



C3 Supporting Land Use Transformations: WP3 Resilience and Adaptation

Mike Rivington, Mohamed Jabloun, Emmanuel Udugbezi,
Matt Aitkenhead.

RESAS SRP Project C3 Land Use Transformations,
End of year 3 meeting, Saughton House 25th March 2025

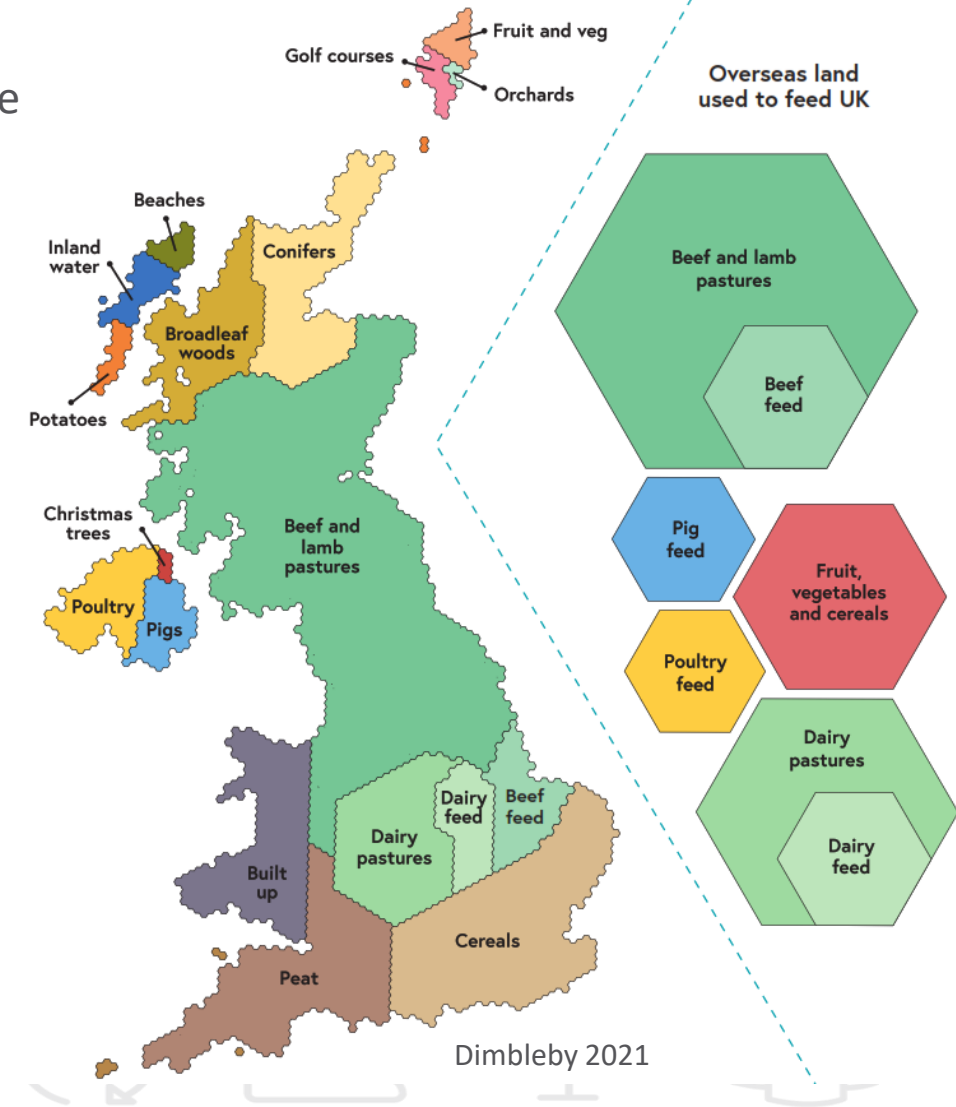


The James
Hutton
Institute

Assessing climate change impacts on land use and consequences on transformation, adaptation and resilience

Research context: Biophysical impacts and multiple drivers

- How changes in Scotland's climate will impact Land Use risks and opportunities to inform development of net zero pathways, climate change adaptation and resilience building:
- Achieving multiple objectives from land: Land Use and Food System Transformations.
 - Biodiversity Strategy / Net Zero / 30x30
 - Adaptation Strategy – Objective 'Nature Connects'
 - Food security / healthy diets / resilient supply chains
 - Land Capability for Agriculture and food production.
- Need to understand the spatial and temporal variation in climate trends and projections.
 - High spatial and temporal resolution
 - Enables focus on unique climate-land use combinations.
 - Place based interventions
- **Climate proofing policies and building resilience** in socio-ecological systems.



