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# The future challenges of environmental change on water as an economic resource in Scotland?

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# Global Water-Economy Links

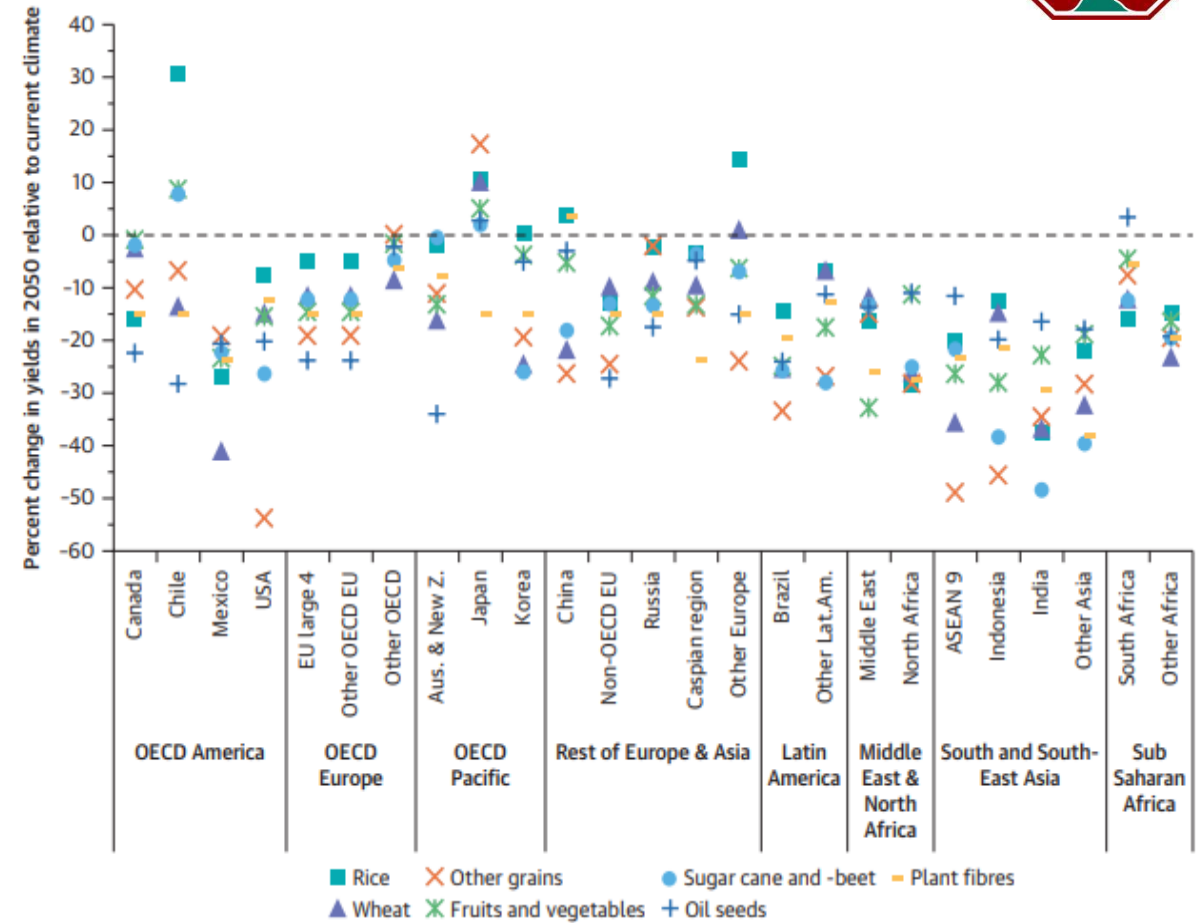


The global economy relies on freshwater, so changes to our environment as a result of climate change, population growth and changing demand patterns on water pose significant economic challenges.

