



LAND USE, LAND-USE CHANGE AND FORESTRY

This briefing summarises how land use, land-use change and forestry (LULUCF) has been assessed in the latest UK Climate Change Risk Assessment (CCRA) Technical Report, and what types of action to adapt to climate change risks and opportunities would be beneficial in the next five years.

The full assessment looks at risks and opportunities for the UK under two climate change scenarios, corresponding to approximately a 2°C or a 4°C rise in global temperature by 2100. It answers three questions, for 61 different risks or opportunities using available published evidence and analysis:

- 1. What is the current and future level of risk or opportunity?**
- 2. Is the risk or opportunity being managed, taking account of government action and other adaptation?**
- 3. Are there benefits of further adaptation action in the next five years, over and above what is already planned?**

The main findings from the full assessment related to land use, land-use change and forestry are summarised below, together with the adaptation actions that would be beneficial over the next five years. Each risk or opportunity has an identifier code linked to the full analysis, which is available in the CCRA3 Technical Report.

Readers are encouraged to use these briefings to locate the parts of the Technical Report of most relevance to them.

Key messages

- Changing risks to soils and natural carbon stores and sequestration from higher temperatures and changing rainfall patterns will affect the whole LULUCF sector, though there is likely to be a mix of positive and negative impacts. Wildfire also poses a serious risk to natural carbon stores.
- Forestry could also be impacted both positively and negatively by a changing climate and through an increase in the number of extreme weather events.
- UK forests could be at risk from an increase in pests, pathogens and invasive, non-native species that may increase in numbers due to climate change, especially milder winters.
- Conversely, there may also be opportunities for the productivity of forests because of climate change, as it may make the UK suitable for new tree species.
- Forests are an important contributor to the UK's landscape character, meaning that changes to the former could directly affect the latter.

Alternatively, if you would like a summary of the analysis by UK nation, please go to the national summary documents:

• **England** • **Northern Ireland** • **Scotland** • **Wales**

This briefing is aimed primarily at the UK Government, the governments of Scotland and Wales, the Northern Ireland Assembly and their respective departments and agencies responsible for land use and forestry. However, it should also be of interest to a wider audience.

Risks, opportunities, and benefits of further action



More action needed

Further investigation

Sustain current action

Maintain a watching brief

Average UK wide scores

N4. Risk to soils from changing climatic conditions, including seasonal aridity and wetness

N5. Risks/opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity

N6. Risks to and opportunities for forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind)

N8. Risks to forestry from pests, pathogens, and invasive non-native species

N9. Opportunities for forestry productivity from new/alternative species becoming suitable

N18. Risks and opportunities from climate change to landscape character

1. Risk to soils from changing climatic conditions, including seasonal aridity and wetness (N4)



Soils are a fundamental underpinning resource for woodlands and forestry, as well as all terrestrial ecosystems. There is increasing evidence of the negative impacts of climate change on soil resources since CCRA2, often in combination with other factors, notably land-use change.

Heavier rainfall events, and increased soil moisture deficits in summer will exacerbate the loss of soil resources. The current rate of erosion is estimated at 2.9Mt/year in England and Wales with losses from productivity estimated at £40m/year. Values are not currently available in Scotland and Northern Ireland.

Severe degradation of soil quality would be very likely to have long-term, potentially irreversible, implications particularly given the critical importance of soil in providing a range of ecosystem services. At the same time, higher temperatures could have some benefits for soil function from increased microbial growth and activity, though emissions of carbon and methane from soil may also increase with warming.

The balance of these risks and opportunities for soils from climate change is still a subject for debate and further research. The risk is considered medium magnitude now, rising to high by the 2050s across the UK.

Beneficial actions in the next five years include:

- Further research and comprehensive monitoring of soils to support development of sustainable soil policy initiatives to help to boost the resilience of soils to climate change.
- More investment in national-scale soil monitoring programmes and monitoring of different management interventions linking adaptation and mitigation.
- An improved evidence base on the climate-related implications for the wider range of multiple benefits delivered by soils, including maintenance of water quality, alleviation of flooding at catchment-scale, reduce drought risk and for priority habitats and species.
- Further integration of adaptation and mitigation strategies based upon long-term planning, including for ambitious land use policies such as woodland expansion and new bioenergy crops, based upon local soil properties. Soils, and especially soil organic carbon (SOC), are crucial to the Net Zero agenda and hence climate-related impacts on SOC will have important implications for achieving the Net Zero goal, especially for peat which has high carbon stocks.
- Improved advice for land managers together with payments that incentivise improved soil health.