Questions of interest (what if... and so what?)

- How does climate change impact Land Capability?
 - Shifts in capability implies land use changes and therefore trade-offs:
 - Risks to increasing GHG emissions (i.e. soil carbon loss)
 - Opportunities for increased production (i.e. easing of climatic constraints)
- How does climate change influence risks and opportunities for Land Use Transformations?
 - For Net Zero?
 - For multiple sustainable socio-ecological system objectives?
- What does climate change look like: what will we have to adapt to?
 - Climate trends and extremes
 - Changes in water availability
 - Impacts on ecosystems and supply of ecosystem services.
- How to adapt land uses for multiple objectives?
- How to build resilience in complex socio-ecological systems?



Progress this year

- Updated and refreshed the Land Capability for Agriculture run on Land Capability Research Platform
 - Two observed periods and four future climate projections
 - Paper in review
- Progress on developing a new Land Capability for Forestry approach
- Development of a Damage Screening conceptual framework
 - Includes new forms of data visualisation by combining data types at different spatial and temporal scales, i.e. climate and peatland area (PowerBi platform)

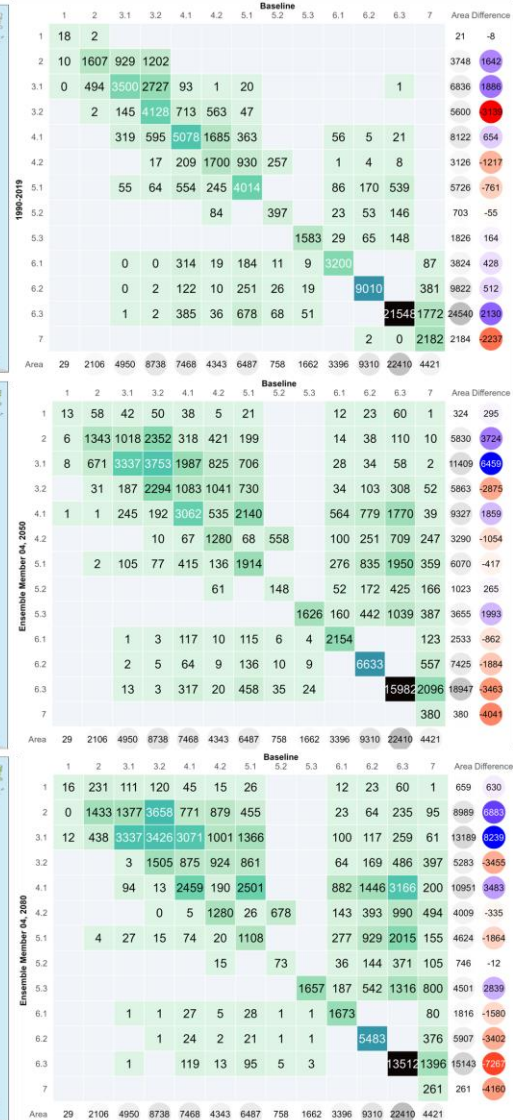
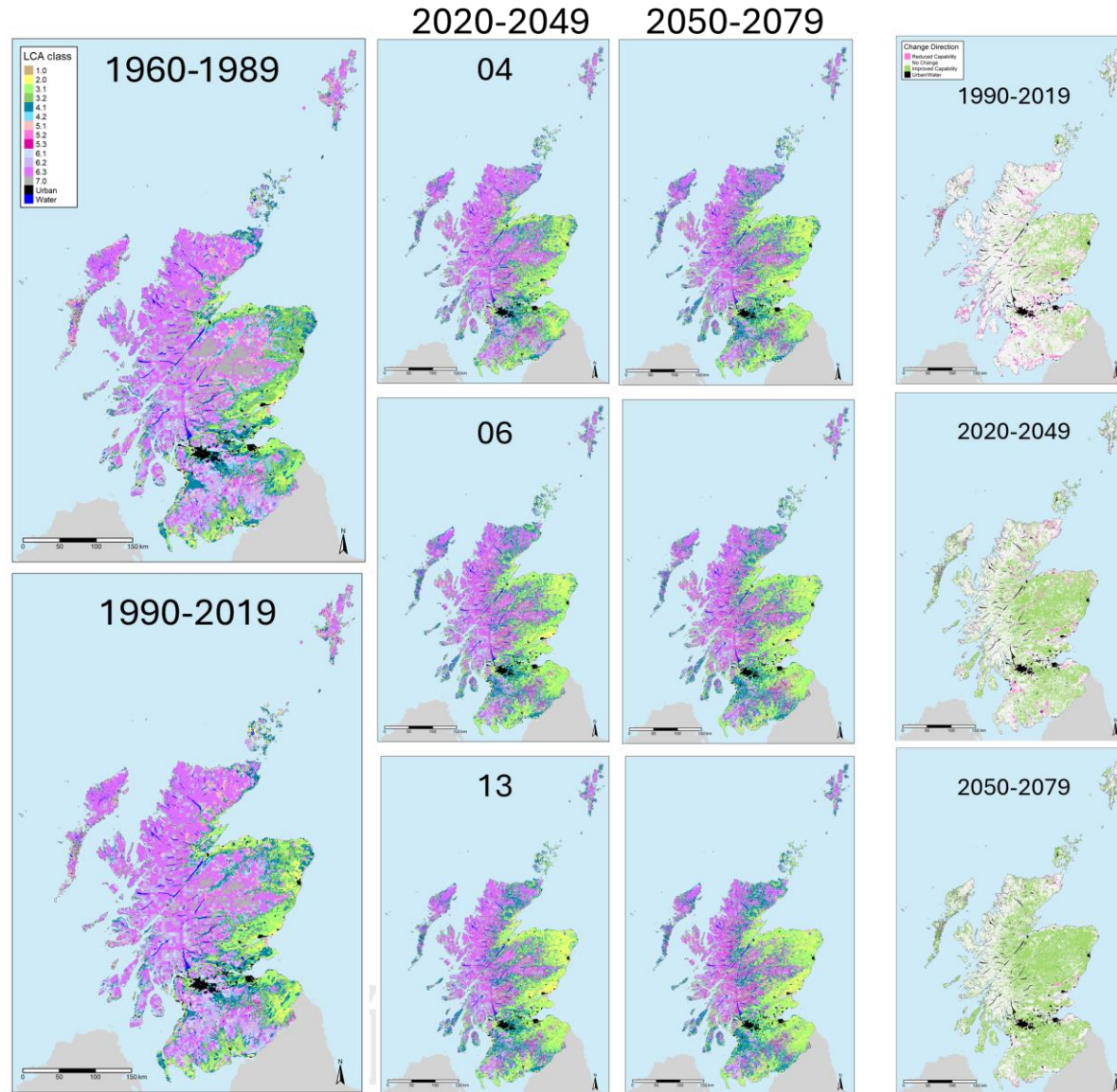