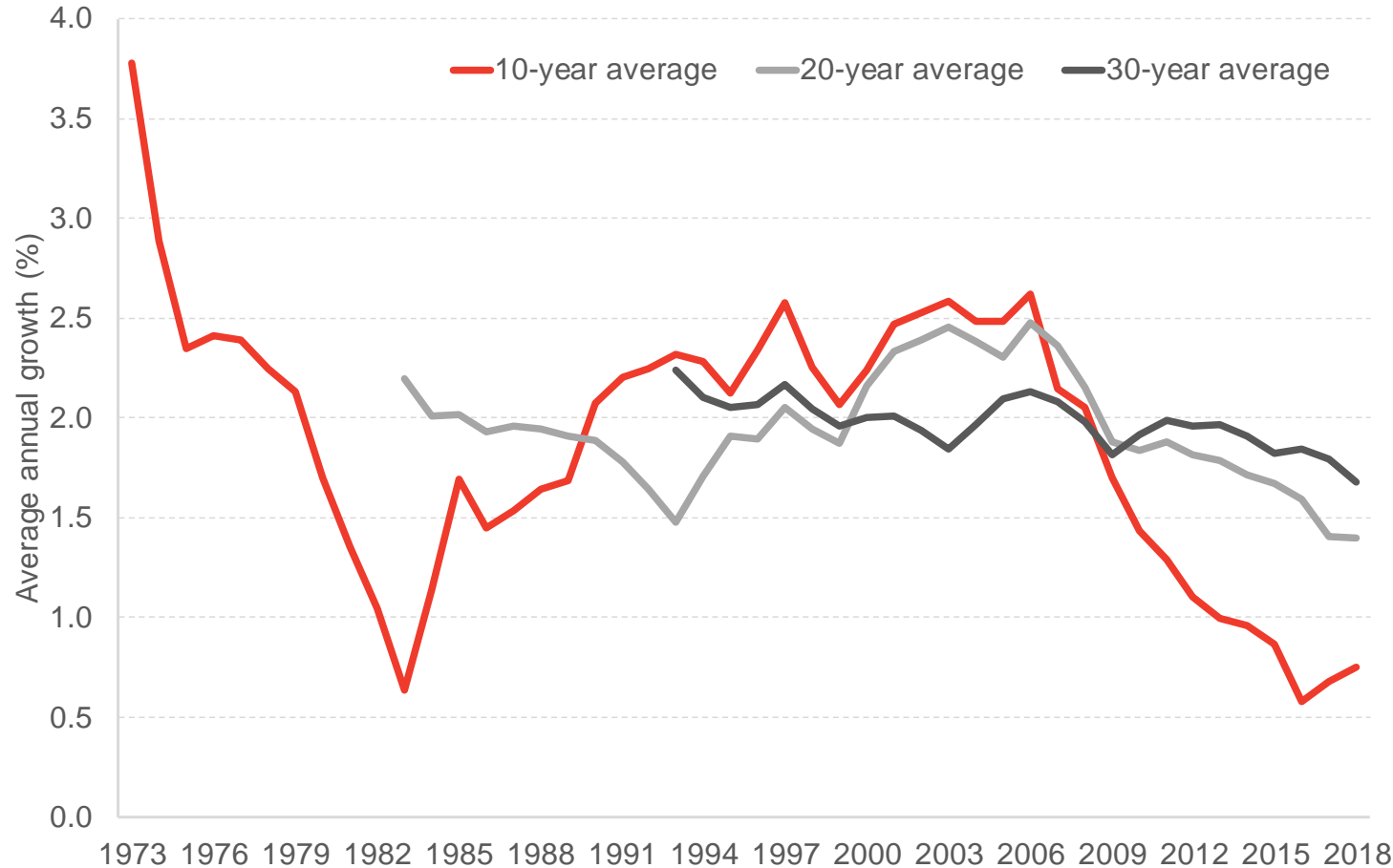
Agriculture and energy production (connected via the so-called WEF nexus) are particularly susceptible to changing water availabilities.

Extreme events (droughts, floods, hurricanes etc) threaten supply chains, logistics and property damage.

Significant changes to the global climate will result in health impacts (labour force) and migration from particularly challenged area where water resources are especially diminished.



# The Scottish Economy



Economic growth in the past few years in Scotland has been extremely slow.

Future uncertainty beckons as a result of things like Brexit....but many of the challenges that we face are structural and reflect an underlying weakness in productivity and our ageing population.

# Scotland's Water Resources

- Our temperate climate results in an abundance of freshwater resources – a key challenge is distribution from where rain mostly falls (west) to where key population centres are located (south and east).
- Drought conditions are rare, but prolonged dry periods have impacted Scotland in the past century (including 2018).
- Seasonal temperature changes, reducing snowpack storage and increasing rainfall during winter months are already posing challenges for reservoir storage and runoff timing.