Further details on this risk: Natural Environment and Assets Technical Chapter, risk N4



2. Risks and Opportunities for natural carbon stores, carbon sequestration and greenhouse gas emissions from changing climatic conditions, including temperature change and water scarcity (N5)



Forests can reduce air pollution, mitigate flood risk, and provide wildlife habitats and recreation. Alongside these benefits, the LULUCF sector is especially important to the UK's greenhouse gas (GHG) balance, and the extent to which carbon sequestration and storage will be able to offset emissions elsewhere.

Important stores of carbon considered in the CCRA analysis includes soils (peatlands), coastal and marine habitats including saltmarsh and kelp forests ('blue carbon') and trees. The CCRA updates evidence that peatland degradation and carbon losses will be exacerbated by runoff during intense rainfall events, in addition to increased oxidation from warmer and sometimes drier conditions.

Wildfire also poses a significant risk to loss of carbon stores. A major wildfire in the Flow Country in Scotland in 2019, for example, was estimated to have released GHG emissions of approximately 0.6-1.4 MtCO₂e. There is also projected to be a much greater risk of loss of coastal and marine carbon sequestration at higher magnitudes of climate change globally, associated with both warmer temperatures and acidification risks for marine organisms, as well as sea level rise. The risks across the UK are projected to increase from medium to high by the 2050s.

Beneficial actions in the next five years include:

- **An integrated land use policy and a more spatially targeted strategy for land-use change initiatives, together with more integration of the mitigation and adaptation policy agendas.**
- **More targeted actions to restore degraded carbon stores, particularly peatlands.**
- **A more strategic approach to land use planning, integrating agriculture and forestry, based on linking net GHG emissions reductions with other multiple benefits.**
- **More research is needed to account for climate change risks to carbon stores in UK GHG Inventory projections.**
- **A better understanding of carbon storage and sequestration potential for blue carbon and the risks to these assets from climate change.**
- **A systematic programme of soil carbon monitoring for diverse land uses, bioclimatic zones, management interventions etc.**

Further details on this risk and opportunity: Natural Environment and Assets Technical Chapter, risk/opportunity N5



3. Risks and opportunities for agricultural and forestry productivity from extreme events and changing climatic conditions (N6)



Weather and climate variations will affect both land utilisation and forestry productivity from changing patterns of heat and cold, wetness and drought.

Whilst opportunities are available, the risk magnitude is also assessed to increase from medium at present to high in future.

Suitability for tree species is expected to change, for example for sessile oak and Sitka spruce which are set to decline in suitability significantly in southern regions of the UK by 2080, mainly due to increases in soil moisture deficits.

The magnitude is considered medium now, rising to high by the 2050s across the UK.

Beneficial actions in the next five years include:

- **Develop an improved assessment capability.**
- **Regular systematic surveys on the uptake of adaptation practices in the UK.**
- **Application of near-term climate forecasts.**
- **A more comprehensive assessment of climate resilience and robustness of different land use options in the context of changing water availability.**
- **Better integration of Net Zero carbon targets and adaptation pathways.**
- **Combined use of climate projections with socioeconomic scenarios to place UK production in an international context.**

Further details on this risk and opportunity: Natural Environment and Assets Technical Chapter, risk/opportunity N6



4. Risks to forestry from pests, pathogens and invasive non-native species (N8)



Pests, pathogens and invasive non-native species (INNS) present serious risks to forest productivity, with consequences for livelihoods and businesses, and for the multiple ecosystem services that forests provide.

Due to the combined effect of climate and other risk factors like changing trade patterns, the magnitude of this risk is increasing, with a projected change from medium magnitude now to high across the UK by the 2050s.

Current management of forests limits the impacts at present, but the scale of climate change could see new threats emerging.

An illustrative example is the Oak Processionary Moth, whose range has expanded across northern Europe due to warming and has been brought into 60 sites in the UK in 2019 via imported oak trees from the Netherlands and Germany. It is primarily a risk to hardwood species in multifunctional forestry and its caterpillars are a human health hazard.