Land Capability for Agriculture



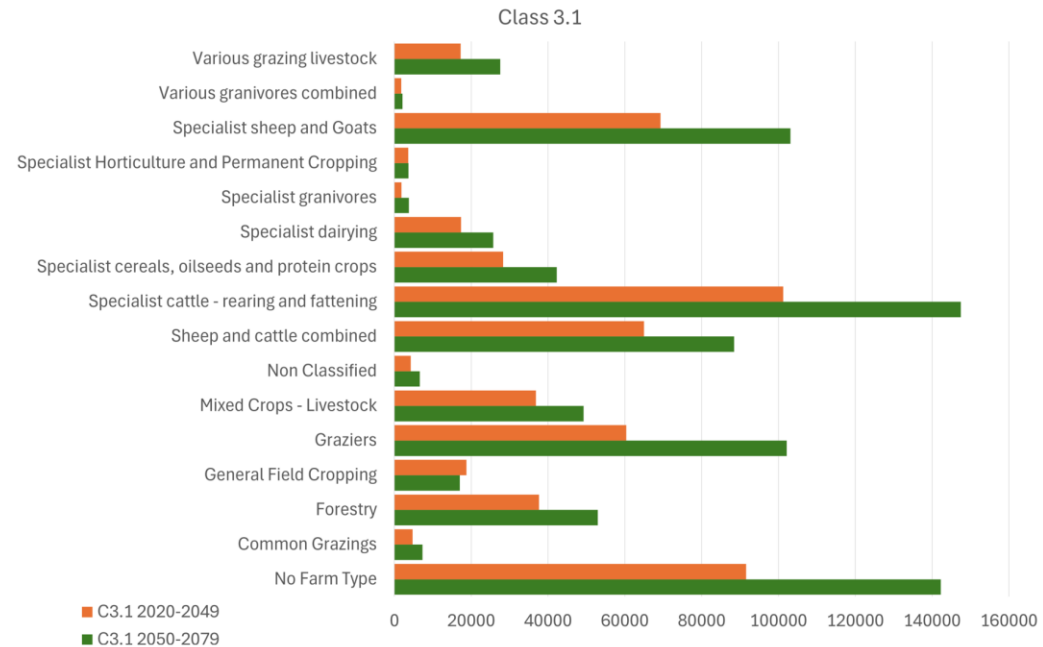
The James
Hutton
Institute

- Easing of mean climatic and soil wetness constraints will result in a general improvement in land capability.
- Extremes and increasing climatic variability may possibly counter constraint easing benefits.
- Some locations may experience a decrease in capability due to reduced water availability.



Changes by Farm Type

- The improvement in LCA varies between farm types and changes over time.
- Opportunity driven land use change need to be carefully managed not to damage biodiversity or result in risking increased emissions
- Consequences on NPF4 and presumption against development on Prime Agricultural Land (classes 1 to 3.1)

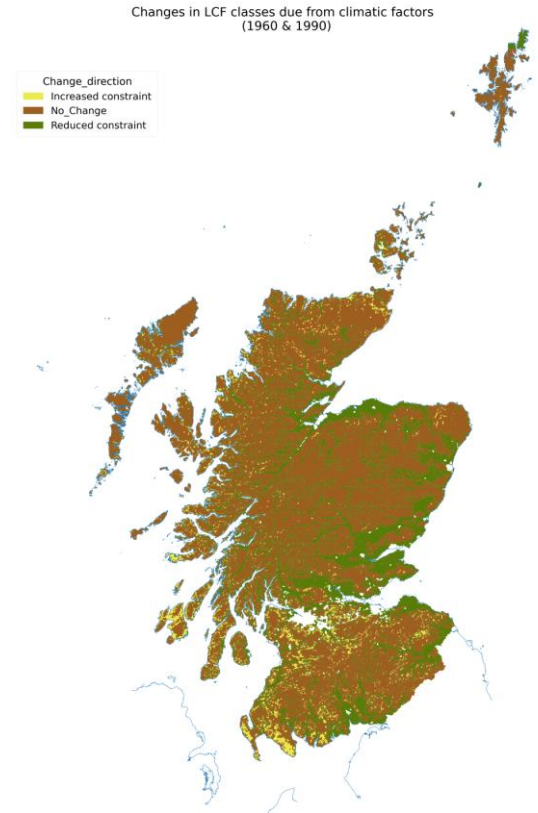
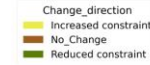


Land Capability for forestry

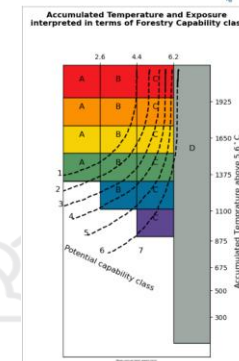
- Revising and updating the original LCF
- Implemented on the new Land Capability Research Platform
- Similar to LCA constraints
- Challenge of windthrow hazard
- Challenge of future windspeed



Changes in LCF classes due from climatic factors (1960 & 1990)



Land Capability for Forestry estimates for Accumulated Temperature and Exposure relative to Forestry Capability class (1960 - 1990) climate reference

