



## INTEGRATED SOLUTIONS TO ADDRESS HIGH LEVELS OF CLIMATE CHANGE

We are not yet on track to meet the Paris agreement goal to keep global mean temperatures well below 2°C (and ideally 1.5°C) above pre-industrial levels. IMPRESSIONS modelled the risks and opportunities of high levels of climate change (above 2°C) in Scotland under different socio-economic scenarios, taking into account the interactions between agriculture, forestry, water, health, tourism and biodiversity.

### Key Findings

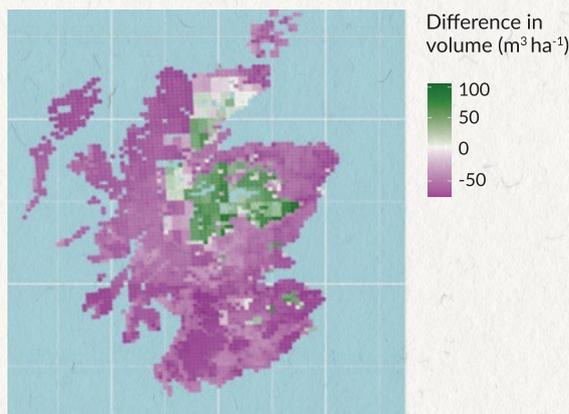
- **Mixed impacts:** Climate change impacts in Scotland are mixed: some crops, species, sectors and areas might benefit from a warmer climate but others (especially native species) will lose out.
- **Integrated strategies:** In all scenarios, integrated governance strategies with local community empowerment can play a key role in dealing with climate change.

### What are the impacts and risks in a future above 2°C?

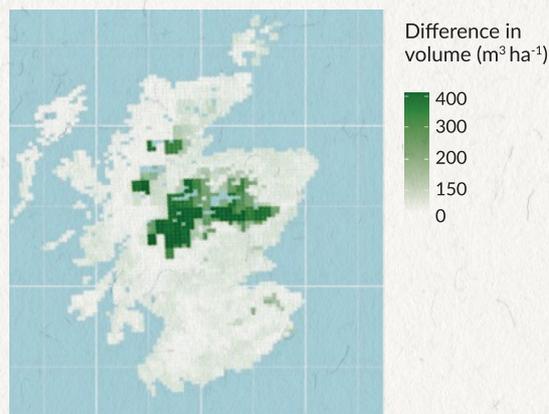
Advanced simulation models predict that climate change will have a range of positive and negative impacts, providing both opportunities and threats.

- **Forestry:** Forest productivity is projected to increase in most of Scotland but yields of the native Scots pine are projected to decrease, while yields of some non-native species (Douglas fir and Sitka spruce) could increase. This could affect biodiversity, landscapes and tourism.

Scots pine (*Pinus sylvestris*)



Douglas fir (*Pseudotsuga menziesii*)



**Difference in harvested volume under high climate change (average of RCP4.5 and RCP8.5 scenarios, compared to baseline)**

- **Land Use/Agriculture:** Modelling of crop yields reveals a mix of increases and decreases in productivity overall. Socio-economic scenarios have an important influence. A scenario focused on reducing food imports leads to farmland displacing forest area in Scotland, whereas a resource-intensive technology-driven scenario increases yields so the agricultural area shrinks. These extremes highlight the implications of agricultural land use change for biodiversity and ecosystem services in the context of the land-sparing/land-sharing debate.
- **Biodiversity:** Some charismatic species such as the capercaillie, osprey and wildcat could lose substantial areas of suitable habitat due to climate change, while others such as the golden eagle could increase their range. In scenarios where the area of intensive agriculture expands, there are significant biodiversity losses.
- **Tourism:** The aesthetic quality of landscapes will be affected by climate change, but surveys using photo-shopped

landscape photos indicated that altered vegetation patterns and water levels would not have a major impact on the Scottish tourism industry.

- **Lyme disease:** Lyme disease risk is projected to increase across all scenarios as tick habitat expands in a warmer climate and outdoor activity by people increases.
- **Water:** Modelling suggests that discharge is likely to increase in the spring and winter and decrease slightly in the summer. High-flow events are also likely to increase, potentially resulting in flooding.

## What are the transformative solutions?

Stakeholders developed a set of pathways for transforming society to address the causes of climate change while also adapting to the impacts. Three of the pathways play a key transformative role in all scenarios.

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| Integrated environmental and resource management | Land use and resource management plans are coordinated to provide multiple benefits across sectors and scales, including integrated transport, energy and food systems. This enables synergies to be exploited (e.g. via the multiple benefits of nature-based solutions) and trade-offs (e.g. for competing land uses) to be managed.  |
| Local community empowerment                      | Local democracies and community cohesion are strengthened by devolving responsibility for environmental quality to the local level, while connecting communities and individuals via knowledge-sharing networks. This builds the capacities of communities and individuals to make independent decisions over key areas of their lives (e.g. food, energy) and triggers a shift to community-owned resources, alternative working patterns, local low carbon economies and more sustainable lifestyles. |
| Local, low carbon and circular economies         | Local economies build on alternative economic activities, such as sharing of goods and local trading systems. This is central in scenarios with weaker central governance, as communities can self-organise (e.g. to grow food together using innovative techniques such as vertical farming or hydroponics.)   |

Within these pathways, **technological innovation in food production** and shifting to more **sustainable dietary habits** can significantly increase the amount of land available for wildlife habitat and for reforestation. Strong environmental regulations are needed to support the shift to a sustainable economy.

## Policy Recommendations

- **Assess the impacts of changing forestry species.** Using a mix of tree species could contribute to the future viability and productivity of forests, for provision of timber and as a carbon sink. However, the impacts on biodiversity and landscape value of replacing native Scots Pine with non-native species should be assessed.
- **Assess land use trade-offs.** Cross-sectoral impact assessments are needed to examine land-use trade-offs including the impact of ambitious reforestation projects on local food production, biodiversity and landscapes.
- **Reduce agriculture impacts on biodiversity.** Modelling showed that biodiversity losses are particularly high in areas of intensive agriculture. Sustainable farming practices should be supported, to reduce impacts on vulnerable species. Initiatives such as the “Farming for a better climate” programme are a good starting point for educating land managers.
- **Raise awareness of Lyme disease.** Lyme disease risk is projected to increase under high climate change and it is likely that more people will pursue outdoor recreation. It is therefore important to increase efforts to educate the public as well as public health practitioners to ensure that both patients and doctors are aware of what to do in case of infection.

**Case study leader:** Professor Mark Rounsevell, [mark.rounsevell@kit.edu](mailto:mark.rounsevell@kit.edu).

**Find out more:** [www.impressions-project.eu](http://www.impressions-project.eu).