Beneficial actions in the next five years include:

- Improve preparedness through action to enhance surveillance, monitoring horizon scanning and addressing the increased prospect of emergent risks.
- Further modelling of risk reduction measures and assessment of early warning factors.
- Better understanding of current/future risks and improving biosecurity, especially at ports of entry.
- Changing plant purchasing and sourcing practices and increasing emphasis on disease and pest resilience.
- Further investigation of management initiatives to enhance resilience, such as diversification.

Further details on this risk: Natural Environment and Assets Technical Chapter, risk N8



5. Opportunities for agricultural and forestry productivity from new/alternative species becoming suitable (N9)



Forests presently restricted by cold to lowland areas and southern England will be able to be grown across a larger area of the UK in a warming climate, with the opportunity increasing from medium at present to high by the 2050s.

Different types of trees could become more suitable such as productive broadleaf like lime, and species which are valued for other distinctive properties such as walnut, and fast-growing species that are selected for bioenergy sources (e.g. black poplar) will also benefit from warming.

Emphasis will need to be placed on tree species selection matched to the right soil type and other conditions such as soil moisture and biodiversity considerations.

Water availability is likely to be a key limiting factor for new species, particularly in eastern areas of England.

Beneficial actions in the next five years include:

- **More detailed scoping and investigation of opportunities that is also consistent with changing patterns of land capability and individual suitability of different species across the UK.**
- **New opportunities related to agro-forestry would benefit from further systematic investigation.**
- **An extended inventory of a changing distribution of crops/varieties/cultivars including geographic changes in distribution and uptake of more novel practices like inter-cropping.**

*Further details on this opportunity:
Natural Environment and Assets
Technical Chapter, opportunity N9*



6. Risks and opportunities from climate change to landscape character (N18)



This topic is broadly defined to include risks and opportunities relating to landscapes, landscape character and the historic environment and considers both prevention of landscape character changes and planning for inevitable projected changes.

There are many examples of landscapes that are integral to the UK's landscape character and that are also important in ecological terms, but that could also be affected by climate change.

Related to forests, these include iconic and ancient woodlands, coppices and orchards. Future changes to landscape character will occur from a range of natural responses to a changing climate, including changes to forestry. Landscapes have already been modified by a combination of changing conditions, including warmer temperatures, through eutrophication in freshwater landscapes, climate-related changes in agricultural landscapes and increasing incidence of wildfire, the frequency of which is likely to be higher in forests than on most other landscapes in future.

The impacts on landscape character are assessed as increasing in magnitude from medium at present to high by the 2050s across the UK.

Beneficial actions in the next five years include:

- **A collaborative approach between local and national government that incorporates climate change into planning as part of the production of Landscape Character Assessments.**
- **Further investigation into public perceptions on landscapes and climate change factors to help with managing and innovating changes.**

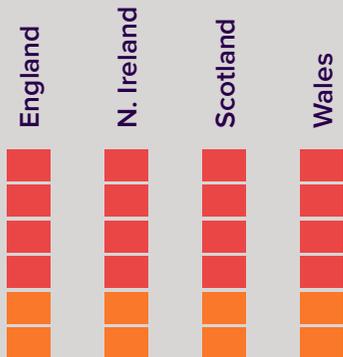
Further details on this risk and opportunity: Natural Environment and Assets Technical Chapter, risk/opportunity N18



