C3 – Overview of Mitigation and Adaptation

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Objectives - reminder

- Aim: to better understand **how land use might respond to climate change, how the resilience of systems can be enhanced and the degree to which there will be the need to adapt to climate change that is already entrained or the indirect consequences of changes elsewhere**.
  - Climate change may undermined the capacity of Scotland's land to deliver provisioning and other ecosystem services whilst any positive feedback on emissions will undermine efforts to mitigate climate change. This is assessed by:
    - Damage Screening using spatio-temporal mapping of climate change impacts across agricultural, forestry and peatland systems.
    - Assessing the consequences of climate change for resilience, looking at a range of ecosystem functions across scales, linking field/parcel and business-scale analyses with assessments of multifunctionality at landscape scales.
    - These specific analyses are shaped by higher-level analysis that contextualises land use change scenarios by linking the Shared Socio-Economic Pathways and UK regionalisation initiatives from the UKCEH-SPEED project.
    - This tests how these assumptions (e.g., on indirect drivers of land use change) might play out in space across Scotland (using the APoLUS model) and assess their outcomes.

Shared Socio-economic Pathways

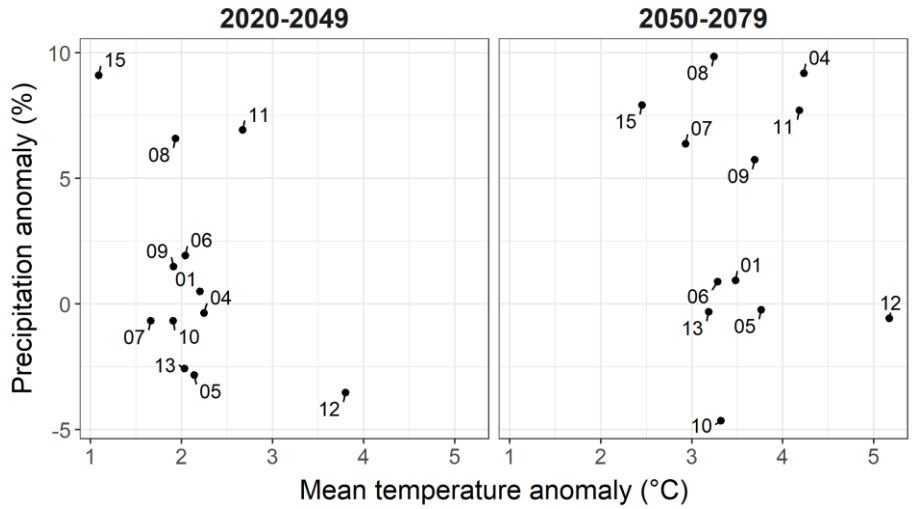
Report - Milestone M1.3 Shared Socio-economic Pathway Scenario Analysis “Putting Scotland in the context of global Shared Socio-economic Pathways to inform Land Use Transformations for Net Zero and Resilience”.

- **Aim:** detail the global Shared Socio-economic Pathways (SSPs) narratives and their structure and how they can be used to inform research on Land Use Transformation.
- **Objective:** to explore the development of Scotland-focussed SSPs and place them in a spatial context to inform discussion, research and analysis on achieving net zero and socio-ecological system resilience in the context of land use transformation.
  - Understanding the SSP assumptions and caveats and benefits of their use.
  - Using spatial analyses with the SSPs to address questions on what net zero looks like with respect to land use in Scotland
- **Conclusions:**
  - Despite large assumptions and multiple caveats, the SSPs have sufficient to warrant their use in LUT analyses.
  - Using two SSPs with contrasting narratives:
    - SSP1 – ‘Sustainable Development’ as it aligns with Scottish Government policy objectives
    - SSP3 – ‘Regional Rivalry’ as it provides a ‘cautionary tale’ on the consequences were policy ambitions are not achieved, and leads to warming in excess of 2°C and challenges for societal development and environmental quality
  - A key challenge is to translate the SSP into land use transformation narratives - presented in the Land Use Transformations story map.