# Water & the Scottish Economy



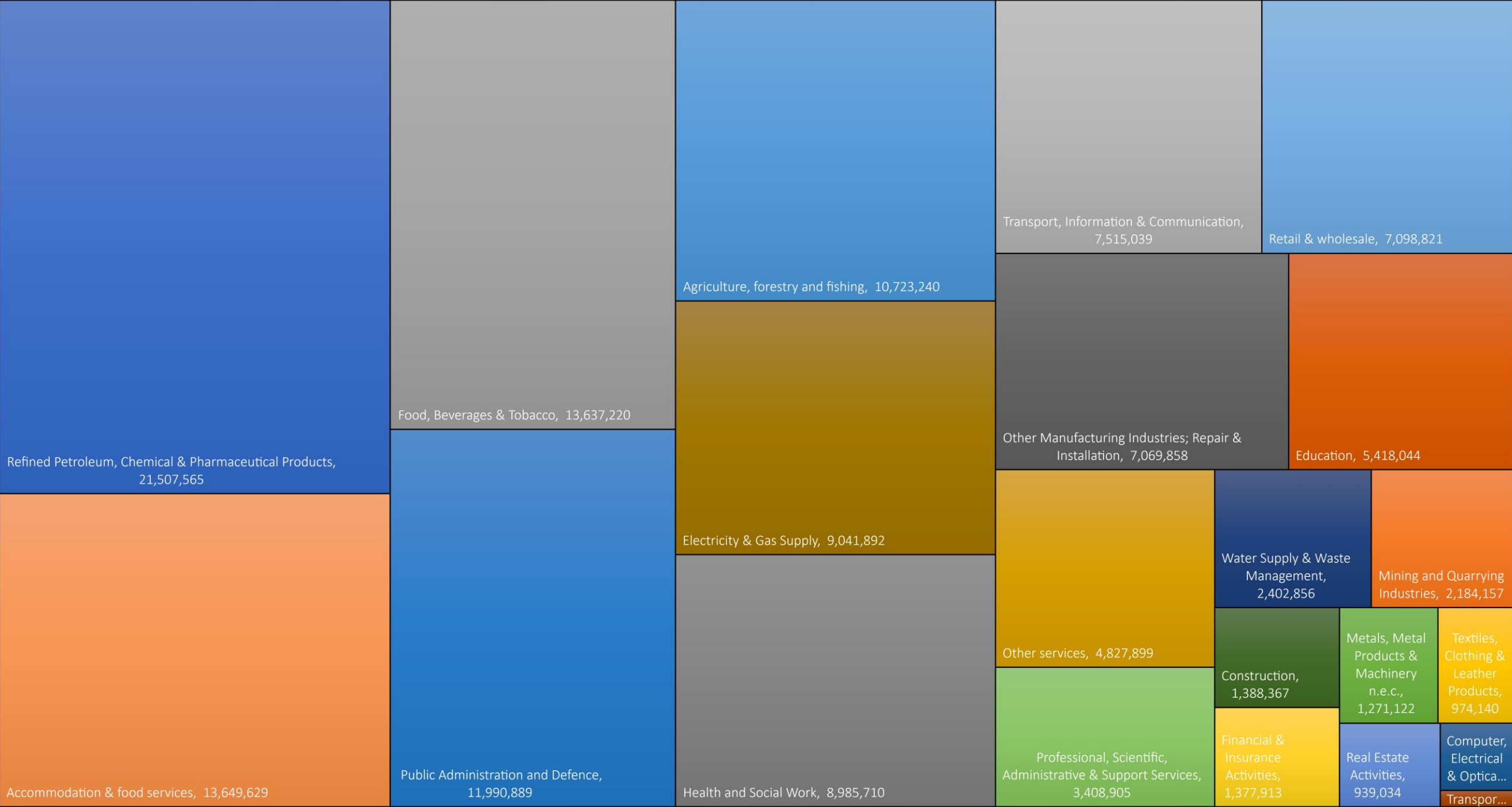




# Water & the Scottish Economy

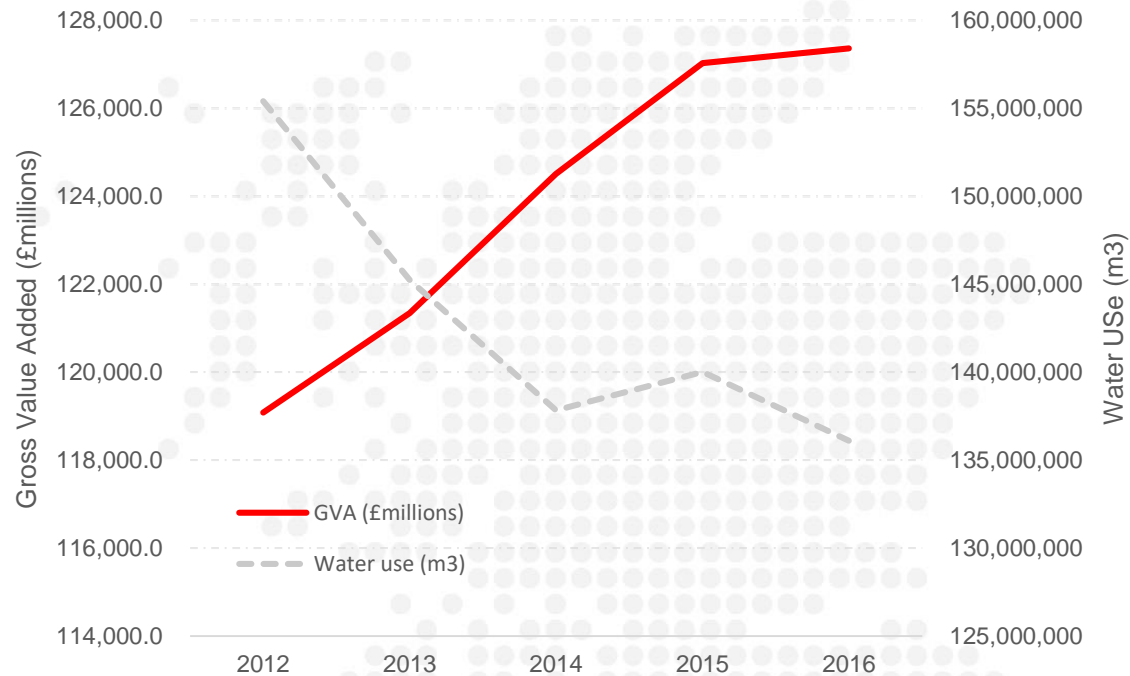
- Direct abstraction from water bodies or rainfall support a number of key sectors in the Scottish economy – whisky, agriculture, soft drinks, craft beer...
- Unlike public water supply (Scottish Water), water supply is “private” in the non-domestic customer market (wholesale provision to 23 suppliers provide water to c.130,000 business customers).
