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Briefing note: Triggering environmental change on large landholdings

Decision-making and the role of climate data visualisations

Highlights

- Land use decisions on large landholdings can make a significant impact on net zero targets.
- Through interviews and workshop discussions, owners and managers of large landholdings shared their decision-making regarding environmental land management to identify key 'triggers for change'.
- Four key factors were identified as potential triggers for changes in decisions related to land management and climate resilience: (i) policy change; (ii) financial priorities; (iii) succession processes; and (iv) extreme weather events.
- Immersive climate change visualisations, using new facilities at the James Hutton Institute, were seen as useful for informing decision-making and guiding options for future engagement.

Background and project objectives

The Scottish Government has committed to becoming a net-zero society by 2045 and the land use sector has an important role to play. In a recent research project[1] funded by the UKRI Agri-food for Net Zero Network, researchers at the James Hutton Institute, partnering with Scottish Land and Estates, sought to identify how best to support transformational change towards achieving Net Zero, biodiversity and other targets on large land holdings in Scotland. The project also aimed to understand the role and value of data visualisation in triggering changes in land management trajectories and informing landowners of future environmental risks and opportunities.

This research involved the owners and managers of landholdings larger than 1000 hectares located within and around the Cairngorms National Park. These individuals are particularly important for their ability to shift the trajectory of large volumes of land, often have the skills and resources to pursue diverse trajectories, and are uniquely suited to achieving landscape scale change.

The impacts of 'triggers' for transformational change were considered through semi-structured interviews (conducted online July-November 2025) and a workshop held at the James Hutton Institute in September 2025, using its 'Hutton Hub' new immersive visualisation facilities. The key questions were:

- What 'triggers' change on large land holdings?
- What is the role of contemporary succession processes in the environmental trajectories of large land holdings?
- How can climate change maps influence decision-making?

[1] https://www.hutton.ac.uk/project/triggering-environmental-transformation-on-large-land-holdings/

In total, seven large landholdings were represented in this study, covering an area of approximately 60660 hectares[2]. Participants were six men and one woman, ranging in age from mid-30s to late 70s, who were landowners (5) and estate managers (2).

Key 'triggers' of change

Qualitative thematic analysis of workshop discussions and interview transcripts indicate the following key triggers of change on large landholdings:

(i) Policy change

Participants mentioned how influential policy changes, and particularly changes to the financial support available to farmers and landowners, can be for their decision-making. For example, several participants mentioned Peatland Action as an initiative (with policy support) that had encouraged and enabled them to take environmentally-beneficial actions on their land, because the funding covered all or almost all the associated costs – meaning the landholders were not left out of pocket. On the other hand, several participants raised concerns that changes to taxation, especially around inheritance tax, would limit the ability of large estates to invest in long-term nature restoration. Several participants also suggested that improved stability and clarity around environmental policies and funding would give them further confidence to make changes on their estates.

(ii) Financial priorities

The financial priorities of the landowner were an important factor in determining the changes that participants had made on their land. A key difference is that some landowners are dependent on their land for their income, whilst others have an external source of income and are less dependent on making money from their land. This affects their decision-making regarding environmental changes, as some landowners explained that they are limited to undertaking pro-environmental actions that can be financed through grant funding or commercialisation (e.g carbon markets), whereas others may have more freedom. Importantly, several interview participants whose land is their main source of income described the financial benefits of environmental actions they had taken – including reduced costs by switching to low-input regenerative farming and/or continuous cover forestry, and new sources of income from carbon credits for tree planting and hydro-electric renewable energy generation.

(iii) Succession processes

The participants described a variety of diverse succession processes, including early-stage planning to recent landownership transfers, with successors now taking the lead in land management decision-making. Participants responsible for estates where this has recently occurred described their focus on ensuring financial viability, business streamlining, the exploration of potential diversification and new business opportunities, as well as taking a long-term approach. These priorities had led to environmental changes such as shifting to regenerative agricultural approaches on their land, pursuing peatland restoration, and continuous cover forestry management.

(iv) Extreme weather events

Participants recognised increased frequency of extreme weather events in recent years. The resulting wind and flood damage to housing, trees, and other infrastructure had prompted several participants to consider or take environmental actions to improve the resilience of their land. For example, this

[2] Landholding size was noted during interviews or sourced from 'Who Owns Scotland': https://whoownsscotland.org.uk/

included tree planting, peatland restoration and building 'leaky dams' to increase hillside water retention and reduce flood risk to the landholding and local communities.

The role of climate change visualisations in influencing change

The workshop discussion explored climate projections for the UK and how changes in temperature and precipitation will impact natural capital, e.g. plant heat stress (number of days per year above a temperature threshold); changes in frosts (timing and number of days); meteorological water availability (difference between precipitation in and evapotranspiration out from a ground surface). Participants agreed that they had observed some of these changes already and that the data visualisations highlighted changes that were influencing their own land management and factors over which they had control (i.e. rather than wider geopolitics). Participants raised key questions for future research and communication of climate projections, focusing on predictions of flooding, crop growth and yield, and changing land capability. They were informed of other Hutton research that responds to these questions and could support building resilience to extreme weather events. Furthermore, the climate data are available at a 1km resolution, hence larger land holdings can use the data to explore possible future climate conditions to aid strategic planning.