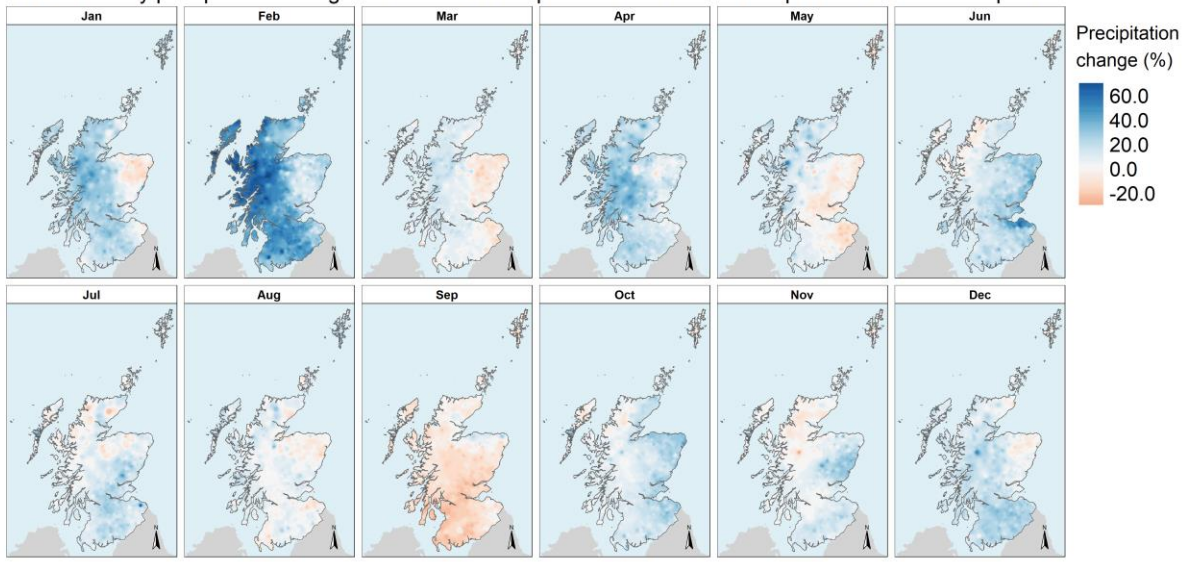
Climate change – analyses and mapping

- Capacity for LUT application has been developed (in alignment with C5 Large Scale Modelling and D5-2 Climate change impacts on Natural Capital).
  - x12 climate projections, includes ones that are compatible with SSP1 and SSP3
  - R Shiny apps for observed and UKCP18 (bias corrected to 1km)spatial visualisation:
    - Observed climate trends, future projections, extremes (new indicators) and return periods
    - Agreement maps / anomaly plots / land area proportion change
    - Climatic Water Balance
- Agrometeorological Indicators:
  - Public facing website with 29 indicators and annual and monthly climate summaries – near completion
- Enables vulnerability mapping – where there may be risks and opportunities for LUT