- As a result, mapping water use can be a substantial challenge from a data perspective. No central, publicly available resource that illustrates water use in Scotland.
- Sensitivity around consumption data...

Non-Domestic Water Use in Scotland, 2016 (m³)



# Water & the Scottish Economy

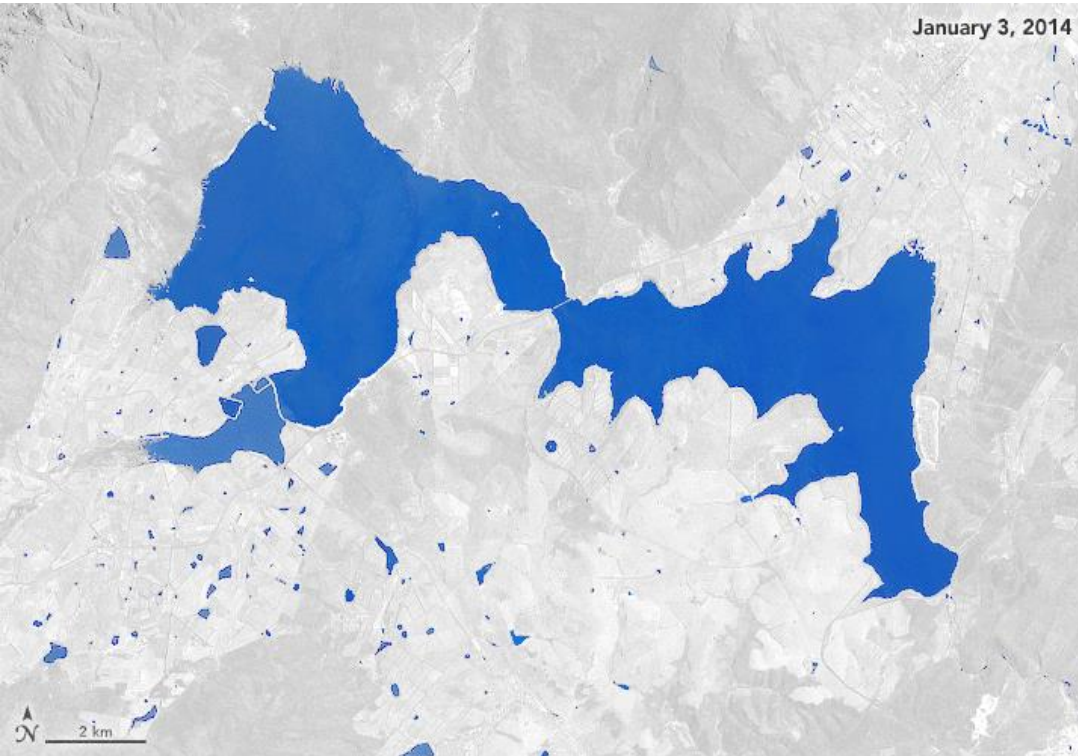
Water Use and Productivity, Scotland (2012-2016)



