

Indicator name			Version
NA13 Abstraction of water for irrigation			15/04/16
Indicator type:	Risk/opportunity	Impact	Action
		X	
SCCAP Theme	SCCAP Objective	CCRA risk/opportunity	
Natural Environment	N3: Sustain and enhance the benefits, goods and services that the natural environment provides	<ul style="list-style-type: none"> AG4 Drier soils (due to warmer and drier summer conditions) BD14 Ecosystem risks due to low flows and increased water demand 	

At a glance

- Climate change is projected to lead to changes in both the supply of water *for*, and in water demand *by* agriculture.
- Areas that contain high-value crops requiring irrigation are also those projected to experience a reduction in available water, unless alternative measures are put in place.
- The Tay region currently accounts for the vast majority of abstraction of water for irrigation.

Latest Figure

Scotland-wide abstraction for irrigation during 2013 was estimated as 16.9 million cubic metres.

Trend

No trend is currently observable

Why is this indicator important?

Crops which are heavily reliant upon irrigation (potatoes, fruit, field-scale vegetables), for both growth and in response to demands for marketable quality form an important part of Scottish agriculture. Although these crops only account for around 9% of cropped area, income from these crops is approximately equal to that generated by grain crops which dominate the rest of arable cropping (Scottish Government, 2014).

The volume of water abstracted for irrigation is closely linked to climate. Irrigation is required when dry periods lead to soil moisture deficits which in turn may impact crop productivity. Irrigation is a seasonal activity, typically occurring during the main growing season between March and October.

Climate change is projected to lead to changes in both the supply of water (from precipitation and evapotranspiration losses) and in water demand as temperatures increase (Brown et al., 2012). Some crops that are currently irrigated are likely to require greater irrigation depths and other previously

rain-fed crops are likely to need irrigating (Knox et al., 2012). Furthermore, indirect effects of climate change via potential improvements in land capability with consequential development of new agricultural opportunities in some areas may result in an increase in typically irrigation-fed crops.

From 2014, the Scottish Environment Protection Agency (SEPA) began reporting, in autumn, the estimated total monthly and annual abstraction by irrigation for each Area Advisory Group (AAG) region used within the River Basin Management Planning process. This data is based upon data submitted to SEPA by operators as a condition of their abstraction licences. This indicator is based upon an evaluation by SEPA of each regions uptake factor (% of licenced amount used) from the data that have been supplied and applied to each abstraction where data are missing.

Related indicators:

NB27 Summer low flow events in Scottish rivers (Normalised Flow Index)

NA29 Drought risk to agricultural land

What is happening now?

Scotland-wide abstraction for irrigation during 2013 was 16.9 million cubic metres. This includes abstraction from surface water, groundwater and transitional/coastal waters. This represents 39% of the total licensed abstraction volume for irrigation in Scotland.

The vast majority of this abstraction (88%) occurred in June, July and August.

What has happened in the past?

There is currently insufficient data to indicate historical irrigation abstraction patterns.

What is projected to happen in the future?

Irrigation demand in the 2050s is projected to increase by up to 100mm per year (Brown et al. 2012) To put this figure in context, the typical values for irrigation in areas with highest demand in Scotland are currently around 170 mm per year.

This projected increase in irrigation demand is due to the UKCP09 projections of lower summer rainfall and higher temperatures leading to greater evaporation. Many areas that experience a reduction in available water also contain high-value crops that are likely to require additional irrigation water, unless alternative measures are put in place. Furthermore, there may be additional water demands from crops that are currently not irrigated, such as cereals, which may result in an expansion of the currently irrigated area (Brown et al., 2012).

The highest volumetric changes in irrigation demand are projected in the Fife and Angus regions. Figure 1 highlights that this area (Tay AAG) already accounts for the highest abstraction levels of any AAG region. Particularly vulnerable are smaller catchments that are not supplied by large rivers that have their source in the west, though larger catchments may also experience increasing problems, particularly in extremely dry years (Brown et al., 2012).

Declining river flows may require regulatory intervention in order to maintain environmental flow conditions. SEPA are currently trialling a new approach to abstraction management by taking a whole catchment approach, working with land managers in catchments that have been identified at risk of impact from irrigation abstraction and focussing on crop requirements, water efficiency, irrigation programming and use of storage ponds (SEPA, 2013).