Dr Mike Rivington presents climate data to workshop participants, September 2025

Participant suggestions to support science communication

Participants provided useful feedback on the utility of the material presented and made suggestions for improvement to support land manager decision-making. For example, they suggested that instead of showing maps if climate data with annual projected changes, aggregated 5- or 10-year syntheses of changes would be better for comprehension and clarity of possible impacts.

Participants also proposed that researchers use Artificial Intelligence to generate illustrations of the range of land use outcomes from different climate projections. The research team are currently investigating options to utilise AI approaches in combination with the projection visualisations, crop modelling, and land capability assessments to provide summary reports.

Participants explained that they had been inspired to start recording more about climate change impacts and to monitor biodiversity on their own landholding, and that this data may support

knowledge transfer through succession processes. It was also noted that similar workshops with other types of land managers (e.g. forestry managers or agricultural consultants) may be valuable as they might have different perspectives on the potential utility of the climate change visualisations for land management decision-making.

Opportunities to build resilience on large landholdings

Workshop participants also considered the ways that large landholdings could prepare now for future climate change scenarios (as presented during the workshop[3]). They described initiatives on their own landholdings including afforestation, wetland creation, and planting hedgerows, as well as converting from conventional to regenerative and/or organic farming systems.

A key point of discussion were the barriers experienced by these landowners to implement land management activities that they perceived would support climate resilience on their land and further afield. These barriers included the burden of bureaucracy relating to land use changes (e.g. tree planting) associated with planning and other regulations, as well as perceived lack of integration and alignment between Government departments, policy goals, and funding schemes. Whilst the participants agreed that there was a 'climate emergency', they did not believe that government were addressing this issue comprehensively and as a priority.

The high standard of Wildlife Estates Scotland[4] accreditation was mentioned as a route to identifying 'trusted operators' who may then be enabled to progress with climate resilience initiatives (i.e. 'cutting through the red tape').

> "*If estates could be trusted to say, 'Look, you know what you're doing. You know how to build in climate resilience. You're planning all these fantastic things. We trust you to do it. You get top of the list for your grant money, whatever it is, and just get on with it,' to me, that's a much more sensible way of dealing with things"* [Workshop participant].

Furthermore, the success of catchment partnerships that involve private landowners working alongside environmental NGOs and public sector organisations (e.g. Forestry and Land Scotland), was highlighted.

> "*What I found was, by getting everyone together, that suddenly we're pushing against an open door, because everyone's aligned, you work out with them what you want to do…and then it all starts to happen, and that's made a huge different to us.*" [Workshop participant]

Conclusions and recommendations for policy and science communication

The 'Triggering Change' project has provided an opportunity to initiate discussions with the owners and managers of large landholdings in and around the Cairngorms National Park about drivers of environmental change, building climate resilience, and how climate data visualisations can support their practical understanding. This is an initial exploratory study: it would be desirable to for further research to test and refine our insights by engagement with other landowners. This is an initial exploratory study: it would be desirable to for further research to test and refine our insights by engagement with other land-owners. Key points relating to the research questions include:

[3] The 'Triggering Change' workshop presentation is available online: https://www.hutton.ac.uk/wp-content/uploads/2025/12/Storyboard-for-Triggering-Change-workshop-12-9-25.pdf
[4] https://wildlife-estates.co.uk/

What 'triggers' change on large land holdings?

The participants in this study explained that (i) policy change and interventions such as incentives or regulation; (ii) financial priorities, including whether or not the landowner has other sources of income beyond the landholding; (iii) succession processes, including the impact of these on streamlining or diversification on landholdings; and (iv) the frequency and impact of extreme weather events, which lead landowners to consider and implement climate resilience measures on their land (e.g. tree-planting, wetland creation, etc).

What is the role of contemporary succession processes in the environmental trajectories of large land holdings?

Succession processes remain highly variable and personal to different landholding families, therefore it is difficult to disentangle succession from other factors that influence environmental actions on large landholdings (e.g. policy change, financial priorities, and extreme weather). Successors involved in this study described their role in decision-making that led to positive environmental actions, such as maintaining continuous cover forestry, regenerative agriculture, and peatland restoration. Aspirations for further environmental actions and taking a long-term approach are mediated by pressing financial priorities, and ensuring landholding viability.

Can climate change maps influence decision-making?

The workshop participants noted that the climate projections presented in the Hutton Hub 'immersive suite' were of interest and related to their local observations. They had been inspired to pursue/continue climate and biodiversity-data collection on their landholdings, which would support knowledge transfer during succession processes. They made valuable suggestions for how the research team could revise these visualisations to best inform land manager decision-making, e.g. providing clearer comparisons between observed and modelled data, baseline and comparative data on key topics, and using AI to generate images to present alongside the projections.

The research team will use this feedback to develop future climate projections, land capability assessments, and visualisations of climate and land-related data to best inform landowner decision-making, and policy development.

Further information

https://www.hutton.ac.uk/project/triggering-environmental-transformation-on-large-land-holdings/

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