- Concept that economic growth = increasing water consumption no longer valid.
- Evident decoupling in water resource consumption and economic growth.
- Technological advancement (increased efficiency) and water re-use as part of a circular economy have significantly reduced consumption rates.



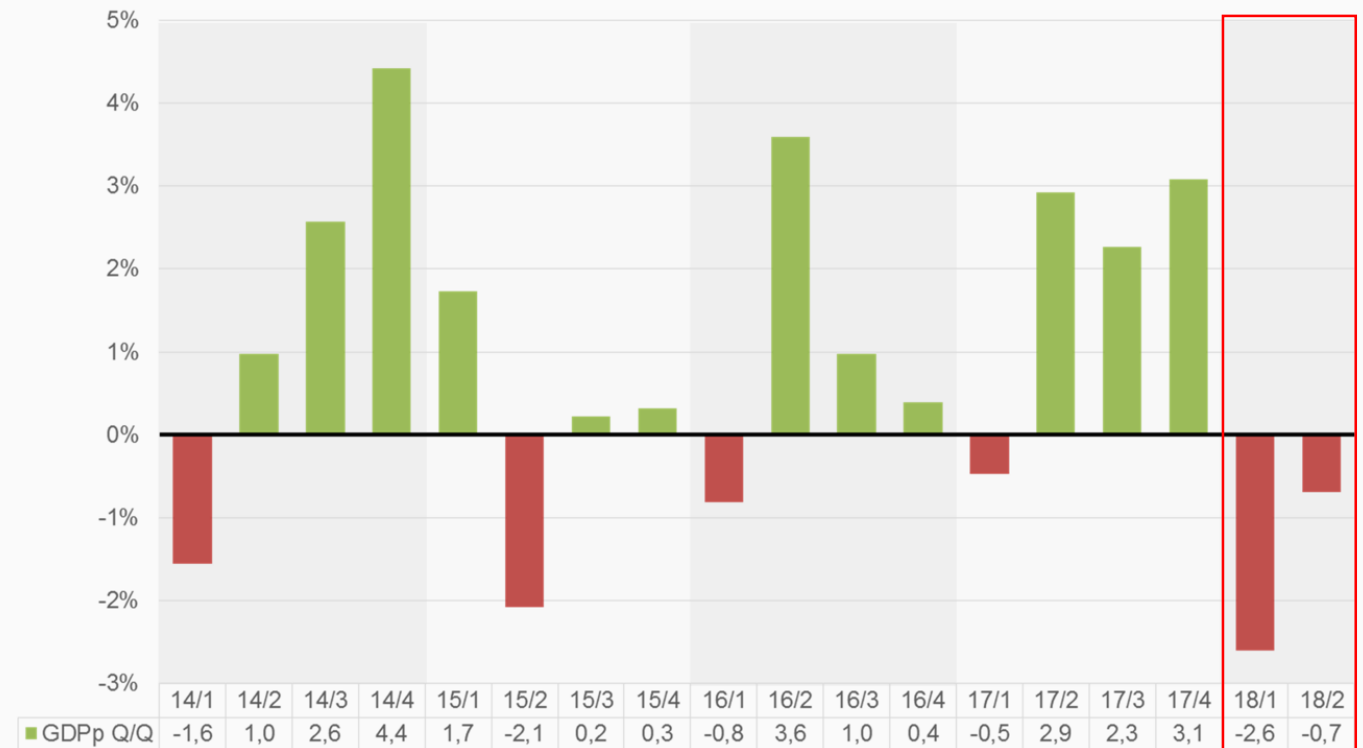
# Changing Water Resources



Cape Town drought highlighted the fragility of the South African economy to shifting water availability and poor water-governance during time of crisis.

