Scotland's changing climate:
Trends, projections and extremes

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SRP Project: JHI-D5-2 Climate Change Impacts on Natural Capital



Project and Reports; https://www.hutton.ac.uk/project/climate-change-impacts-on-natural-capital/
Climate Data Viewer: https://climatedata.hutton.ac.uk/index.html

Introduction

This research assesses spatially and temporally the changing patterns of Scotland's climate and interprets potential impacts on our Natural Capital.

We have already experienced some changes in the climate that are comparable in magnitude to those projected by climate models for the future (2020 and 2049, and in the case of January and November precipitation, the 2050 -2079 period).

Future changes have serious consequences for Scotland's Natural Capital, society and our economy through changes in ecological processes

Impacts: substantial impact through raising awareness amongst policy teams, agencies and businesses. It achieved:

- **Capacity building** within policy teams and politicians.
- **Conceptual change** though recognition of urgency for action due to improved understanding of the scale of change and spatial and temporal variability of climate impacts and consequences.
- **Instrumental change** evidenced by the emphasis for action now reflected in the Scottish National Adaptation Plan 3 and aims for the Climate Change Plan.

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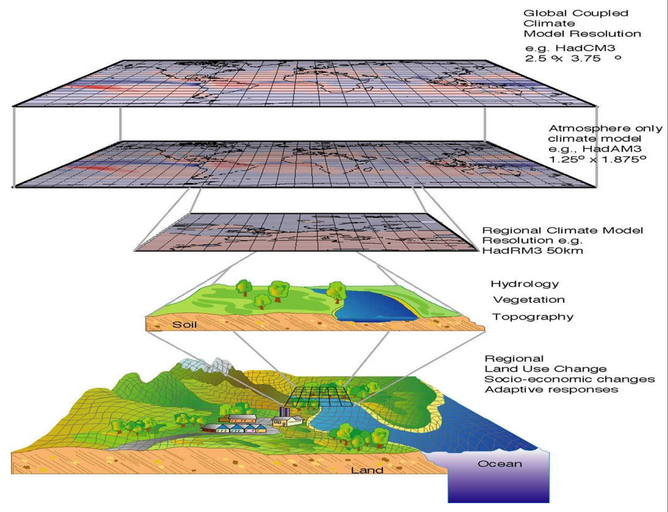
Methods

Use bias corrected (1km) daily UKCP19 climate data from 12 projections (2020-2079) and compare against UK Met Office gridded observed baseline (1960-1989) and current period (1990-2019).

- Map climate variables: Precipitation, max and min temperature.
- Estimate Climatic Water Balance (Precipitation – Evapotranspiration).
- Map observed changes and future projections compared to baseline.
- Generate Agreement Maps for the future using multiple projections.



Results: Observed trends

- Changed precipitation amounts, spatial and temporal distributions: November, December and January's mean monthly precipitation totals have already increased since the 1960-1989 baseline period to amounts greater than those projected for the 2020-2049 period.
- February observed temperatures have already increased to be at the lower end of the 12 climate projections (high emissions scenario) used in this study for the 2020-2049 period.

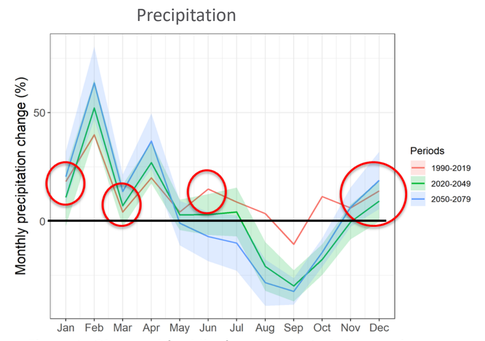


Figure 1. Observed (red line) and projected changes in precipitation compared to the 1960-1989 baseline (black line)

Future projections

- August, September and autumn are **likely to become drier**, but the **winter is likely to become wetter**. Spring shows large spatial and temporal variation, with increasing risks of drought.
- Lower precipitation and higher rates of evapotranspiration associated with higher temperatures are **likely to reduce water availability**, impacting ecological processes and agricultural production.
- **Increasing variability and level of extremes**: longer, hotter dry periods (water scarcity); heavier rain in winter (water surplus).
- Large upland areas of central and eastern Scotland are projected to shift from climatic water surplus to deficit (evapotranspiration > precipitation).