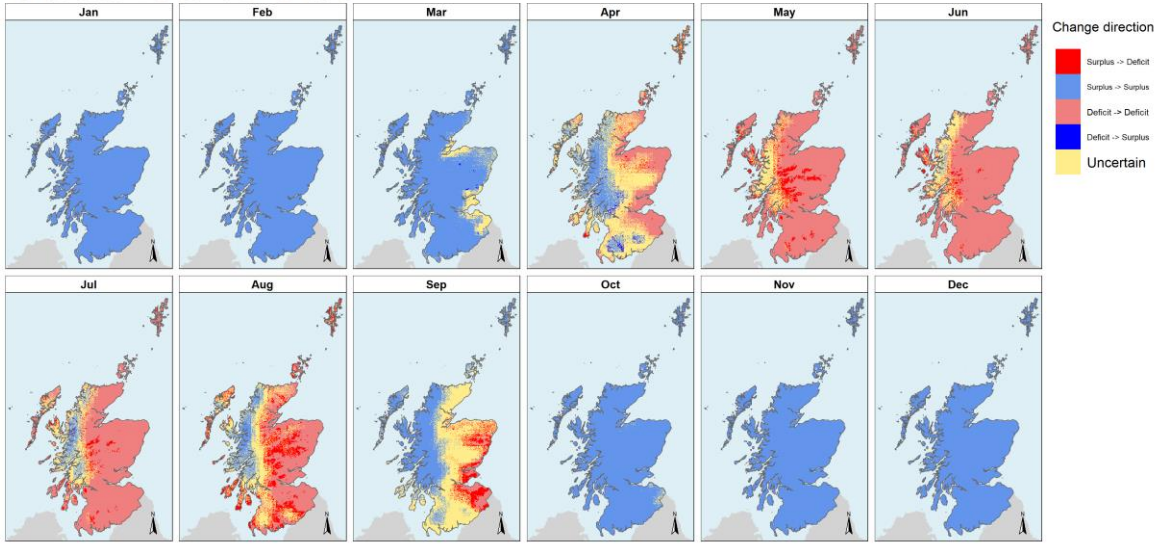
Visualisations



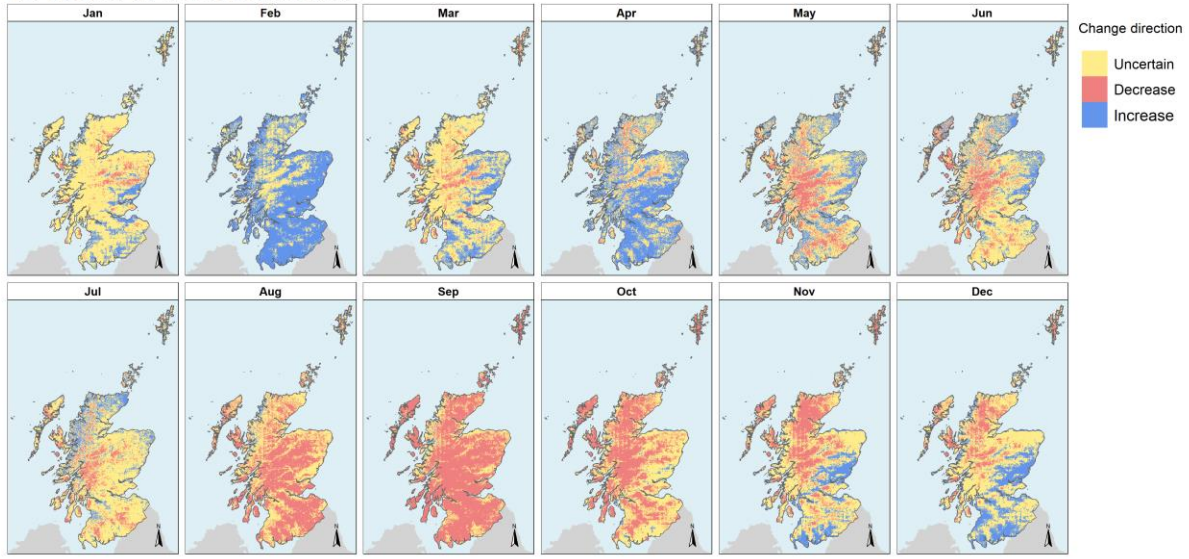
Mean monthly precipitation change over the historical period 1990-2019 as compared to the baseline period 1960-1989



Change direction agreement for mean monthly climatic water balance over the period 2020-2049 for at least 12 ensemble members



Change direction agreement for mean monthly precipitation over the period 2020-2049 for at least 12 ensemble members



Land Capability for Agriculture

- Continued development of the Land Capability research platform:
  - Improved evapotranspiration estimation (location specific parameter value) – important for determining soil wetness and maximum soil moisture deficit.
  - Better configuration of data sets and software structures to enable the Research Platform to run on HPC.
- Initiated assessment of LCA and actual land uses

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Previous related analyses are also available from the Hutton Land Systems Research Team website - https://ics.hutton.ac.uk/research/land-systems-research-team/

The sets of slides and maps generated in Agriculture Policy analysis from 2010 onwards are available from - https://ics.hutton.ac.uk/research/land-systems-research-team/cap-analysis/

For woodland expansion analysis see - online mapping and paper.

Story Map for Land Use Transformations - land use change modelling.

Further research in the RESAS Strategic Research Programme 2022-27, in the Land Use Transformations (C3-JHI-1) and Land Reform (E3-JHI-1) projects.

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