## South African economic growth over time

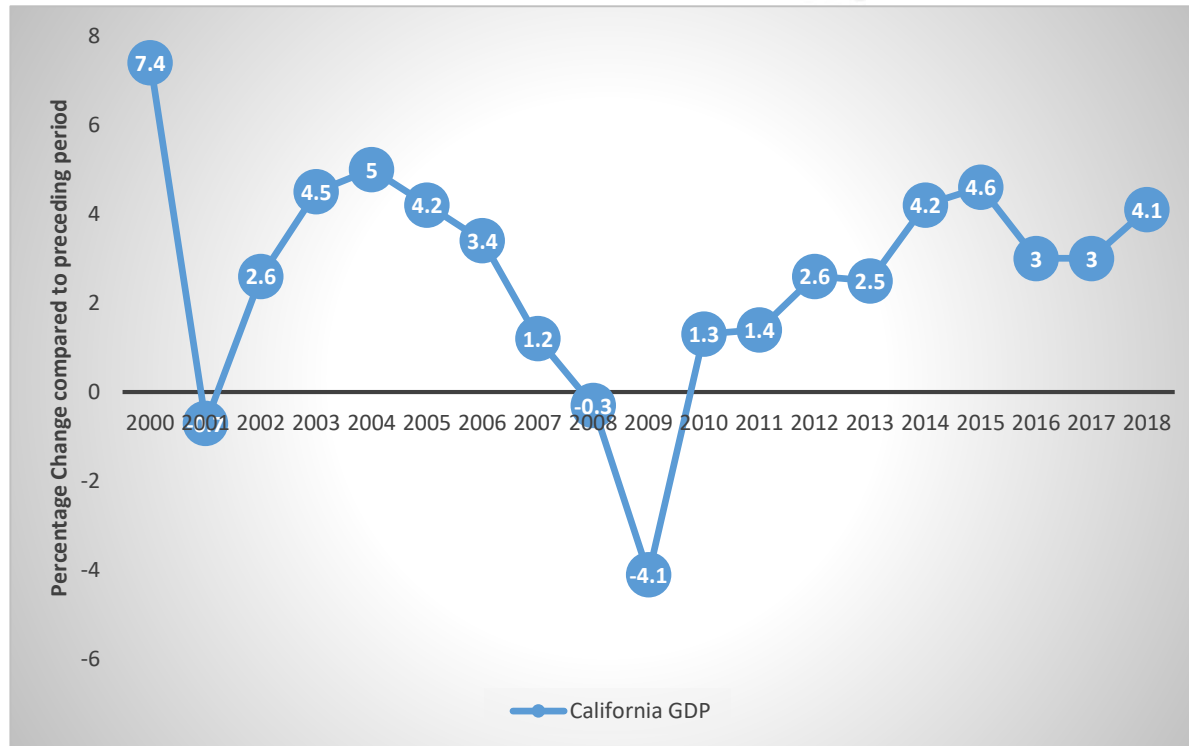
Quarter-on-quarter growth in gross domestic product (GDP)



Seasonally adjusted and annualised Source: Gross domestic product (GDP), 2<sup>nd</sup> quarter 2018

# Changing Water Resources

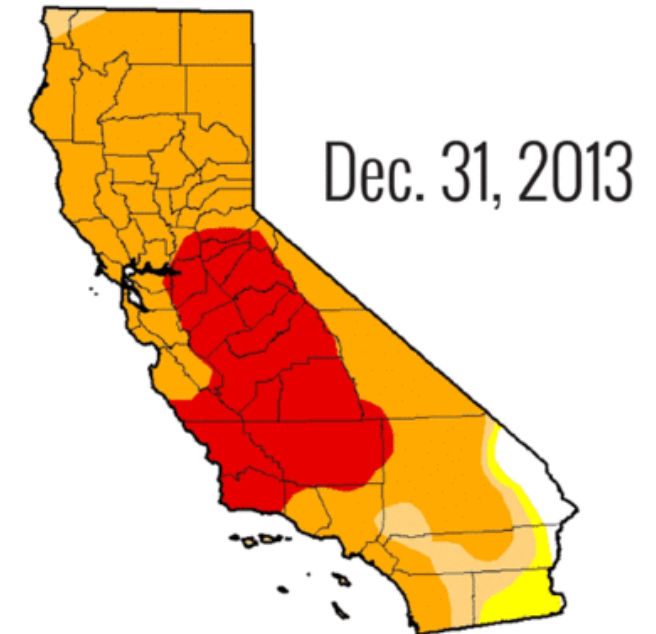
While certain sectors of the California economy were impacted by drought (particularly around ag- and viticulture), the overall impacts were negligible thanks to strict water management practices – groundwater resources were significantly depleted however, resulting in land subsidence, saltwater intrusion and an increase in arsenic levels.