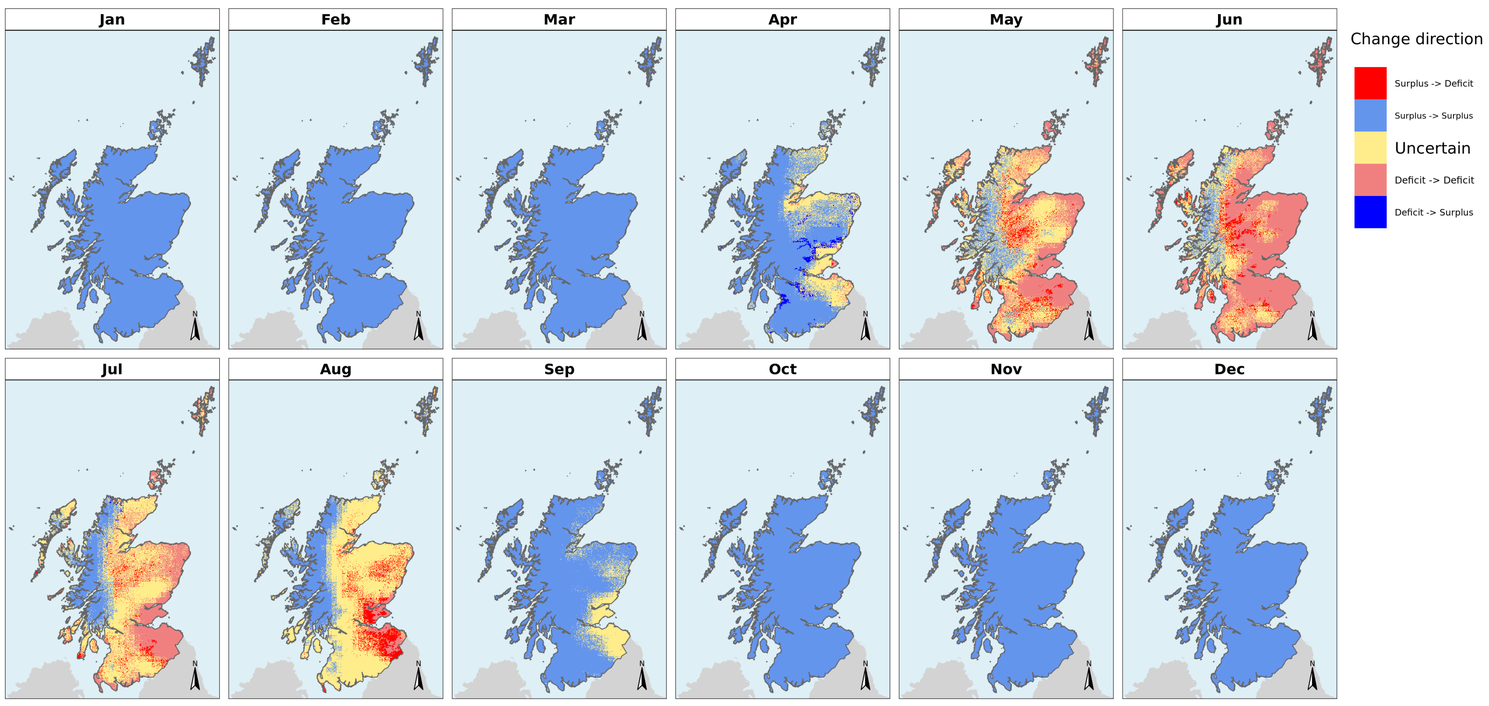


Figure 2. Agreement Map (x12 climate projections) of changes in direction in Climatic Water Balance in the period 2020-2049 compared to the 1960-1989 baseline.

Conclusions: Implications for Natural Capital

- Increased water stress for multiple species and habitats, affecting ecosystem function and the provision of ecosystem services. Reduced water flow in streams, and higher soil and water temperatures.
- Increased species competition for water and nutrients, favouring those with broader tolerance ranges (i.e., pioneer and invasive species), risking species loss, habitat alteration and changes in ecological processes.
- Mixed range of impacts for Peatlands: drier climate eases access and working conditions benefitting restoration efforts but will increase respiration (CO_2 release). Droughts may decrease primary production and risks of drying of exposed soils. Multiple drought years threaten poor recovery.
- Drier more flammable vegetation and peatland soils increases fire danger.
- Crops: increasing variability – some good years, others reduction in production.