Patterns of change

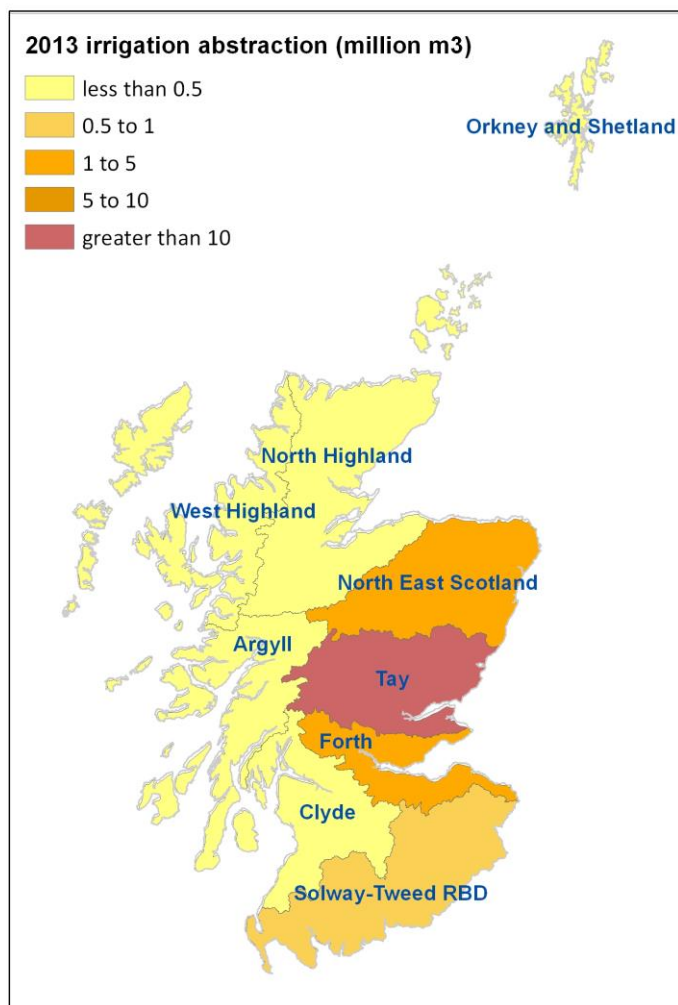


Figure 1 Irrigation abstraction per Area Advisory Group (AAG) region (2013). Note that the Solway-Tweed RBD includes abstraction only within the Scottish part of this cross-border area.

Figure 1 shows the Scotland-wide figure of 16.89 million cubic metres broken down by regions known as SEPA Area Advisory Groups. The clear distinction between abstraction levels for AAG regions in the East and West reflects the relative dominance of arable farming in these regions, as well as the higher rainfall levels in the West.

Interpretation of indicator trends

SEPA has only been licencing abstractions since 2005 and has only a few years of operator data returns so a historical trend analysis is currently not possible for this indicator.

However, it can be assumed that this indicator will have a relationship with the summer low flow indicator, NB27 Summer low flow events in Scottish rivers (Normalised Flow Index), for which trend analysis is currently possible.

Limitations

The figures shown are overall estimates, based on incomplete data. Abstraction operators are obliged to submit actual abstraction figures, but many do not. In order that an overall abstraction estimate can be made, submitted actual abstraction figures as a fraction of licensed abstraction limits were extrapolated to abstraction locations for which no figures were submitted (see Table 4 Indicator Methodology). The total of all submitted actual abstraction figures was 5.65 million cubic metres, 33% of the overall abstraction figure arrived at by extrapolation of the submitted figures. The extrapolation of the submitted figures to all locations implies the assumption that the locations for which data were submitted are a representative sample of all locations.

This indicator will only be available for the years 2013 onwards. Prior to this, comprehensive actual irrigation data are not available. It will therefore be many years before a trend analysis will be possible. However, it can be assumed that this indicator will have a relationship with the summer low flow indicator, NB27 Summer low flow events in Scottish rivers (Normalised Flow Index), for which trend analysis is currently possible.

References

Brown, I., Dunn, S., Matthews, K., Poggio, L., Sample, J. & Miller, D. (2012) *Mapping of water supply-demand deficits with climate change in Scotland: land use implications*. CREW report 2011/CRW006. Available online at: www.crew.ac.uk/publications/water-supply-demand-balance-and-climate-change

Knox, J.W., Hurford, A., Hargreaves, L. & Wall, E. (2012) *CCRA Risk Assessment for the Agriculture Sector*. UK 2012 Climate Change Risk Assessment, Defra, London.