## The Drying of California

The spread of California's drought, Dec. 31, 2013 - July 29, 2014

Abnormally Dry Moderate Severe Extreme Exceptional



Source: National Drought Mitigation Center

# Scotland's Changing Water Resources?

- Despite the current state of “plenty”, climate change and population growth will place new pressures on our aquatic systems.
- UKCP18 projections highlight wetter winters, as warming temperatures reduce snowfall and increase rain. However, increasingly hot and dry summer conditions are also forecast, presenting capacity for seasonal stresses.



# Economic Implications



## Scotch on rocks as Islay prays for rain

By Gillian Harris, Scotland Correspondent

April 25 2003, 1:00am, The Times

AN EIGHT-WEEK drought is threatening whisky production on an island with Scotland's highest concentration of distilleries.

The unseasonable lack of rain on Islay has dried up supplies of the soft, peaty water that the seven distilleries use to produce their distinctive whiskies.

## Drought drying up water of life

EXCLUSIVE: Distilleries forced to halt whisky production

The Courier & Advertiser (Perth and Perthshire Edition) 4 Aug 2018 [+6 more](#) PAUL REOCH

**The Observer**  
Scotland

**Paul Kelbie**

Sun 22 Jun 2008 00:01 BST

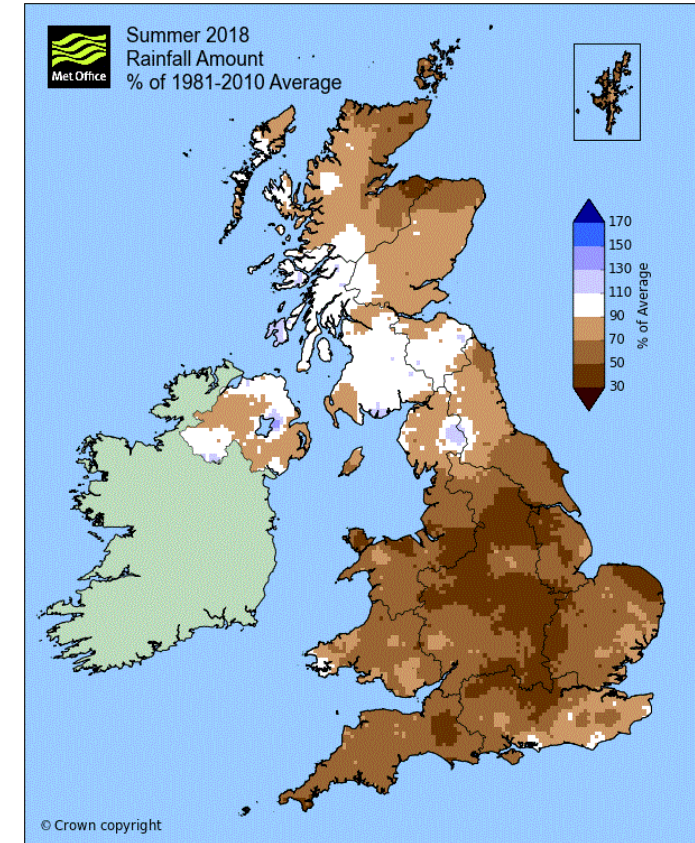
## Drought turns the whisky stills dry

Distilleries in the Western Isles are at a standstill as long spell of sunshine puts strain on the lochs

Scotland's largest product exporting sector (in terms of GVA), exporting around 1.2 billion bottles per annum (SWA).

Industry supports around 70k jobs across the UK, with c.10% of this being in rural areas and serving as significant regional employers.

Impacts of climate change and water go beyond the immediate regional consequences to water in Scotland – reducing barley yields, impacts on forests (barrels)