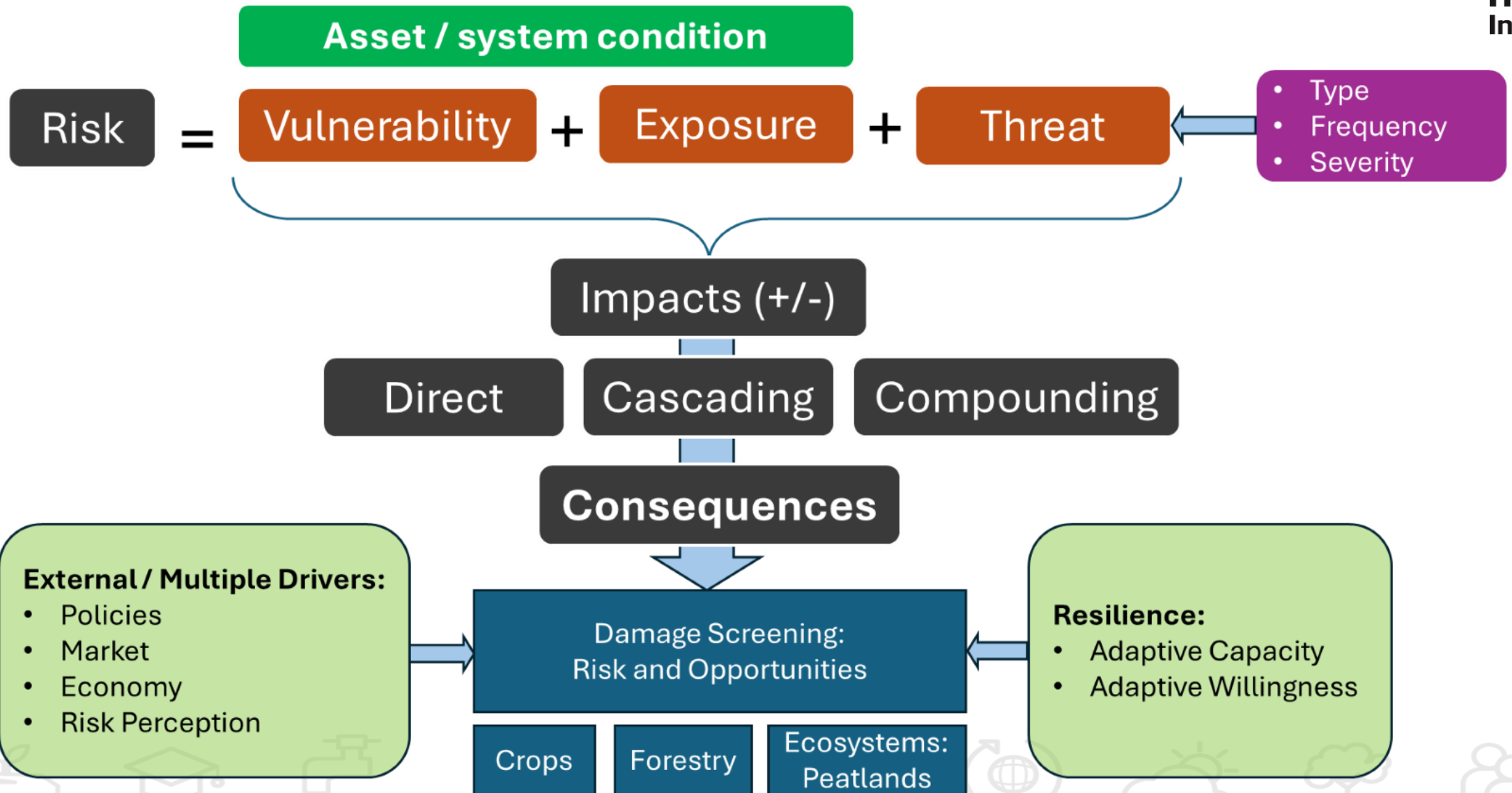


Damage Screening

- The damage screening uses a range of data integration and modelling approaches, including:
 - Unique soil and climate data combinations (soil series and 1km daily time step climate data).
 - Spatial Agrometeorological Indicators and climate trends and extremes mapping ([The James Hutton Institute Climate Data Visualisation](#))
 - Spatial crop modelling.
 - Land Capability for Agriculture classification ([Updating Land Capability for Agriculture](#)).
 - Data fusion and visualisation (PowerBi examples)
 - Alignment with other C3 Land Use Transformation and SRP project outputs.



Damage Screening: Conceptual Framework



Supporting Information: PowerBi data visualisation

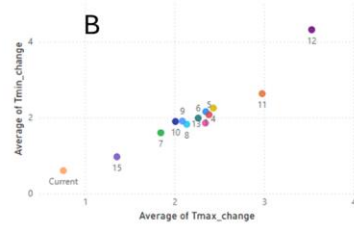


The James
Hutton
Institute

Baseline Tmax and Average of Tmax_change by Month

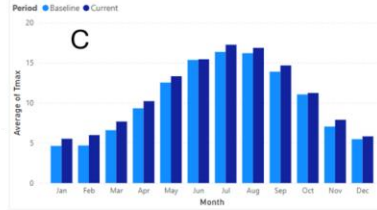


Average of Tmax_change and Average of Tmin_change by Member

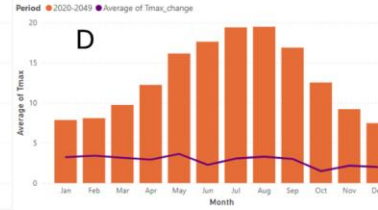


- NUTS_NAME, PARName
- Eastern Scotland
 - Highlands and Islands
 - North Eastern Scotland
 - Southern Scotland
 - West Central Scotland