Scottish Government (2014) *Economic Report on Scottish Agriculture 2014 Edition*. Report produced by the Directorate for Environment and Forestry Rural and Environment Science and Analytical Services. Available online at: <http://www.gov.scot/Publications/2014/06/3709/downloads>

SEPA (2013) *New trial approach to irrigation abstractions in Angus, annual data returns and exemptions*. SEPA media release. Available online at: <http://media.sepa.org.uk/media-releases/2013/new-trial-approach-to-irrigation-abstractions-in-angus,-annual-data-returns-and-exemptions/>

Further information

Abstraction:
http://www.sepa.org.uk/water/water_regulation/regimes/abstraction.aspx

Acknowledgements

Development of this indicator and primary author of this document: Richard Gosling, Scottish Environment Protection Agency (SEPA)

Richard Morris of SEPA for collating and analysing the irrigation data and developing the interpolation methodology.

Appendix One: Indicator metadata and methodology

Table 1: Indicator metadata

	Metadata
Title of the indicator	NA13 Abstraction of water for irrigation
Indicator contact: Organisation or individual/s responsible for the indicator	Anna Moss (CXC, University of Dundee)
Indicator data source	SEPA Controlled Activities Regulations Water Use Licences, SEPA Water Resources Data Returns, internal SEPA analysis
Data link: URL for retrieving the indicator primary indicator data.	None yet available

Table 2: Indicator data

	Indicator data
Temporal coverage: Start and end dates, identifying any significant data gaps.	2013 Calendar Year
Frequency of updates: Planned or potential updates	September each year, for previous calendar year (Jan – Dec).
Spatial coverage: Maximum area for which data is available	Scotland
Uncertainties: Uncertainty issues arising from e.g. data collection, aggregation of data, data gaps	The national figure has been derived by extrapolating data from available data which cover 33% of the overall figure
Spatial resolution: Scale/unit for which data is collected	SEPA Area Advisory Groups (10 within Scotland)
Categorical resolution: Potential for disaggregation of data into categories	Data can be broken down by source type (surface water, groundwater, etc.) and by irrigation type (fixed pump, mobile pump)
Data accessibility: Restrictions on usage, relevant terms & conditions	See SEPA general terms and conditions of use of data

Table 3 Contributing data sources

Contributing data sources

Data sets used to create the indicator data, the organisation responsible for them and any URLs which provide access to the data.

Data sets used:

SEPA Corporate Licence Administration System (for list of irrigation locations and licensed annual abstraction limits)

SEPA Water Resources Data Returns System (for actual annual abstraction figures)

Table 4 Indicator methodology

Indicator methodology

The methodology used to create the indicator data

As indicated under “Limitations”, the figures are based on incomplete data, as not all operators of irrigation locations report annual actual abstraction figures. The methodology used to produce the indicator from the data sources for each calendar year is as follows:

1. A table of all irrigation locations, their source type, abstraction mechanism and licensed annual abstraction limits (L) is extracted from the SEPA Corporate Licence Administration System. The SEPA Area Advisory Group (AAG) within which the location falls is added to each location on the list.
2. All locations on the list for which an actual annual abstraction figure is available within the SEPA Water Resources Data Return System for the year in question have this annual figure (A) entered against the location.
3. The locations on the list are divided into groups, by AAG, source type (i.e. surface water, ground water or transitional waters) and abstraction mechanism (i.e. whether abstraction is by fixed or mobile pump), so that each group contains locations with the same combination of AAG, abstraction mechanism and source type.
4. Within each group, the overall ($\sum A/\sum L$) across all locations for which a value for A is available is calculated. For each location for which a value for A is not available (i.e. those locations for which an actual annual abstraction figure is not held within the SEPA Water Resources Data Return System), A is estimated by multiplying L for the location by the calculated overall ($\sum A/\sum L$) value.
5. If any group contains only locations for which a value for A is not available, A is estimated at all locations within this group using the overall ($\sum A/\sum L$) across all locations with the same abstraction mechanism and source type (regardless of the AAG within which they are located) for which an actual annual abstraction figure is available within the SEPA Water Resources Data Return System.
6. If any group is still without any values for A , A is estimated at all locations within this group using the overall ($\sum A/\sum L$) across all locations with the same abstraction mechanism (regardless of the source type or the AAG within which they are located) for which an actual annual abstraction figure is available within the SEPA Water Resources Data Return System.
7. The values of A at all locations are summed to arrive at the figure for Scotland-wide abstraction for irrigation. AAG-wide figures are produced by summing the values for A at all locations within the AAG.