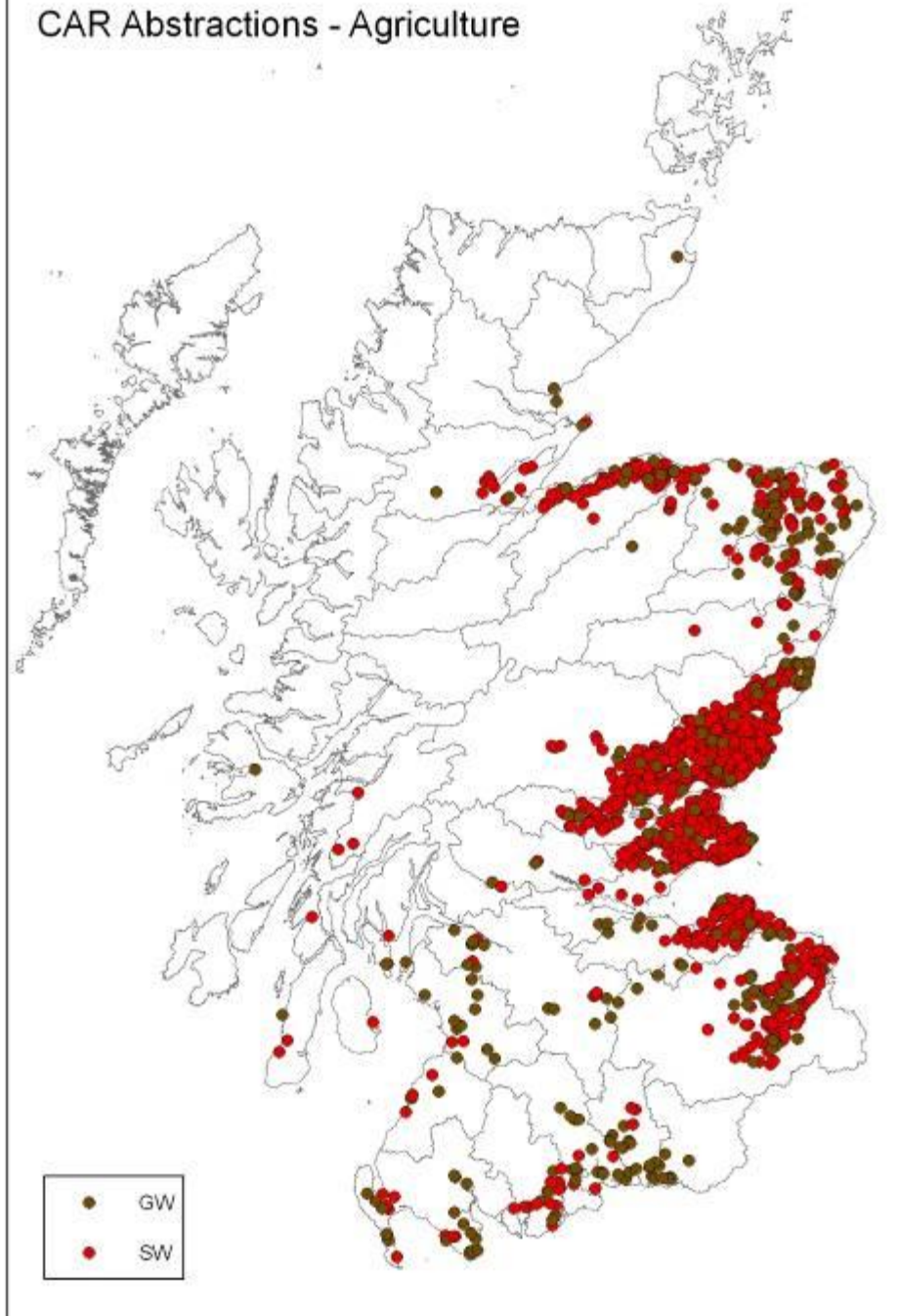
Where next?

- A SEPA R and D project on Drought Indices is about to go to tender.
- This aims to review existing literature and choose a small number of indices which can be used to provide real time drought assessment.
- The indices chosen will be coded into SEPA's hydrology management system (WISKI) for each suitable rain gauge site and flow gauging station.
- Spatial interpolation should allow national coverage
- The aim would be to make these available on the internet via a web map service.



An increasingly common sight in parts of Scotland?

CAR Abstractions - Agriculture



Protecting low flows



How do we set HoFs for abstraction?



Comp and freshets



Communication