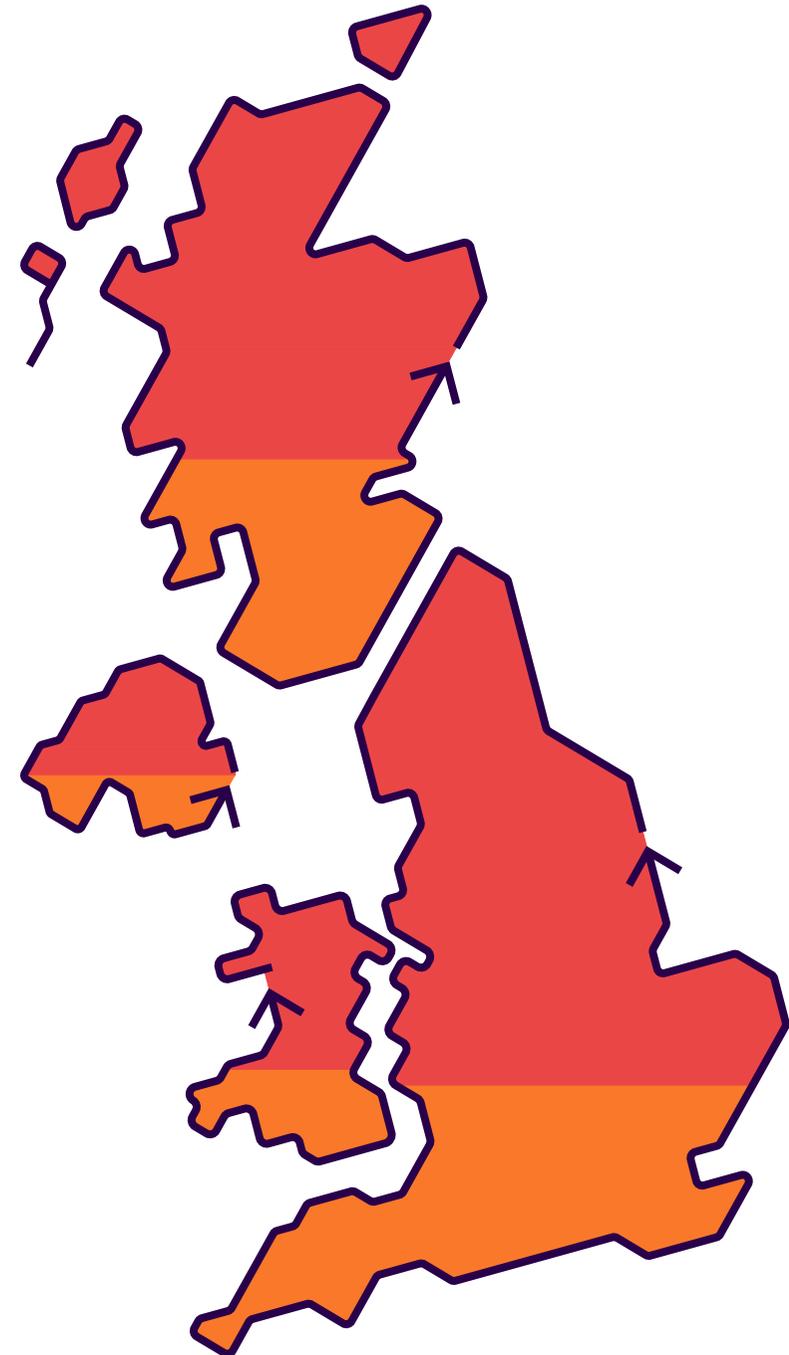
Variations across the UK

Key

- More action needed
- Further investigation
- Sustain current action
- Maintain a watching brief



Risk or opportunity	England	Northern Ireland	Scotland	Wales
Risk to soils from changing climatic conditions, including seasonal aridity and wetness (N4)	●	●	●	●
Risks/opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity (N5)	●	●	●	●
Risks to and opportunities for forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind) (N6)	●	●	●	●
Risks to forestry from pests, pathogens, and invasive non-native species (N8)	●	●	●	●
Opportunities for forestry productivity from new/alternative species becoming suitable (N9)	●	●	●	●
Risks and opportunities from climate change to landscape character (N18)	●	●	●	●



Background

The UK Government is required by the UK Climate Change Act 2008 to assess the risks and opportunities from climate change to the UK every five years and respond to the risks via a National Adaptation Programme, covering England. The devolved administrations also publish their own adaptation programmes in response to the risk assessment.

For this third UK Climate Change Risk Assessment, the Government's independent advisers on climate change, the Climate Change Committee (CCC), have been asked to prepare an independent risk assessment setting out the latest evidence on the risks and opportunities to the UK.

Over 450 people from more than 130 organisations have contributed to preparing the assessment. The risks have been assessed using the latest climate projections for the UK which were updated in 2018 by the Met Office. These briefings summarise some of the key topics that are assessed through the Technical Report, to enable readers to understand the key messages and where to find more detail.

Where to find more detail

Each risk or opportunity in this briefing has an identifier code linked to the full analysis, which is available in the CCRA3 Technical Report. Readers are encouraged to use these briefings to locate the parts of the Technical Report of most relevance to them.

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