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Future predictions of water scarcity in Scotland: impact on distilleries and agricultural abstractors

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Miriam Glendell[1], Kirsty Blackstock[1], Kerr Adams[1], Jack Brickell[2], Jean-Christophe Comte[3], Zisis Gagkas[1], Josie Geris[3], David Haro[3], Mohamed Jabloun[1], Alison Karley[1], Kit Macleod[1], Shaini Naha[1], Eleanor Paterson[1], Mike Rivington[1], Chloe Thompson[1], Kirsty Upton[2], Mark Wilkinson[1], Kirsten Williams[4]

[1]The James Hutton Institute, Craigiebuckler, Aberdeen AB15 8QH, Scotland
[2]British Geological Survey, The Lyell Centre, Edinburgh, EH14 4AP, Scotland
[3]School of Geosciences, University of Aberdeen, Aberdeen, AB24 3UF, Scotland
[4]SAC Consulting, Turriff, AB53 4DY, Scotland

Research Purpose

Climate change in Scotland, will increase the number and duration of water scarcity events, impacting a range of water users dependant on abstracted and rain-fed water.

The aim of this project was to provide summaries of future projections of water scarcity in Scotland and the impacts this may have, tailored to three groups of abstractors: crop producers, livestock producers and distilleries.

To produce summaries, we investigated the current understanding of current and future water availability in Scotland, followed by structured engagement with stakeholders to understand:

- How are water resources currently used by each of the three sectors?
- What future changes in water shortages can we expect to see?
- What do future projections mean for the three sectors?

How are water resource currently used by each of the three sectors?

Rainfall is a key source of water for the growth of crops such as barley, and grass consumed by livestock. Rainfall is also important for ensuring sufficient water flows in surface waters (rivers, burns and lochs) and groundwater stores.

Water sourced from surface water and groundwater is required for irrigating vegetable and fruit crops, production and cooling of alcohol, including Scotch whisky, and as a drinking water source for livestock.

What future changes in water shortages can we expect to see?

Projections to 2049 indicate reductions in the water available through rainfall during summer and early autumn in eastern Scotland, a key crop growing area, compared to current conditions. Mean number and duration of events where river flows are significantly low are projected to approximately double by 2050. For example, the River Spey, an important river for the production of Scotch Whisky, is likely to experience

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To access the outputs for this project, please visit: crew.ac.uk/publication/water-scarcity-impacts-distilleries-agricultural

significant low river flows once every two years, compared to once every five years at present.

For groundwaters, we developed a new framework to provide an initial water security risk assessment based on aquifer storage capacity and recharge rates across Scotland. In Eastern and Central Scotland, long-term average groundwater recharge is projected to decrease in future, making aquifers more vulnerable to long-term depletion.

What do the future projections mean for the three sectors?

Many stakeholders across all sectors indicated that water scarcity was becoming an increasing problem for their business and had already experienced negative impacts. Although our projections look to the future, it is important to note that significant water scarcity events are already occurring.

Less rainfall at key growth stages leads to reduced crop yields, resulting in lower farm incomes. Impacts on grassland growth reduce feed availability for livestock and herd productivity, while warmer temperatures and reduced access to drinking water affect animal health.

The predicted increasing number and duration of low flow events is likely to increase the occasions that water use from rivers is restricted to secure water for other vital uses and protect the natural environment. Even short periods of water shortage for abstractions can lead to vegetable and fruit crop failure and would lead to distilleries having to stop production.

Scotland's current water scarcity plan indicates the potential for groundwater as an alternative source for irrigation and production. However, further research supported by expanded monitoring networks is needed to understand where and how groundwater can be used to provide future resilience to drought locally. Our findings highlight the areas where abstraction from high-storage sedimentary aquifers are likely to be more secure through drought periods, and where abstractions from lower-storage aquifers will be more vulnerable to drought.

How can sectors adapt to current and future water scarcity?

Stakeholders mentioned that they were already taking steps to address the water scarcity problem, particularly in the distilling sector where technological advances could significantly reduce the need for water for cooling activities.

More efficient irrigation methods can be introduced, however introduction of more water demanding crops should be avoided. Increased storage of water during winter months, when increased rainfall is projected, should also be encouraged for use during scarcity events. Harvesting of rainwater can also be used for livestock drinking and cleaning purposes. A farm water calculator would help farmers estimate how much water to store.

There is less scope to adapt for sectors reliant on rain fed sources for growing crops and grass. Effective management that promotes soil organic matter content can increase the ability of soil to hold water to support crop growth and promote groundwater recharge. Ground-water recharge can also be encouraged using nature-based solutions, by temporarily holding water and allowing it to percolate into groundwaters, although the effectiveness of these measures at larger scales requires further research.

Despite knowledge of potential adaptation measures, stakeholders noted barriers to the implementation, particularly in the crop and livestock sectors. For measures that require the adoption of innovative technologies, or the building of new water storage infrastructure, further clarity and ease of access to financial support is required. Improved coordination of water management and collective action is also required to promote resource sharing.