Average of Tmax by Month and Period



Average of Tmax and Average of Tmax_change by Month and Period



- NUTS_NAME, PARName
- Eastern Scotland
 - Highlands and Islands
 - North Eastern Scotland
 - Southern Scotland
 - West Central Scotland

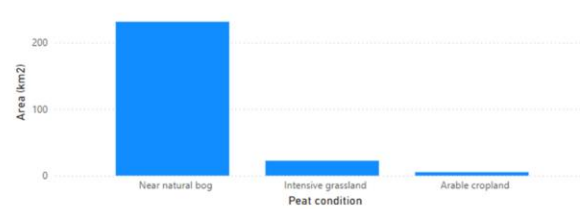
Ensemble Member

1	10	11	12	13	15	4
5	6	7	8	9		

- NUTS_NAME, PARName
- Eastern Scotland
 - Highlands and Islands
 - North Eastern Scotland
 - Southern Scotland
 - West Central Scotland

- Peat condition
- Industrial extraction
 - Intensive grassland
 - Molinia drained
 - Molinia undrained
 - Near natural bog
 - Near natural fen
 - Not peat
 - Other modified peatland
 - Rewetted bog
 - Sedge/rush dominated drained

Area (km2) by Peat condition



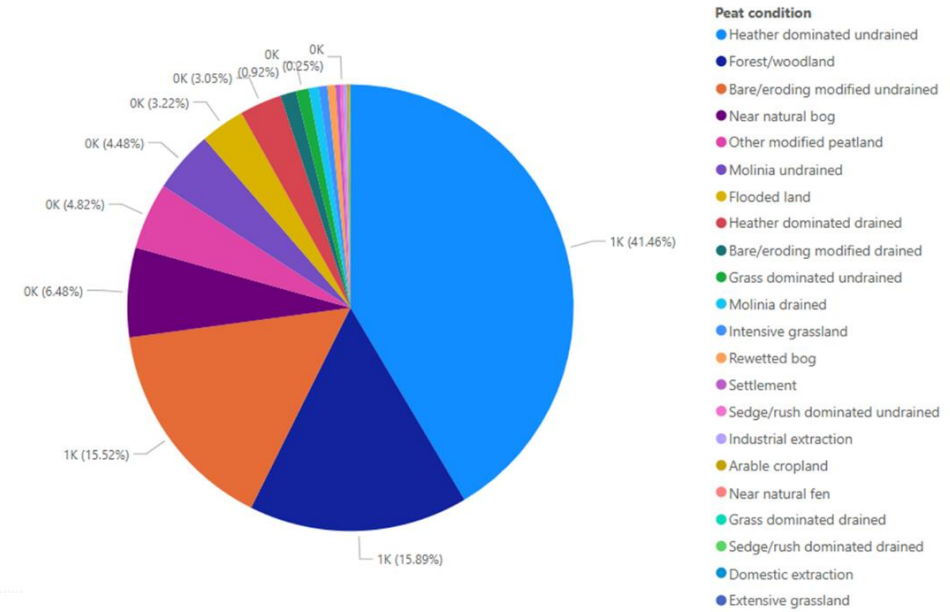
Baseline Tmax, Average of Tmax_change and Average of Tmin_change by Month



Member

1	5
10	6
11	7
12	8
13	9
15	Baseline
4	Current

Area (km2) by Peat condition



- Peat condition
- Heather dominated undrained
 - Forest/woodland
 - Bare/eroding modified undrained
 - Near natural bog
 - Other modified peatland
 - Molinia undrained
 - Flooded land
 - Heather dominated drained
 - Bare/eroding modified drained
 - Grass dominated undrained
 - Molinia drained
 - Intensive grassland
 - Rewetted bog
 - Settlement
 - Sedge/rush dominated undrained
 - Industrial extraction
 - Arable cropland
 - Near natural fen
 - Grass dominated drained
 - Sedge/rush dominated drained
 - Domestic extraction
 - Extensive grassland



Contact – Mike Rivington, The James Hutton Institute, Aberdeen, AB15 8QH,
Tel - +44 (0)1224 395271, Email – mike.rivington@hutton.ac.uk

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.

The James Hutton Institute is supported by the Scottish Government's Rural and Environment Science and Analytical Services Division (RESAS)