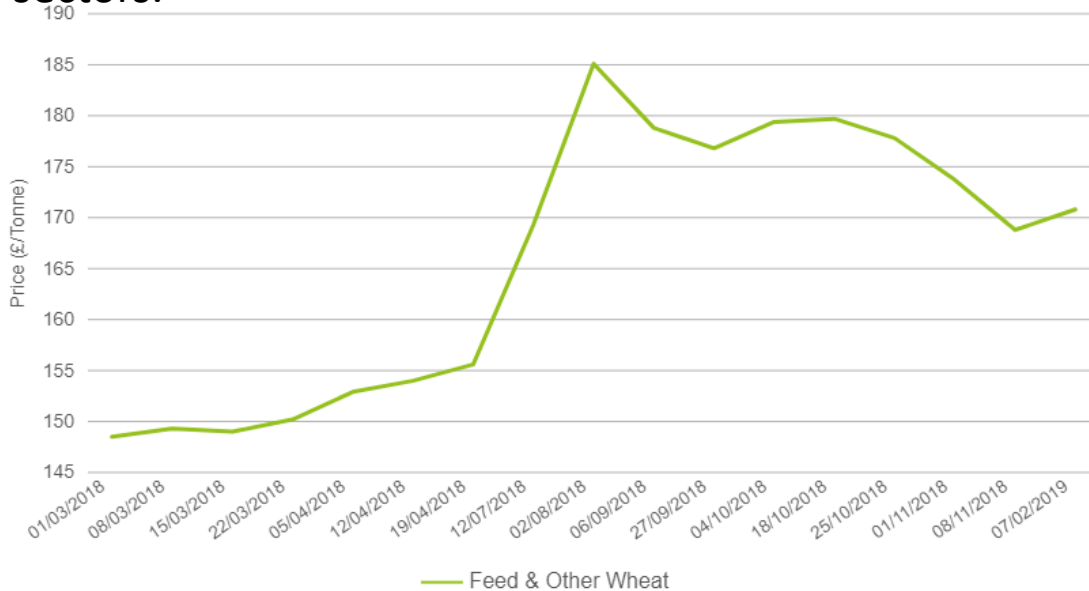




Agricultural direct impacts may impact food security or food supply reliability for industries in retail, manufacturing or services (e.g., hotels and restaurants).

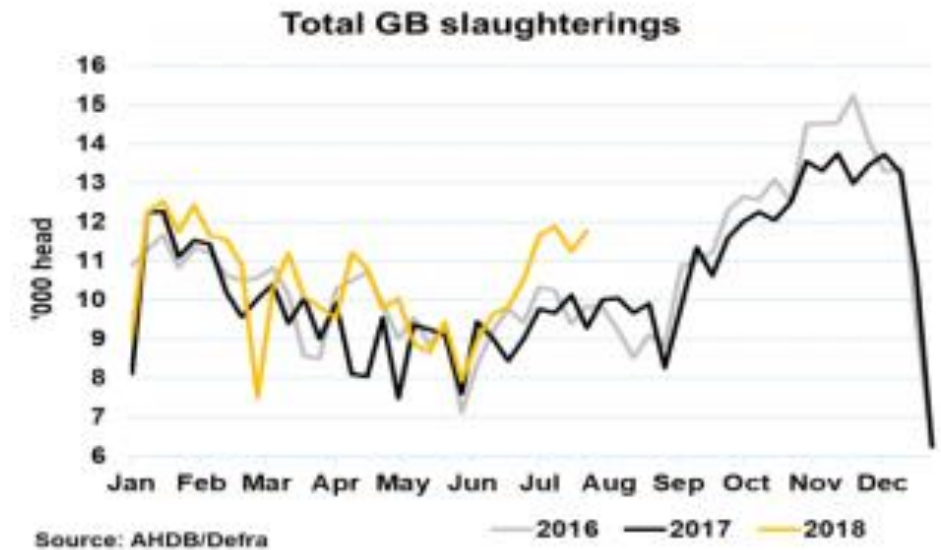
Supply chain and import impacts from outside of the UK may impact economic sectors reliant upon long supply chains – for example, the cost rise associated with courgettes during the 2017 cold weather in Spain.

Consumer prices will rise in line with 'farm-gate' prices, reducing income available for expenditure across other sectors.



**Left:** Price per tonne of feed and wheat during 2018.

**Right:** Cattle slaughter rates 2016-2018.





## Global Environmental Monitoring and Measurement (GEMM)

- Global network of research hubs in monitoring, impacts and policies of regional climate change.
- Technological innovations key to improve monitoring of regional-scale climate dynamics and impacts.
- Support from regional governments (Scottish Government, California Governor's Office) and focus of a new CDT at the University of Strathclyde (launching September 2019).

## Scotland's Water Footprint

- While our understanding of direct water use in Scotland's economy is improving, we require a more holistic picture.
- This will include an analysis of Scotland's virtual water footprint, embedded in our primary imports.
- Despite our abundance of freshwater, close to being a net importer of water.





# Acknowledgements

**Dr Grant Allan** (Department of Economics, University of Strathclyde), **Dr Thomas Baer** (Applied Physics, Stanford University), **Professor Rosemary Knight** (Geophysics, Stanford University), **Professor Allister Ferguson** (Department of Physics, University of Strathclyde), **Scottish Water**, **Dr Francesco Sindico** (School of Law, University of Strathclyde)